



TELECOMMUNICATIONS REGULATORY COMMISSION OF SRI LANKA

Research Studies in the Field of Telecommunications with the support of Universities and Research Institutions 2006/07



Telecommunications Regulatory Commission of Sri Lanka
No. 276,
Elvitigala Mawatha,
Colombo 08,
Sri Lanka.

Tel: 011-2689345, 1900

Fax: 011-2689341

E-mail: dgts@trc.gov.lk

Web: www.trc.gov.lk

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- 2. The views / findings contained in the Research Reports are those of the authors & do not necessarily reflect the views of Telecommunications Regulatory Commission of Sri Lanka**

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Director General
Telecommunications Regulatory Commission of Sri Lanka
No. 276, Elvitigala Mawatha,
Colombo 08.

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Research Studies in the field of Telecommunications with the support of
Universities & Research Institutions in Sri Lanka

1. Initial Research Study Presentations.

- 17th January 2006

Seven research proposals were presented by Universities & a Research Institution at a workshop organized by TRCSL on 17th Jan.2006.

Mr. Kanchana Ratwatte, Director General, TRC welcomed the research teams.

The following research proposals were presented,

“Implementing ENUM in Sri Lanka” by Dr. K.B.N.Ratnayake, Department of Electrical Engineering, Faculty of Engineering, University of Peradeniya.

“Analytical Studies of Co-Channel Interference for Telecommunications Network” by Dr.K.Pirapaharan, Department of Electrical & Information Engineering, Faculty of Engineering, University of Ruhuna.

“Consumer Protection” by Mrs.H.S.C.Perera, Dean/ Faculty of Management and Finance, University of Ruhuna.

“Quality of service” by Mrs.H.S.C.Perera, Dean/ Faculty of Management and Finance, University of Ruhuna.

“Forecasting Demand for Telecom services” by Mr.W.I.C.Gunasinghe, Assistant Lecturer, Department of Economics, Faculty of Humanities & Social Science, University of Ruhuna.

“Problems and prospects of Telecommunications Services in the Ratnapura District” by Prof. J.W.D.Somasundara, Department of Social Science, Faculty of Social Science & Languages, University of Sabaragamuwa.

“Unbundling of Telecommunications Network Elements” by Ms. Malathy Knight John, Head/ Public Enterprise Reform Competition and Regulatory Policy Research Unit, Institute of Policy Studies, Colombo 3.

1.1 Highlights of the event ...



1.2 Closing Remarks and vote of thanks by Mrs. P. R. Amarasiri, Director of Legal Affairs / TRCSL

1.2.1 Implementing ENUM in Sri Lanka - Dr. K.B.N. Ratnayake

Dr. Ratnayake mentioned that ENUM is a vital technology necessary to achieve the convergence of conventional & IP based telephony. ENUM is one of the technologies which would help the process. He also mentioned that ENUM proposed to enable network elements such as a telephone which has an input mechanism limited to numeric keys in a keypad to access services such as web pages and IP telephone address. He addressed the issue relating to international peering connected with ENUM trials. He mentioned that it is important to have a highly desirable coordinating body to maintain the DNS Databases with telecom service providers as well.

With ENUM, according to Dr. Ratnayake's research, users could access alpha numeric internet addresses by dialing just a phone number.

1.2.2 Analytical studies of Co-channel interference for telecommunication networks – Dr.K. Pirapaharan

Dr. Pirapaharan said that interference in communication systems is divided in to co-channel and non co-channel interference. Since the frequency bandwidth is limited for telecommunications and broadcasting the frequency band has to be re used. He mentioned that frequency re-use method can drastically increase spectrum efficiency. Co-channel interference cannot be absolutely avoided, but careful mapping of the signal distribution with respective spectrum interference could be minimized.

He spoke on co-channel interference in GSM Networks which often degrades speech quality and limits network capacity. He has selected Galle City and surroundings for the research.

Identified network being GSM in Mobile Communications, fixed wireless and broadcasting services. He emphasized on the need to obtain accurate data.

1.2.3 Consumer Protection – Mrs. H.S.C. Perera

Mrs. Perera spoke on the importance of looking at the consumers' side. The physical side and the mental side. She mentioned about the 9 steps laid down by the United Nations to protect consumers. She highlighted John F. Kennedy's Bill of Rights more specifically the 4 rights of consumers.

- (1) Safety Hazards.
- (2) Giving fraudulent information.
- (3) Right to choose.
- (4) Right to be heard.

She stressed on the importance of consumer awareness. In Matara where the population is 0.73 million, she will conduct a sample survey. "It will not be a population survey" she said. She will use a questionnaire on which concerns of consumers will be obtained.

1.2.4 Quality of Service – Mrs. H.C.S. Perera

She stated that the two research studies will be combined. Speaking on the three important Ps i.e. People, Physical evidence and Process. She expressed the need to consider the mindset of the people specially by service providers. Mrs. Perera emphasized on time, cost and psychic costs and perceived value being more than expected value.

Talking about customer satisfaction she explained about the 5 gaps which causes unsuccessful delivery of services. These Five determinant factors will be used for the questionnaire –i.e.

§ Reliability. § Responsiveness. § Assurance. § Empathy. § Tangibles.

1.2.5 Forecasting Demand for Telecom Services – Mr. W.I.C.S. Gunasinghe.

He outlined the importance of the study. He said that the demand for services depend on various factors. He also expressed concerns about the long waiting lists, where demand declines due to the increase in waiting time.

He stated that when the initial payment is high people move to other operators. Advertisement costs will have to be considered. He said that structural development would increase demand. He mentioned that if the demand declines we will be able to understand the market for the future. He expressed the need for policy decisions regarding allocation of resources.

Explaining about the objectives of the study he said that the research would be based on secondary data which will have to be discussed with TRCSL. The study employs 2 methods Univariate and multivariate, based on economic models. Demand forecasting is for the entire country.

1.2.6 Problems and Prospects of Telecommunication Services in the Ratnapura District Professor J.W.D. Somasundara.

The research would include demand for telephone connections including CDMA and other supplementary services provided by operators. He compared demand for services in various service categories such as fixed, mobile, internet, payphones etc. He explained the methodology to be adopted for the research.

20 respondents will be selected from each of the 17 Divisional Secretariat areas i.e. 10 people who are using telephones 10 people who are not using telephones which will be on services provided and demand for other services.

Objectives of the study:-

- ◆ Analyse the attitudes towards information and communication technologies.
- ◆ Affordability.
- ◆ Cultural attitudes.
- ◆ Family needs.
- ◆ Demonstratives effects.
- ◆ Need.

1.2.7 Unbundling of Telecommunication Network Elements– Ms. Malathy Knight John.

She said that Local Loop Un-bundling (LLU) could facilitate competition. As there is insufficient competition LLU is one way of stimulating competition. She mentioned that it will be an important step towards removing entry barriers to the access and exchange services in telecommunications.

She spoke on the importance of LLU, and mentioned that no study has been carried out as yet on the possibilities and probable implications of implementing LLU in Sri Lanka. She also said that technical costs would be relatively low. She mentioned about the importance of creating incentives for incumbents to lease it out for a move towards e-areas where we have brought in broadband facilities.

OECD countries have introduced LLU or have legislation in place, but even OECD countries had problems in implementing LLU.

She explained the research objectives:-

- Ø How LLU have been implemented.
- Ø Benefits and Strategies.
- Ø Come up with a strategy for Sri Lanka.
- Ø Solutions for TRCSL.

She also highlighted as to how LLU has benefited the industry and consumers in the areas of teledensity, tariffs etc.

Benchmarking on countries at 3 different levels i.e.

- Countries which have been able to achieve a relatively high performance.
- Countries that have introduced LLU but had difficulties in the process and derived few advantages.
- Countries that have not implemented LLU yet.

She mentioned that it is appropriate to discuss with the operators and come up with a policy paper.

Mrs. Amarasiri concluded by thanking all the research persons for their research proposals and presentations on the same made to the staff of TRCSL.

She thanked the staff of TRCSL for participating in the workshop and also for their thought provoking contributions.

2. Awareness programme on “Implementing E-ENUM in Sri Lanka” by Dr. Nimal Ratnayake, Department of Electrical and Electronic Engineering University of Peradeniya. 6th July 2006



2.1 Presentation :

<p>Implementing ENUM in Sri Lanka</p> <p>Nimal Ratnayake University of Peradeniya</p>	<p>Convergence</p> <ul style="list-style-type: none"> Today we have different networks for data and voice/video <ul style="list-style-type: none"> PSTN and PBXs for voice/video IP Network for data (mostly) Public network and Individual organizations In future these separate networks will converge <ul style="list-style-type: none"> Data Voice over IP (VoIP) Video ENUM is a technology that will facilitate this convergence. (perhaps only in the interim) 	<p>Requirements for Convergence</p> <ul style="list-style-type: none"> Many communication devices used at present are designed for dialing digits But Internet addresses are alpha-numeric <ul style="list-style-type: none"> Email: user@bigu.edu Web: http://www.bigu.edu/~user/ Voice: sip:user@bigu.edu Dialing alphanumeric numbers with a 12 digit keypad is sometimes possible, but difficult Mapping from a telephone number to Internet addresses will aid convergence
<p>ENUM</p> <ul style="list-style-type: none"> Technology proposed by the IETF Way of <i>mapping</i> telephone numbers to Internet addresses Takes a complete international telephone number and <i>resolves</i> it to an Internet address <ul style="list-style-type: none"> Uses a DNS based architecture Process invisible to the user (user “dials” only a number) By dialing just a phone number, user can access alphanumeric Internet addresses 	<p>ENUM in detail</p> <ul style="list-style-type: none"> User dials a number <ul style="list-style-type: none"> User dials a complete e.164 number: +94 81 239 1600 User dials a part of the number, but it is converted to a full e.164 number (e.g. 1600 -> +94 81 239 1600) The leading + is removed from the e.164 number <ul style="list-style-type: none"> 0.0.6.1.9.3.2.1.8.4.9 Order of the digits are reversed (00619321849) Dots are inserted in between The suffix .e164.arpa. is appended <ul style="list-style-type: none"> 0.0.6.1.9.3.2.1.8.4.9.e164.arpa. 	<p>ENUM Applications</p> <ul style="list-style-type: none"> Anywhere you can do DNS lookup <ul style="list-style-type: none"> Calling device can lookup if it is ENUM aware Some intermediate device that is ENUM aware can do the lookup <ul style="list-style-type: none"> PSTN switch, VoIP gateway, SIP server Possible call scenarios <ul style="list-style-type: none"> PSTN user calling IP phone IP phone calling IP phone IP phone calling PSTN phone Call forwarding
	<p>Implementation status</p> <ul style="list-style-type: none"> Different countries in different stages of ENUM implementations <ul style="list-style-type: none"> Austria, Germany in production state Many other countries still in trial USA getting started (Feb 2006) http://www.itu.int/osg/spu/enum/ Private ENUM trees have also emerged <ul style="list-style-type: none"> e164.arpa. delegation seen as too bureaucratic e164.org. Regional efforts (APEET) 	<p>To do list</p> <ul style="list-style-type: none"> Setting up primary and secondary DNS servers for 4.9. e164.arpa subdomain Request delegation from the main e164.arpa servers ENUM is usually administered by a government authority or a neutral third party <ul style="list-style-type: none"> LEARN can host primary DNS server Secondaries at Peradeniya, TRC, LKNIC, service providers Co-ordinating body with representations from service providers
<p>To do list (2)</p> <ul style="list-style-type: none"> Purchase hardware for DNS servers <ul style="list-style-type: none"> Financial Assistance/Donation of hardware Trial access code 99 proposed <ul style="list-style-type: none"> Approval of TRC required Policy decisions to be made <ul style="list-style-type: none"> Numbering scheme within the +94 99 code Number ownership/rights <ul style="list-style-type: none"> for PSTN area codes Routing/Interconnectivity Active participation of service providers in the trial 		

3. Discussion on the Interim Report on “Problems and Prospects of Telecommunications Services in Ratnapura District” at the Department of Social Sciences, Sabaragamuwa University of Sri Lanka, Belihuloya.

13th October 2006



4. Discussion on the Interim Report on “Consumer Protection” and “Quality of Service” at the Deans Office/ Faculty of Management and Finance, University of Ruhuna.

3rd November, 2006



5. Presentation of Final Reports

30th March 2007

5.1 Welcome speech by Mr. Kanchana Ratwatte - Director General, TRCSL



Deans / Heads of Departments and Units/ Senor Professors, Senior Lecturers and other staff from Universities and Research Institutions,
Representatives of the fixed and mobile operators,
Directors and staff of TRC,

On behalf of the Telecommunications Regulatory Commission I am very happy to welcome the distinguished research team from Universities and Research Institutions present here today at this final presentations signifying the successful completion of the research projects undertaken.

One of the duties of this Commission as set out in the Sri Lanka Telecommunications Act No.25 of 1991 as amended is “to promote, in co-operation with the operators or otherwise, research and development in telecommunication at universities and research institutes in Sri Lanka”.

The objectives of this program are to :

- Improve research studies in the telecommunications sector
- Encourage University staff and students to conduct research in the field of telecommunications,
- Use research findings to effect improvements in the sector.

We have invited representatives of the fixed and mobile operators for this seminar and we hope the presentations by the Universities and research institutions will be useful in improving their telecommunication services.

This was a pilot project and I am glad to say it has been a success as we are satisfied with the results. I am happy too inform you that we have been able to increase the research grant upto Rs. 100,000/= this year per project and I think this will encourage more research projects this year.

I wish all success in your presentations and hope your efforts will contribute to create an improvement in the telecommunication sectors.

Thank You.

5.2 Highlights of the event:



5.3 Presentation of the Final Reports

5.3.1 “Implementing ENUM in Sri Lanka” by Dr. K.B.N.Ratnayake, Department of Electrical Engineering, Faculty of Engineering, University of Peradeniya.



5.3.2 “Analytical Studies of Co-Channel Interference for Telecommunications Network” by Dr.K.Pirapaharan, Department of Electrical & Information Engineering, Faculty of Engineering, University of Ruhuna.



5.3.3 “Consumer Protection in Telecommunication Services Southern Province in Sri Lanka” by Mrs.H.S.C.Perera, Dean/ Faculty of Management and Finance, University of Ruhuna.



5.3.4 “Services Quality and Telecommunications Services in the Southern Province in Sri Lanka” by Mrs.H.S.C.Perera, Dean/ Faculty of Management and Finance, University of Ruhuna.



5.3.5 “Forecasting Demand for Telecommunication Services in Sri Lanka: A Case Study of Matara District ” by Mr.W.I.C.Gunasinghe, Assistant Lecturer, Department of Economics, and Faculty of Humanities & Social Science, University of Ruhuna.



5.3.6 “Problems and prospects of Telecommunications Services in the Ratnapura District” by Prof. J.W.D.Somasundara, N N K P Withanage Assistant Lecturer, Department of Social Science, Faculty of Social Science & Languages, University of Sabaragamuwa.



5.3.7 “Unbundling of Telecommunications Network Elements” by Ms. Malathy Knight John, Head/ Public Enterprise Reform Competition and Regulatory Policy Research Unit, and Ms. Dilini Hirimuthugodage, Research Assistant, Institute of Policy Studies, Colombo 3.



5.4 Closing remarks & vote of thanks by Mr. M. K. Jayasekera - Deputy Director Policy & International Relations, TRCSL



Good afternoon ladies & Gentlemen,

Today we listened to seven-research presentations.

The first presentation was based on a random survey focusing on telecommunication services in the Rathnapura District where it was recommended that each village be provided at least two payphones. Prof. Somasundara and his team had also addressed the issue of fault clearance, weak signal strengths, coverage areas amongst others which are important from a consumer perspective.

Dr. Rathnayaka in his presentation on “Implementing E-NUM in Sri Lanka” mentioned that E-NUM is a technology that will facilitate convergence. He also mentioned that active participation of the service providers are necessary for the E-Num trials.

Mrs. Perera in her presentation on “Consumer Protection” used a survey to analyse Right factors such as Right to have physical safety, Right to inform, Right to choose and Right to be heard. The major findings are that the operators do not have a thorough understanding about the consumer rights, rules, regulations and polities in this field. Therefore it was suggested that this

organizations should be educated in consumer protection aspects as well as social responsibilities.

Mrs. Dilani Hirimuthugoda in her presentation on “Local Loop Unbundling ” discussed options for local

loop unbundling such as Wi-Fi, Wi-Max solutions and expanding CDMA facilities.

In her study on “Service Quality “ Mrs. Perera has observed that service organizations which improve service quality factors such as reliability, responsiveness, assurance, empathy, tangibles and other factors can compete effectively and achieve a healthy market share.

Dr. Pirapaharan and his team have developed an analytical model of the resultant and individual field strength distribution that directed them to identify the signal distribution patterns, weak signal areas and co-channel interference effects.

Mr. Gunasingha’s research attempted to investigate all possible factors that could directly or indirectly affect the demand for telecommunication services in the Matara District based on simple visualization techniques.

These findings could be exploited further by the regulator and industry in order to provide a better service.

On behalf of the Telecommunications Regulatory Commission I would like to thank the members of the research teams for their dedication and hard work in successfully completing the task undertaken by them and all of you present here today for accepting our invitation and participating at this event.

I also wish to thank the members of the research committee and the staff of TRC for their assistance.

Thank you so much

Implementing ENUM in Sri Lanka

Nimal Ratnayake

Senior Lecturer, Dept. of Electrical & Electronic Engineering, University of Peradeniya
Technical Manager, Lanka Education and Research Network (LEARN)

January 15, 2007

1 Introduction

ENUM is a technology proposed by the IETF (Internet Engineering Task Force) [1] to enable network elements such as telephones which have an input mechanism limited to numeric keys in a keypad to access Internet services such as web pages or IP telephone address which have alphanumeric URIs.

ENUM at its most basic is the convergence of public switched telephone network (PSTN) and IP networks. It is the mapping of a telephone number from the PSTN to Internet functionalities.

ENUM takes a complete, international telephone number and resolves it to a fully qualified domain name address using a Domain Name Service (DNS) based architecture. But the workings of ENUM are designed to be invisible to the user.

Technologies in conjunction with ENUM will also allow users to send an email message using a telephone number, and a subscriber's email, fax, instant messenger, and phone will be reachable by using the same telephone number. If an application is capable of using mail a URI, then it can be enabled for use with ENUM.

Various countries in the world have already taken steps to implement ENUM. Many service providers in Sri Lanka have also expressed interests in implementing ENUM in our country. This proposal is for implementing ENUM in Sri Lanka by setting up the necessary network infrastructure and conducting trials and research in deploying DNS for ENUM. A national committee with representatives from the service providers will also be set up as in conjunction with the project. It is hoped that the Telecommunication Regulatory Commission will be able to provide the support needed in the effort.

2 Basic operation of ENUM

In order to place an ENUM call, the person initiating the call dials the telephone number as it would normally be dialed. The equipment used for dialing could be a conventional or mobile phone that is ENUM enabled, an IP telephone, a web browser, or any other device that is ENUM enabled.

The telephone number dialed by the user is translated into an Internet address or URI in the following manner.

1. The the network equipment will translate the dialed number phone number into a fully qualified E.164 number by adding the city (or area) and country code if necessary.
For example, if the caller dials the number 001 202 555 1234 to make an international call to a number in USA, it would be translated as +1 202 555 1234. In cases where the user dials less than a complete number, it will be translated into a complete E.164 number. For example, if the user dials 234 5678 from within the area code 081 in Sri Lanka, it would be translated to +94 81 234 5678.
2. All characters are removed except for the digits. In our examples, the result would be 12025551234 or 94812345678.
3. The order of the digits is reversed. In our examples, the result would be 43215552021 or 87654321849
4. Dots are placed between each digit. In our examples, the result would be 4.3.2.1.5.5.5.2.0.2.1 or 8.7.6.5.4.3.2.1.8.4.9
5. The domain e164.arpa is appended to the end. In our examples, the result would be 4.3.2.1.5.5.5.2.0.2.1.e164.arpa or 8.7.6.5.4.3.2.1.8.4.9.e164.arpa

ENUM then issues a DNS query on this domain. There are two possible outcomes.

1. If an authoritative name server for the domain is found, ENUM will retrieve the relevant NAPTR Resource Records [3] and the call will proceed according to the subscribers registered services for that number.

For example, the DNS lookup may result in a SIP URL such as sip:user@company.lk, an H.323 URL such as h323:user@company.lk, an email URL such as mailto:user@company.lk, a web page URL such as http://company.lk/ user/ or any other URL.

If the DNS lookup results in an SIP or H.323 URL, the voice call will be conducted entirely over the Internet, without using the Public Switched Telephone Network. This call will be connected in as little time, or even in less time, as a circuit-switched call using PSTN.

If the DNS lookup results in a non-voice URL, then the call would be handled appropriately depending on the capabilities of the calling device. For exmaple, if the DNS lookup results in an email URL (e.g. mailto:user@company.lk), if the calling device is capable of sending an email, then an email message can be composed and sent. Otherwise the call may proceed as an e-mail message with voice content.

2. If an authoritative name server cannot be found, ENUM will return a 404 Not Found error to the telephone, a connection to the PSTN will be opened, and the call will be routed conventionally.

3 Implementation

The main requirements for implmenting ENUM in a country are the following:

1. Setting up primary and secondary DNS servers for the respective e164.arpa subdomain.

2. Request delegation of the respective sub main from the root server for e164.arpa. domain

3.1 DNS servers

In order to answer DNS queries related to ENUM implementation in this country, the DNS servers should be authoritative for the domain 4.9.e164.arpa.

Two servers (primary and secondary) have been configured at the University of Peradeniya (secondary) and the Lanka Education Research Network (primary). The primary server is located at Peradeniya and the secondary server is located at the Internet Data Center (IDC) of Sri Lanka Telecom. An additional secondary server will also be located at the Telecom Regulatory Commission office, once a suitable server is identified.

The primary server has redundant Internet connectivity via Sri Lanka Telecom and Suntel Ltd. The respective IP addresses are 192.248.1.161 and 202.124.166.177. The IP address of the secondary server is 192.248.40.1

3.2 Application for DNS Delegation

The application to RIPE/NCC, the agency handling ENUM delegation for all the countries, for the delegation of DNS domain 4.9.e164.arpa. has been made in December 2006. However, the actual delegation of the domain may take a longer time as per their delegation policies and guidelines.

Until the 4.9.e164.arpa. domain is delegated to us, the ENUM trial will need to be limited with manual set up DNS servers (i.e. any device intending to do an enum lookup for the domain 4.9.e164.arpa. will need to be configured to send the query to one of the servers listed above.

3.3 ENUM Trials

Prior to day-to-day use of ENUM, it is necessary to conduct several trials with the cooperation of service providers. The access code to be used for the ENUM trials is 99.

The TRC has tentatively allocated the access code 99 for use in the ENUM trial. A memo from the service providers regarding this allocation will be sent shortly so that they may route all calls starting with 99 via ENUM lookups.

3.4 Raising awareness

A presentation about ENUM for registered voice service providers in Sri Lanka was also held in July 2006 at the Telecom Regulatory Commission. The objective of this event was to raise awareness about the use of ENUM and seek active participation of the service providers in the trial period of using ENUM.

4 Future work

The load on the DNS server when the system is fully functioning needs to be assessed and this will require some research with simulations. This is necessary as the number of DNS requests for ENUM would be much greater than the number of requests for normal DNS

name resolution. Another level of delegation, i.e. separate DNS servers for each of the area codes may be necessary depending on the outcome of this research.

International peering with ENUM trials in other countries is also a key activity. This is necessary to ensure that routing of International calls from other countries functions correctly before public use of ENUM. The effect of poor connectivity and relatively long delays in DNS resolution needs to be researched.

References

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- [5] Peterson, J., Enumservice registration for Session Initiation Protocol (SIP) Addresses-of-Record, RFC 3764, April 2004.
- [6] RIPE.NET, , ENUM Progress Matrix - Current ENUM deployment status in various countries, <http://enumdata.org/>.

6.2

Analytical Studies of Co-Channel Interference on Telecommunication Networks

Report Submitted to

Telecommunication Regulatory Commission of Sri Lanka (TRCSL)

By

**Dr. K.Pirapaharan, Dr. K.Gunawickrama, Mr. W.C.G.W.Kumara, Mr. M.C.Dahanayake,
Mr. S.Y.A.C.Muthukumara and Mr. A.M.N.S. Ratnasiri**

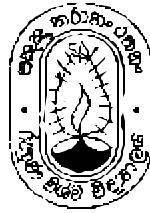
Form

Department of Electrical and Information Engineering

Faculty of Engineering

University of Ruhuna

Galle



17th of November 2006

ABSTRACT

This project is to develop an analytical model of signal distribution of the wireless telecommunication network, which describes the field distribution with the respective spectrum within the selected coverage area. In fact, this model can be used to study the signal distribution and *Co-channel interference* within the coverage area as well as to identify signal weak areas. Further we plan to map the data of field strength of the area of interest and obtain the field distribution contours of the respective spectrum using statistical analysis tool. Hence provide an analytical model of the field distribution of the respective spectrum for the area of interest. Finally we are going to develop user-friendly software to provide useful information to the interested party.

ACKNOWLEDGEMENT

Although only the project member's names are appeared on the front page, this project would not have been possible without the contribution from many other individuals. These include the many engineers who have laboured to bring the Engineering profession to maturity. The project members are indebted to the entire contributors.

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Abbreviation and Notations

CCI	Co-Channel Interference
BCCH	Broadcast Control Channel
CDMA	Code Division Multiple Access
DBMS	DataBase Management Services
GPS	Global Positioning System
GSM	Global System for Mobile communication
TDMA	Time Division Multiple Access
TRCSL	Telecommunication Regularity Commission Sri Lanka

1 INTRODUCTION

1.1 Description of the problem

The range of every wireless networks primarily depends on the path-loss, noise and interference. The interference in communication systems is divided into co-channel interference and non-co-channel interference. Non-co-channel interference includes adjacent channel interference and inter-modulation interference produced by nonlinear elements (e.g. amplifiers).

Since the frequency bandwidth is limited for both telecommunication providers and broadcasting network providers, the limited frequency band has to be reused. This causes creating co-channels (same frequency is used in different non adjacent coverage areas). The frequency reuse method can drastically increase the spectrum efficiency. However, if the system is not well designed, serious interference may arise. Interference due to the common use of the same spectral in nearby coverage areas is called *Co-Channel Interference* (CCI). Even though it cannot be absolutely avoided, by careful mapping of the spectral distribution it can be minimized.

CCI is a common problem inherent to all wireless communication systems. It arises due to the basic frequency reuse scheme in the cellular networks. This means that a number of cells in a given coverage area use the same set of frequencies. The interference between these signals from different cells is also termed as co-channel interference.

CCI is a recognized problem in GSM networks, which often degrades speech quality and basically limits network capacity. CCI occurs when an active handset receives another transmission from a different cell in the same spectrum and TDMA timeslot though it is destined for another handset. Due to this signal, the active handset experiences a high level of interference because of that the genuine signal is temporarily distorted. The result will be poor speech quality or dropouts or even complete call losses in voice calls.

CCI cannot be avoided since the same spectrum must be re-used in the other cells not too far apart. In GSM various techniques such as discontinuous transmission, frequency hopping, power control and adaptive multi-rate coding have been

developed which help reducing the problem. However, the problem remains the ultimate limiting factor for network capacity.

1.2 Research methodology

Since scope of the project is enormous, we preferred to pay our attention only to the CCI in telecommunication networks.

We are really interested of analyzing the CCI in GSM systems within the limited area of interest. Therefore, we are planning to select Galle city and surroundings as our coverage area to be analyzed.

Having collected sufficient data within our coverage area with the support of the TRCSL and GSM providers, we would like to map a statistical modal for the signal distribution in the region. Using the measurement data with the help of software programming we are planning to draw the contour maps of the field distribution with respect to the spectrum. In order to obtain smooth contour of field distribution, we are prepared to use either interpolation or least square method of curve fitting. Having obtained the smooth contour maps, we will be able to provide an analytical model of the field distribution with respect to their spectrum, which would be useful to select the frequency band of the nearby cells to avoid the CCI. Also it would be possible to provide an analytical model using the basic principle of radiation to compare with the previously obtained results.

1.3 Objective

This project is to develop an analytical model by means of data simulation of a telecommunication network within a coverage area. In fact, this model can be used to study the signal distribution and co-channel interference within the coverage area as well as identify signal weak areas with the help of coverage maps. Our main objectives are as follows:

1. Study about the fundamentals of CCI. Hence identify the problems associated with CCI in wireless telecommunication networks.
2. Identify and list the appropriate data to analyze the Co-Channel problems. Hence select the suitable method of acquiring those data with the help of relevant equipment.
3. Map the data of area of interest and obtain the field distribution contours of the respective spectrum using statistical analysis tools. Hence provide an analytical model of the field distribution of the respective spectrum for the area of interest.
4. Also provide an analytical method based on the radiation theory and compare the advantages and disadvantages both models.
5. Develop user-friendly software to provide useful information to the interested party.

1.4 Scope

This project directly deals with telecommunication industry. Thus it has vast scope since plenty of companies are competing in this industry and facing co-channel interference as the common problem. Hence we limit our goal as follows.

- **Limiting the analysis of signal distribution for the GSM spectrum:**
Since the co-channel interference is a vital topic in the wireless network, we are limiting our analysis to GSM spectrum. Also we have received positive responses from the respective GSM providers for their support towards the success of our project.
- **Restricting to a predefined area around Galle:**
Since the coverage area of the GSM networks in Sri Lanka is very large, it is impossible to cover up the entire region with our manpower. Therefore we are going to select a predefined area around Galle for our analytical modelling. However the predefined area might be changed if the GSM providers would request a different area of interest.

With the aforementioned predefined limitations, finally we are going to develop an analytical model for the signal distribution with the respective spectrum by using statistical approach. Hence describe the behaviour of the signal distributions and the effect of co-channel interferences within the area of interest using. Finally we hope to develop user-friendly software package, which could be used by the GSM providers to identify co-channel interferences and signal weak areas with the help of signal distribution maps.

1.5 Outcome

Constructing an analytical model from the gathered data using statistical analysis tools, which describes the signal distribution with the respective spectrum. Also obtain a mathematical model using the measurement data using the basis of radiation and compare both results. Further, by providing user-friendly software to identify co-channel interference and weak signal areas with the help of maps, the quality of the service by the GSM providers would be improved. The area of interest could be extended depending on the requirements and future needs.

2 Field Strength Data

2.1 Field strength

Field strength is the intensity of the electromagnetic field of a particular signal at the point of interest that generally measured in decibel (dB). There are several factors that determine field strength of a particular signal as given below:

- Distance from the antenna to the point of interest: Electromagnetic Radiation.
- Type of the antenna: Directed or Undirected.
- Elevation of the antenna and the point of interest: Ground reflections.
- Geographical nature of the area: Reflection, Scattering and Out of direction.
- Surrounding structures around the antenna and point of interest: Scattering and Multi-path Reflection.
- Co-channel effect: Interaction.

2.1.1 Far-Field Electromagnetic Radiation.

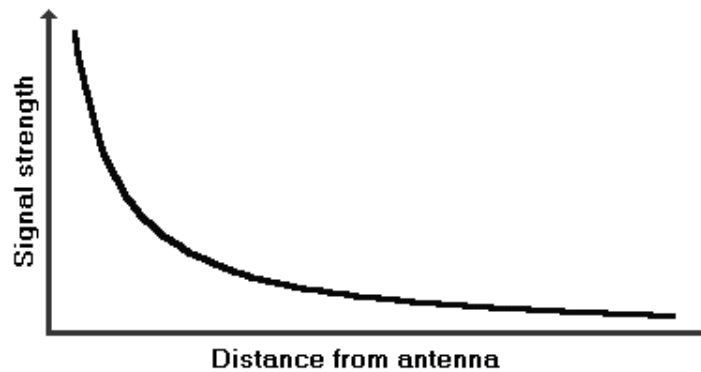


Figure 01: Field strength variation with the distance from antenna

The influence of far field radiation on electromagnetic field strength is shown as in Figure 01 where the field strength is inversely proportional to the distance from antenna to the point of interest.

2.1.2 Geographical nature of the area

If the area between the base station and point of interest is flat or open landscape, the signal strength will not be affected by the geographical nature. If the area is hilly, the signal will be influenced by reflection, scattering and out of directional effect. Trees in the path between the base station and the mobile phone will also decrease the level of the signal.

2.1.3 Surrounding structures around the antenna and point of interest

In the case of urban environments, the so-called multi-path fading is also contributing to attenuation or distortion of the signal. The signal can be reflected once or several times between the buildings. If the signal from the base station is reflected from two different buildings and reaches the same point, the resulting signal may be amplified or attenuated depending on the phase delay of the signals. Even in the amplified condition the signal may be distorted due to the phase delays. Hence it affects the actual field strength of particular point of interest. This phenomenon is called fading effect.

2.1.4 Co-channel effect

Another important factor is the effect of CCI to the original signal. Since the receiving antennas of the mobile phones are designed as omni-directional antennas, it receives the resultant field of the respective frequency. Then it is obvious that the received signal is either attenuated or distorted due to the co-channel effect.

2.2 Field strength meters

Field strength meters are used to obtain field strength within the coverage area to verify the field strength in wireless communication networks. Basically there are two major components in field strength meter i.e. antenna and receiver circuit. Various types of field strength meters are used based on frequency range and the type of application. Multi mode field strength meters are available, by changing the receiving antenna, it can be used to measure the range of frequencies though only one signal strength can be measured at a time by tuning the receiver circuit to the required frequency. However, field strength

meters cannot be used to measure the two different field component form two different sources at the same frequency. Therefore it is obvious that field strength meters cannot be used to identify the co-channels.

2.3 Directional Antennas

An antenna is a transducer, which converts voltage and current on a transmission line into an electromagnetic field in space. An antenna is a crucial element in the successful design of any telecommunication system. More specifically, an antenna is an arrangement of components designed to radiate (transmit) an electromagnetic field in response to an applied alternating electromotive force (EMF) and vice versa. Antenna characteristics are essentially the same regardless of whether an antenna is sending or receiving electromagnetic waves. However, directional antennas are the specific kind of antennas that can be used to receive from or send to EM waves in the specified direction. Beamwidth is very important parameter when considering directional antenna. Beamwidth is the angular separation of the half-power points of the radiated pattern.

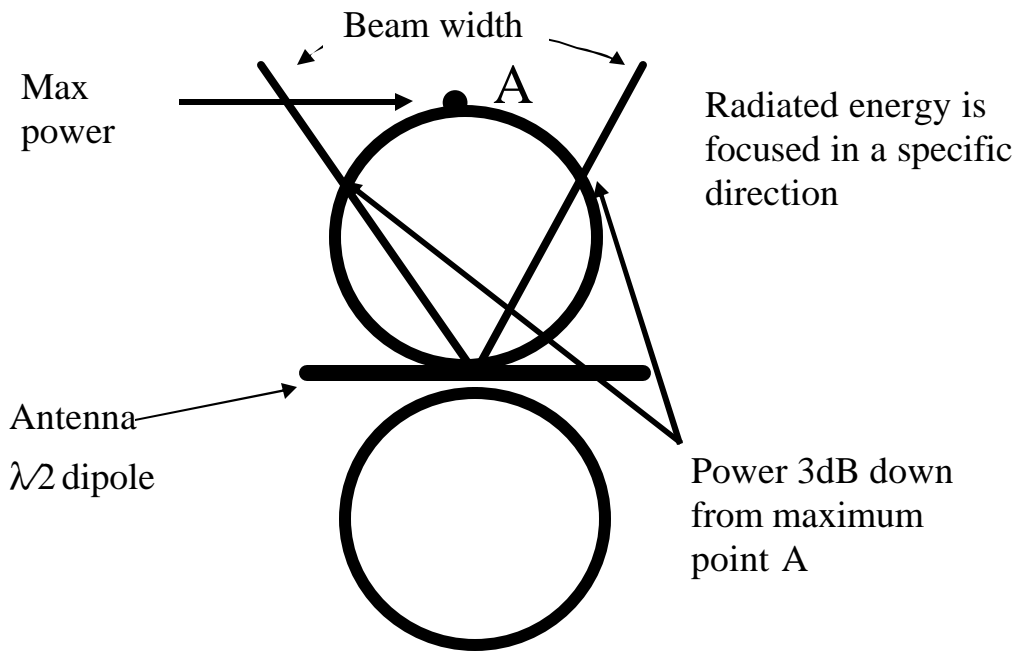


Figure 02: Directional Antenna.

The main lobes of the directional antenna are focused into certain direction, causing energy to be concerned in a particular direction. Therefore, it is clear that directional antennas can be used to separate the field strength from two different sources in the different directions at a same frequency. Hence it can be used in our project to measure the field strength from two different towers operating at the same frequency.

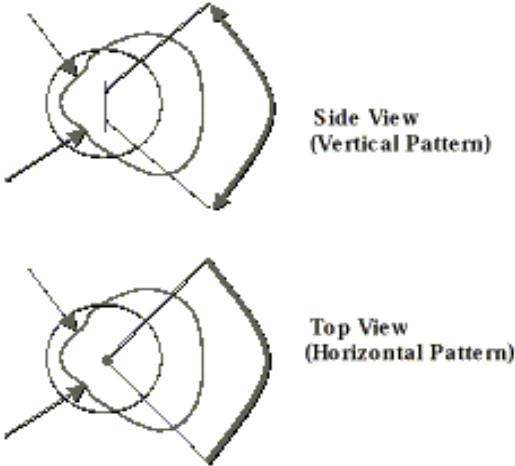


Figure 03: Side and top view of Directional Antenna.

2.4 Data collection procedure

Data collection is the one of the major part of this project. It is required to obtain field strength data of all the co-channel signals within the area of interest to analyse the co-channel effect. By using field strength meter with a directional antenna, approximate contribution of field strength of the each co-channel can be measured. However, it is not possible to take field strength at each and every point within the area of interest. Thus we need to collect enough samples field strengths within the area of interest to predict the entire field strength by modelling an analytical model.

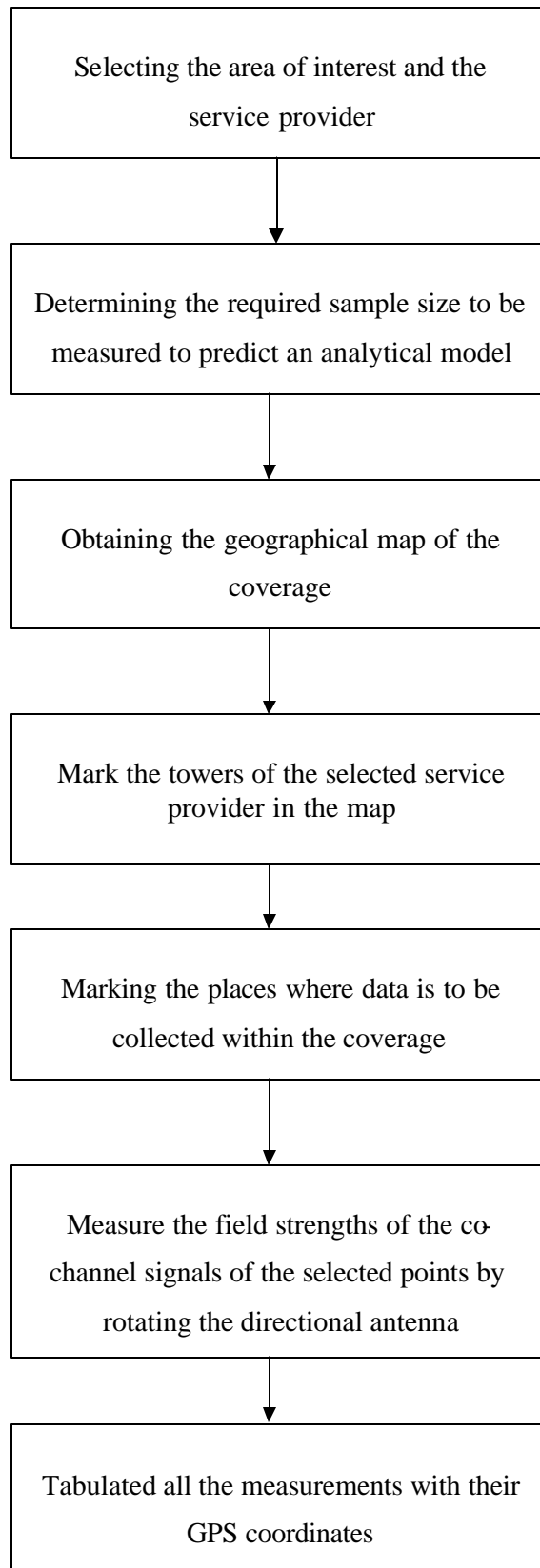


Figure 04: The flowchart of the data collecting procedure

- The first step of collecting data is selecting the area of interest and the relevant GSM service provider. We select Galle town as our area of interest and Dialog GSM as our service provider.
- With the help of the service provider estimate the minimum no of field strength samples to predict the analytical model.
- Next step is obtaining the geographical map (GPS map) of the area of interest. With the support of Radio Mobile software, The Galle town elevation map with GPS coordinates can be down loaded.
- All the base stations of the selected service provider are marked in the downloaded map according to the information provided.
- The road map of the Galle district is merged to the geographical map to identify the accessible locations within the area of interest to locate the data collection position that should be accessible to the frequency-monitoring vehicle of TRCSL.
- The next step is measuring the field strength data of the co-channel signals by using the rotating directional antenna available in the frequency-monitoring vehicle of TRCSL.
- Finally all the measurements are sorted out and tabulated with their respective GPS coordinates as shown in Table 01 as an example.

3 Data Collection

Data collecting part of this project can be divided in to two major parts.

1. Collecting vital information from the service provider.
2. Collecting field data within the selected area of interest

3.1 Collecting necessary parameters from the service provider

Since it is required to do the analysis for a selected wireless network, it is necessary to collect their vital information of the service provider before collecting field data. We have successfully gathered the vital information for the project by collaborating Dialog GSM as our interested wireless network service provider. Dialog Telecom has provided information relevant to Galle district such as operating cells of Galle district with their respective operating frequencies, co-channel cells of operating cells of Galle district, orientation (Azimuth) of the antennas, antenna types and antenna height. The summary of the information collected from Dialog GSM is shown in Table 02 and Table 03.

3.2 Collecting field data within the selected area of interest

Then as a second part, the following observations related to Dialog GSM network within Galle town are taken by using the frequency monitoring mobile unit of TRCSL.

- GPS coordinates of the field data measuring position.
- Field strength measurements
 - Resultant field strength of the relevant point using omni-directional antenna.
 - Field strength components of relevant point using directional antenna.

3.2.1 Frequency monitoring mobile unit

The field strength is measured using 100 MHz-3 GHz receiver provided with the frequency monitoring vehicle. Since field strength equipment is operated via a computer it is provided a lot of other additional functionalities such as storing measured data in the database, getting printouts of measured data etc. Then it is required to measure resultant field strength and the related co-channel field strengths of the relevant point. Omni directional antenna is used at the receiver to measure the resultant field strength at particular point for a particular frequency. Even though omni directional antenna cannot be used to measure the co-channel field strengths, it enables us to identify the usage GSM frequencies in that point. Then by connecting directional antenna to the receiver and rotating it by a step of angles around 360° , the respective field strength of all the step of angles can be measured and plotted in a polar plot. Rotating the directional antenna can also be done via software interface or manually.



Figure 05: The internal view of the frequency-monitoring vehicle.

3.3 Data collection methodology

- **Selecting sufficient enough sample of field strength data within the area of interest**

It is essential to take sufficient samples of field strengths to form an analytical model. Therefore the data measurement points have been selected uniformly to cover the entire region considering the geographical factors and accessibility. Also the factor of traffic congestion is also considered while selecting the density of measurement points since the co-channel effect is considerably high in those areas.

- **Obtaining fair random samples throughout the coverage**

In order to enhance the quality of our analytical model by ensuring that the uniform selection of points does not bias the final model, it is very important to obtain a number of random measurements throughout the coverage. These random measurements can be used to verify the analytical model, which has been modelled, by using non-random measurement.

- **Obtaining samples of remote areas**

Obtaining samples of remote areas is another challenge in measurement. It is due to many reason such as the point of interest may be on

a mountain or water stream else in a jungle that cannot be reached by the frequency monitoring vehicles. In such condition,

we need to use specific techniques to cover that point by taking measurement in the nearby accessible points and predict the measurement to the relevant point by interpolating or extrapolating.

- **Ignoring samples of non-coverage areas**

The measurement in the non-coverage area could be easily avoided by referring the provider's GSM coverage map.

Considering all the above factors, the sampling points of Dialog GSM network in Galle district are identified as shown in Figure 06.

Figure 06.

3.4 Software requirements

Basically following software programmes are to be used in this project.

- Database management system software (DBMS).
- Software to visualize the geographical maps with their GPS coordinates and corresponding elevation data.
- Modelling software to model the field strength contours within the selected coverage.
- Software to test the developed model and evaluate its performances.

3.4.1 Storing the measured data

Measured field strength data should not be recorded or stored manually due to the requirement for easy access, control and manipulation of the data. Therefore it is required to have an appropriate database to store and access the data for the trouble-free management of the data according to the requirement. Thus we use a DBMS to develop a database such as Microsoft Access or SQL server 2000.

3.4.2 Visualizing geographical maps

It is required to have the geographical map with the respective GPS coordinates and the corresponding elevation data of the selected area. *Radio mobile* software can be straightforwardly used to visualize such a map from the satellite data available in the web site of International Telecommunication Union (ITU). Figures 07 and 08 show the visualized maps of Galle district via the *Radio mobile* software from the unrefined data available at ITU web site.

Radio mobile is also featured with importing an available road map and merging the road map with already existing GPS coordinate and elevation data gathered from ITU

web site. Since the road map and details of the building are missing in the downloaded map from ITU web site, we have merged a road map and building details of Galle area to the existing GPS coordinates and Elevation data with the help of *Radio mobile* software and it is shown in Figure 09.

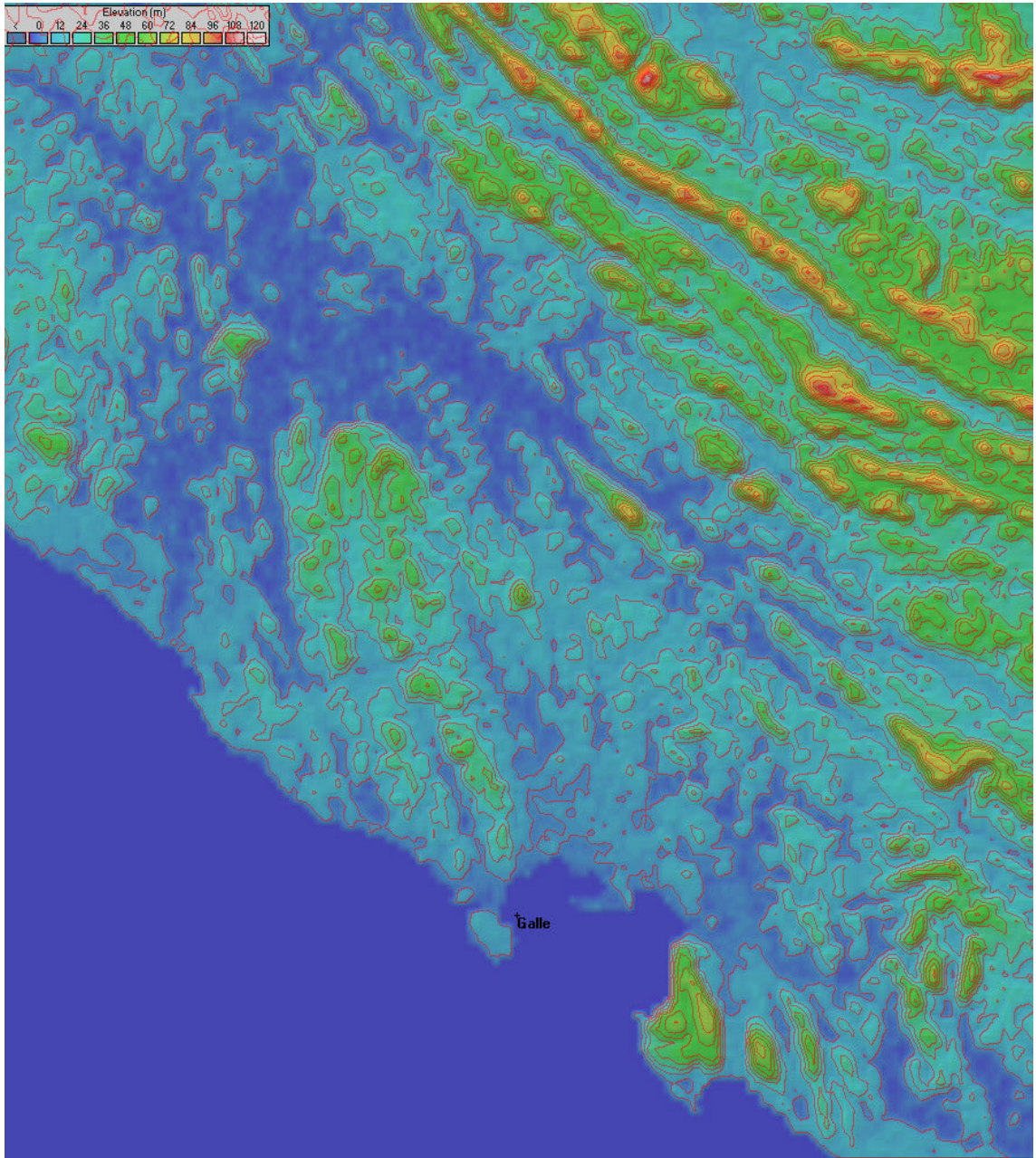


Figure 07: The visualized elevation contour map of the Galle area

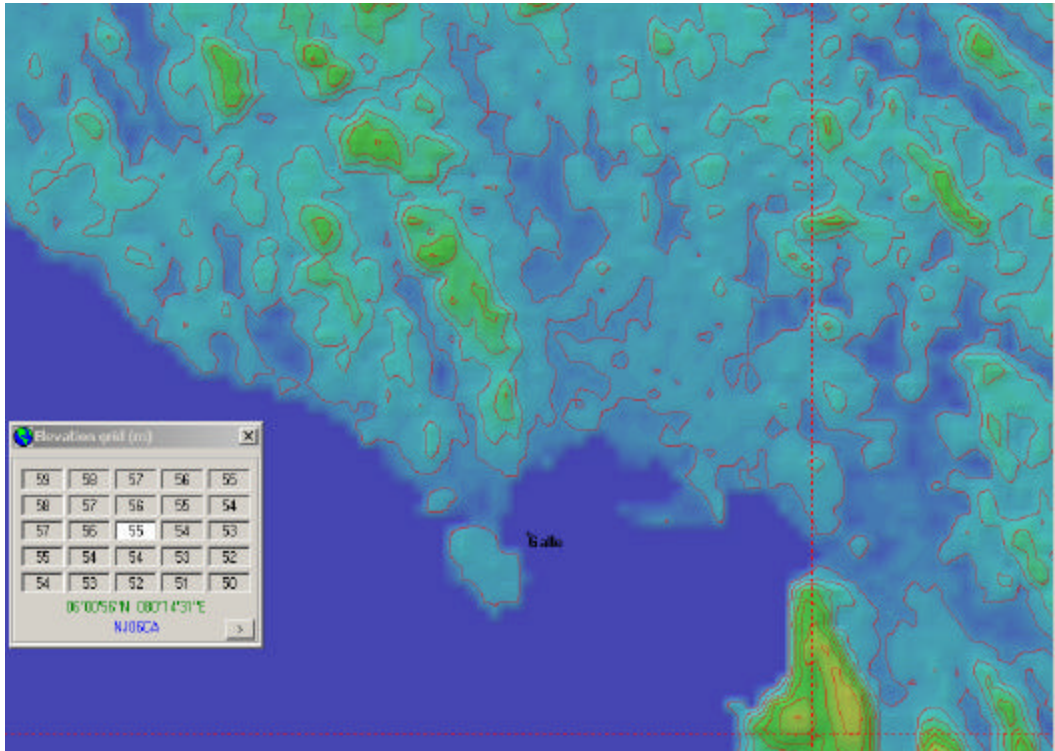


Figure 08: The visualized map of Galle with elevation data and corresponding GPS coordinates.

Figure 09.

DBMS and *Radio mobile* are used to store the field strength data and visualize the geographical map, respectively. We use *Surface* software to plot the distribution field strength contours from the measured data available in the database. Hence we obtain the analytical model of the field strength distribution. The validity of the model can be tested with the randomly measured data. The validity of the

model in the rural area can be tested with the results from *Nec2* software simulation results since *Nec2* simulation doesn't consider the reflection and scattering effects.

4 Field Work and Data Analysis

4.1 Field work

The objective of our project is to innovate a method to obtain an analytical method from the field measurement data that could be useful to the wireless providers in the future to carry out their survey according to their area of interest. Therefore we are not interested about a large area of coverage for our modelling and due to the limited time, manpower and resources, we have limited the area of interest to three cells around Galle city such as Galle SLT, Galle Elliot and Kaluwella cells.

Figure 10.

Generally it takes around 45 minutes to take measurement at a single point. Therefore we had to limit the number of points at about 50 within the area of interest since we have been provided the frequency-monitoring vehicle for 3 days. Hence we have located about 50 data measurement points around our coverage area as shown in Figure 10.

The following measurements are taken in each relevant point using the facilities provided in the frequency-monitoring vehicle.

- GPS coordinates.
- Resultant field strengths of available GSM 900 band frequencies one by one.
- Field strengths by scanning the whole 360 ° angle by 10 ° step using Directional antenna. However in special cases the step is kept at 5°
- Hence the polar plots of respective frequencies as shown in Figure 13.
- Co-channels and their respective field strengths using polar-plots.



Figure 11: *Frequency monitoring vehicle.*



Figure 12: The directional antenna

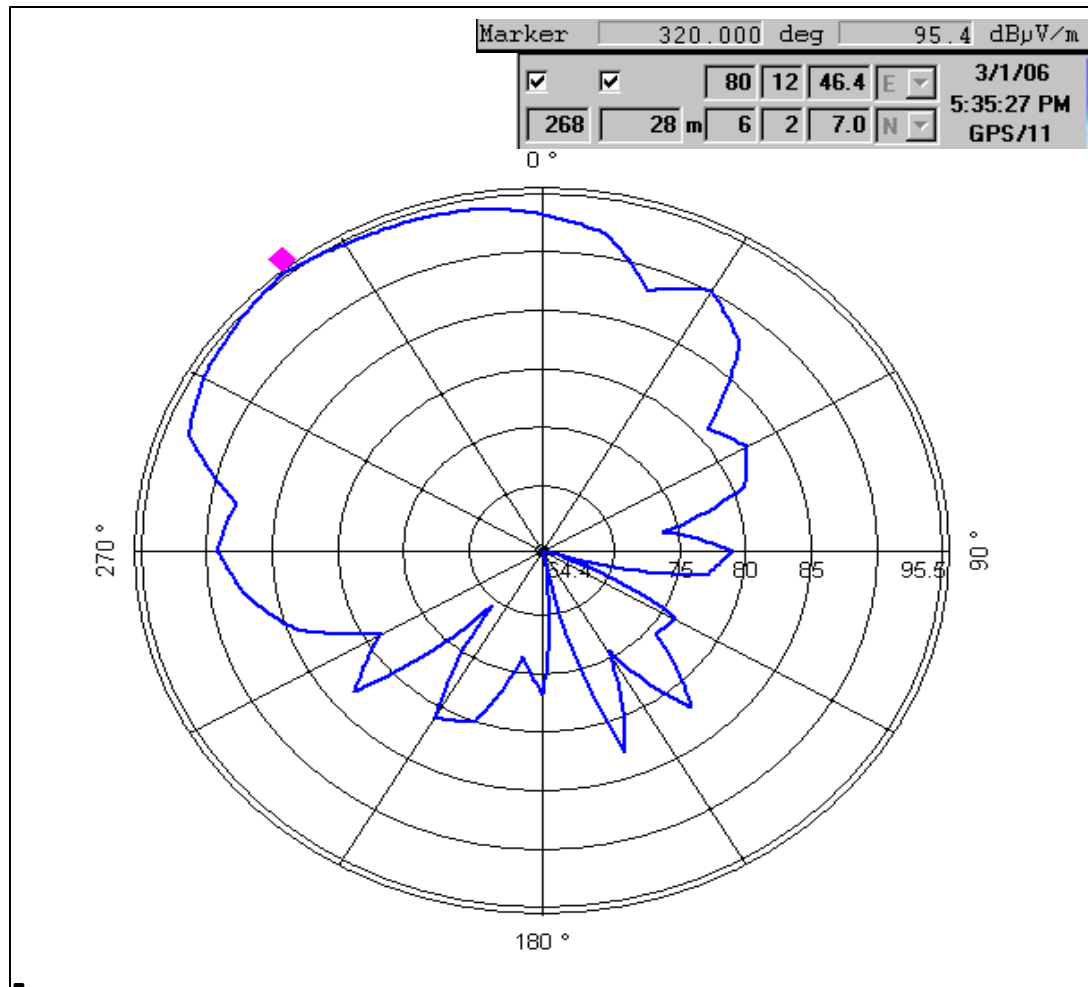


Figure 13: Polar plot of field strength at the measurement point

According to the above polar plot it is clear that operating tower is located in between 30° to 270° angle, because large lobe is appeared in that direction. There are few small lobes in other direction of the polar plot. However, we cannot conclude that those are co-channels, because those may be due to reflection effect due to geographical nature and the physical obstacles such as High voltage power lines, buildings and metal objects. However, referring the other tower details, we can almost recognize the co-channel lobe from the reflection lobe.

4.2 Data Analysis

This is the most important, complex and time consuming part of this project. Initially it is required to transfer the measured data into a soft form since we only have the hard copies. Then it is required to insert these data into relevant data sheets by sorting them out according to their operating frequencies. Table 04 shows the one of sorted data sheets.

Table 4

Having sorted out the measured data, it is required to analyze them. We have done the two major analyses as follows:

1. Analysis of resultant field strength at the area of interest.
2. Analysis of CCI at the area of interest.

4.2.1 Analysis of resultant field strength

Eight operating frequencies of Broadcast Control Channels (BCCH) are identified in selected coverage area. Hence it is appropriate to plot the field strength distribution contours for all eight frequencies separately. Having used the measured data, the analytical models of the field strength distribution are obtained for the eight different frequencies. Figure 14 shows the field strength distribution contours of the operating frequency of 953 MHz channel.

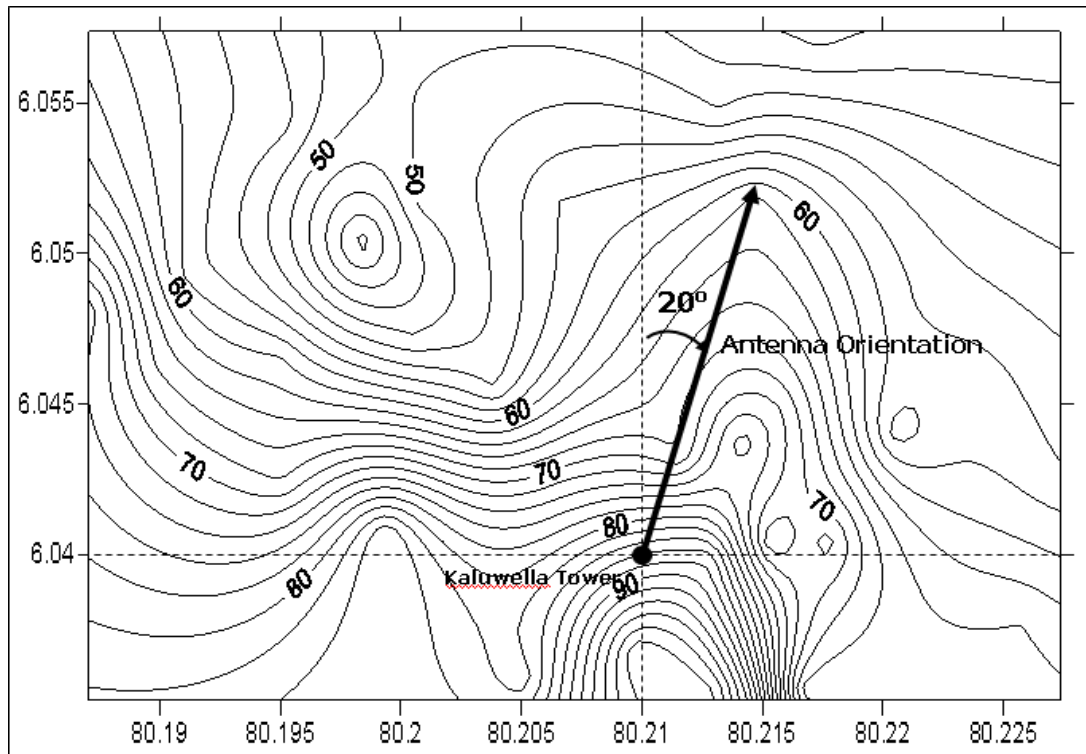


Figure 14: Field strength contour at 953 MHz.

Using the above field strength contour map, it is obvious that we can identify the signal weak areas (non-coverage areas). Also it is possible to locate the tower position and its azimuth angle from the field strength distribution contour. The *Surface* software is also capable of drawing 3D surface pattern of the contour map. Figure 15 shows the 3D view of the field strength distribution of the 953 MHz frequency channel.

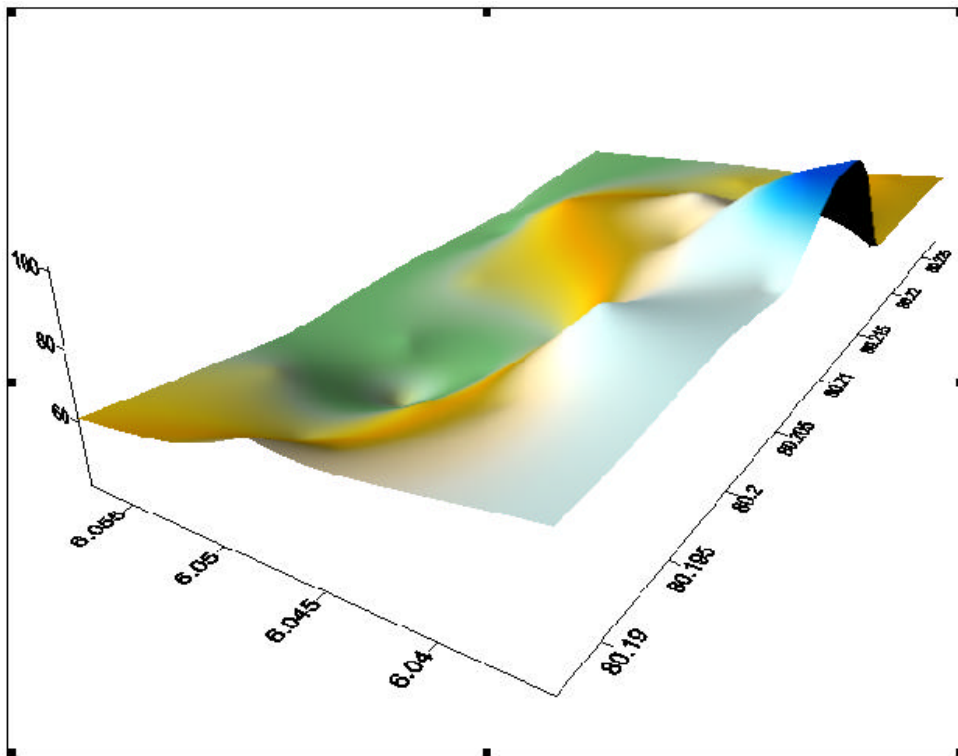


Figure 15: 3D view of field strength distribution at 953 MHz

More over, the 3D pattern of the field strength distribution shown in Figure 15 explicitly shows the field strength distribution and tower location. *Surfer* is also have the capability of plotting 2D shaded contour maps that gives unequivocal information about the field strength distribution as shown in Figure 16. It is also possible to merge the contour map to the geographical map of the Galle city in order to have a clear picture of the location and field strength distribution as shown in Figure 17.

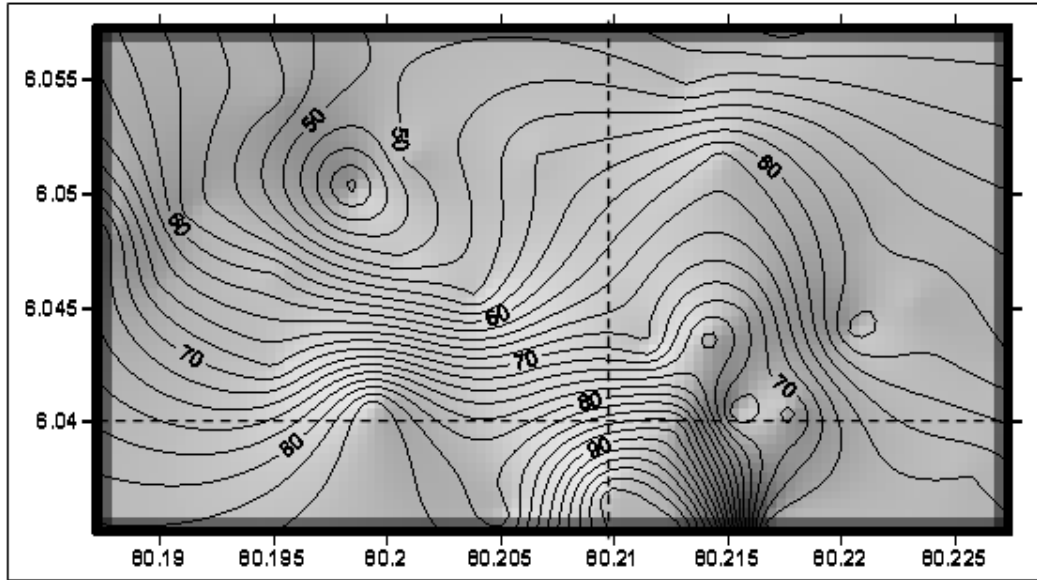


Figure 16: 2D shaded field strength contour map at 953 MHz.

Figure 17:

4.2.2 Analysis of Co-channel effect

Finally we analyse the field strength distribution due to the individual antennas. Since we have already separated the contribution of the field strength from each individual antenna for the respective frequencies, the field strength distribution contours of individual antennas for the respective frequencies can be plotted. Comparing the resultant field strength distribution and the individual field strength distribution contours, the CCI within the area of interest can be identified. The individual component of the field strength distribution contour

from the antenna located at Kaluwalla tower is shown in Figure 18 at the frequency of 953 MHz.

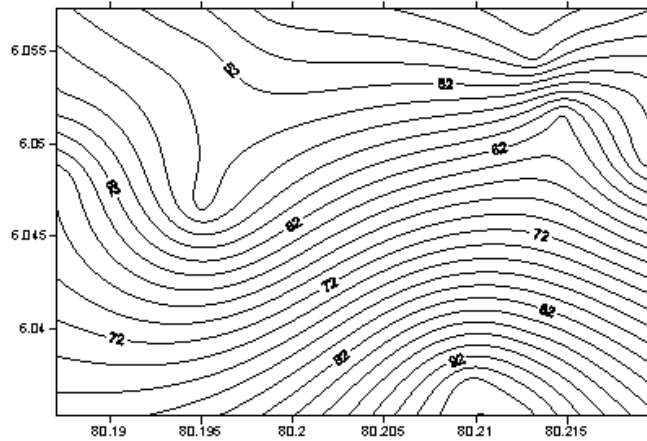


Figure 18: Individual component of field strength contours at 953 MHz

Comparing Figure 18 with Figure 14, we can identify the influence of CCI at the frequency of 953 MHz in the Galle city region. Even though we could not identify a considerable different between two contour patterns, those two patterns are not matching due to the CCI or reflection effects. This effect is clearly visible in the 3D surface plot of the same signal by comparing Figure 19 and Figure 15.

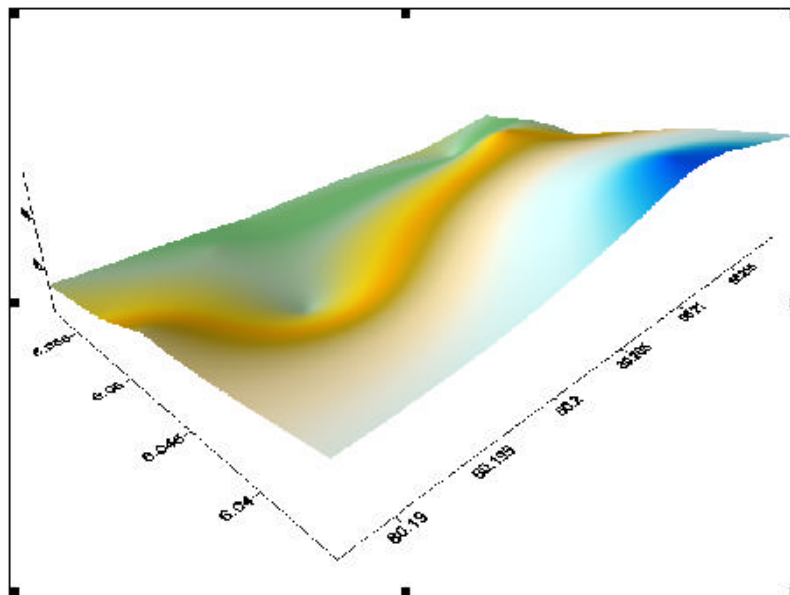


Figure 19: 3D view of individual field strength distribution at 953 MHz.

5. Analytical Model Using the Radiation Principle

Previously we have provided an analytical model from the measured data using the *surfer* software that uses the interpolation/extrapolation methods to predict the field strength from the nearby data. The analytical model obtained from interpolation method has following shortcomings.

- Intense data are necessary to predict the precise analytical model.
- Error in one data influences surrounding region of the analytical model.
- Extrapolation is necessary to define the boundary of the model.
- Only the nearby data is used to predict the model of the respective region.
- Even though, the electric field is a vector, there is no way of incorporating this factor in interpolation method.

The above drawbacks could be observed in our results especially in the contour plot shown in Figure 17. Where the tower no 2 is operated at 953 MHz but the contour map is giving the impression that the field strength is increasing towards the sea. This is because of that the tower is closed to the sea and the measurement from the seaside has not been taken. Therefore, in this method, there are no ways than extrapolating the ground measurement that shows the very high strength towards sea though the high strength is around the tower. Herewith we are proposing an analytical model based on the radiation principle that is free from above drawbacks.

5.1 Formulation of Analytical Model

The Electric field of the dipole antenna is given by the following expression with usual notations deriving from the Maxwell's equation:

$$\begin{aligned}
 E_r &= \frac{2h_0 b_0^2 I d l}{4p} \cos \mathbf{q} \left[\frac{1}{b_0^2 r^2} - j \frac{1}{b_0^3 r^3} \right] e^{-j b_0 r} \\
 E_q &= \frac{2h_0 b_0^2 I d l}{4p} \sin \mathbf{q} \left[j \frac{1}{b_0 r} + \frac{1}{b_0^2 r^2} - j \frac{1}{b_0^3 r^3} \right] e^{-j b_0 r} \\
 E_f &= 0
 \end{aligned}$$

(01)

Where \mathbf{h}_0 and \mathbf{b}_0 are free space intrinsic impedance and propagation constant, respectively. Considering equation (1), the electric field components are identified as follows.

$$\frac{1}{\mathbf{b}_0^3 r^3} \rightarrow \text{Electrostatic component due to the polarity of the dipole}$$

$$\frac{1}{\mathbf{b}_0^2 r^2} \rightarrow \text{Magnetostatic component (Biot-Savart law)}$$

$$\frac{1}{\mathbf{b}_0 r} \rightarrow \text{Radiating component due to the oscillating current in the dipole.}$$

Electrostatic and Magnetostatic components are near field components since they rapidly disappear with the distance from the antenna. Only the radiating component is used to contribute to the far field. Therefore, we should only concentrate to the far field component when modelling the analytical equation. Since the radiation field is influenced

by the factor $\frac{1}{\mathbf{b}_0 r}$, it is appropriate to use the $\frac{1}{r}$ as the weighting factor in the analytical model to predict the field at the arbitrary point from the measured data considering each measurement point as the source point. Thus we can formulate the analytical function to predict the field at an arbitrary point as follows:

$$\bar{\mathbf{E}}_a = \frac{\sum_{i=1}^N \bar{\mathbf{E}}_i / r_i}{\sum_{i=1}^N 1 / r_i}$$

(02)

Where $\bar{\mathbf{E}}_a$, $\bar{\mathbf{E}}_i$, r_i and N are the Electric field at arbitrary point, Electric field at i^{th} Measurement point, the distance between the i^{th} measurement point and arbitrary point and number of measurement point, respectively. Finally we derive an analytical function based on the radiation principals to predict the electrical field strength of an arbitrary point using the measured data as given in equation (02). However, this method will not be constructive when we are modelling the metropolitan area where the most of the signal received to the

specific point due to the reflection. Therefore more general model would be as given in equation (03) where the order n must be defined depending on the physical condition of the area of interest.

$$\bar{\mathbf{E}}_a = \frac{\sum_{i=1}^N \bar{\mathbf{E}}_i / (r_i)^n}{\sum_{i=1}^N 1 / (r_i)^n}$$

(03)

In certain cases, considering measurement of the points far away from the point of interest may mislead the calculation if there is a sharp change in the field around the surrounding area. Hence, in order to avoid the influence from the far away points, we could further modify our analytical model equation as given in equation (04)

$$\bar{\mathbf{E}}_a = \frac{\sum_{i=1}^N \bar{\mathbf{E}}_i / (r_i)^n}{\sum_{i=1}^N 1 / (r_i)^n} \quad \text{where } r_i < r_{\max}$$

(04)

Where we need to define the distance r_{\max} depending on the geographical location and the nature of the field variation. Thus, a careful study is mandatory before deciding the order

factor n and the maximum distance r_{\max} to match with the particular geographical conditions, physical environment and antenna locations of the area.

5.2 Simulation Results

We have verified our analytical function by testing with the available measurement. The resultant field strength data is available for 953 MHz signal at 38 points as shown in Table 04. Each point's electric field strength is independently predicted by considering other 37 measurements using the

analytical function. We have observed a very close match between measurement and simulation results as shown in Table 05.

Table 05.

We have also plotted the contour plot of the field strength distribution for the resultant field at 953MHz as shown in Figure 20. The contour plot obtain from the analytical function is more appropriate than the contour plot that we obtained using *surfer* software as shown in Figures 14, 15 and 17.

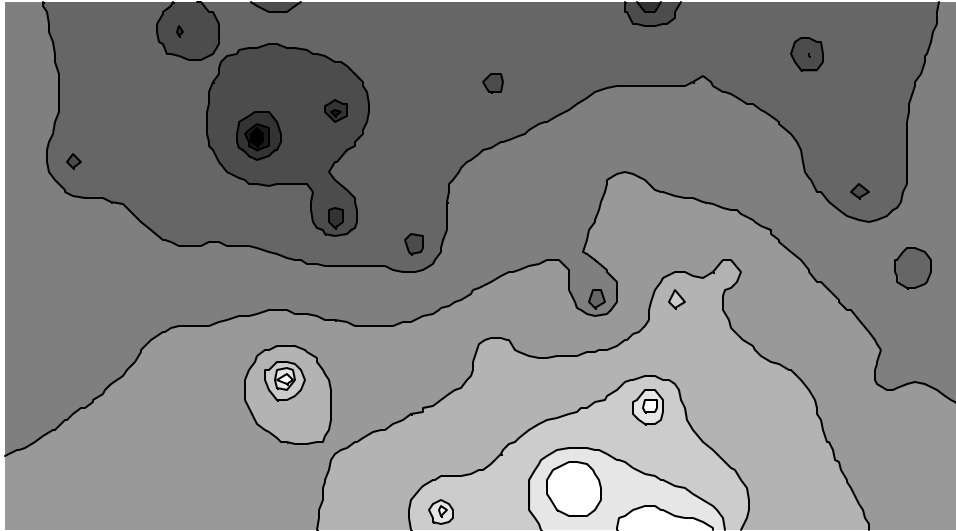


Figure 20: Resultant Field strength contour at 953 MHz by using the analytical function.

In the above contour plot, high field strength region has been indicated by low gray level. It is appeared to have a very close match with the antenna position and other geographical

patterns. Also we have overcome all the discrepancies observed in Figures 14, 15 and 17. In addition to that, almost all the disadvantages observed in the interpolation method have been conquered in this method.

The contour plot of individual field component using the analytical function that could be compared to Figure 18 is also shown as in Figure 21.

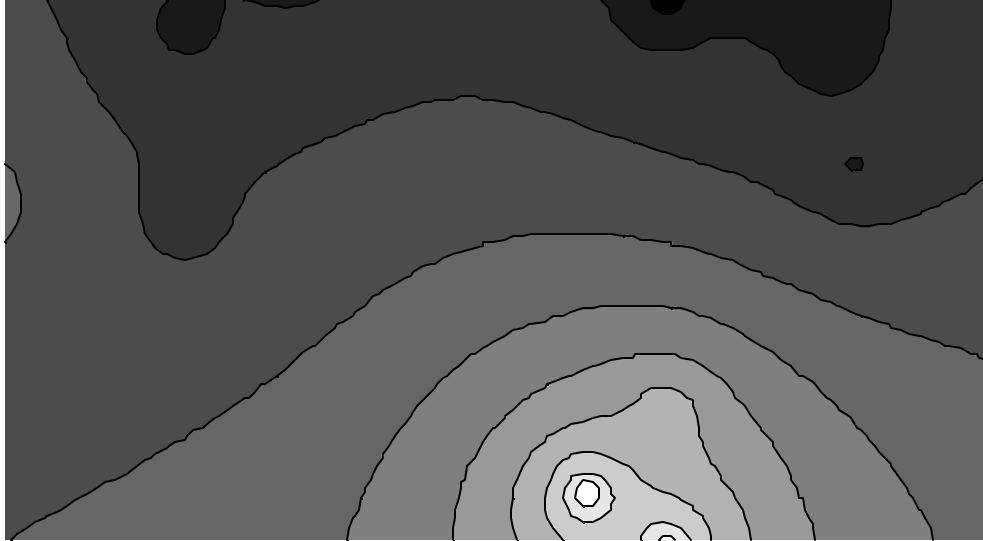


Figure 21: Individual component of field strength contours at 953 MHz by using the analytical function.

Since there are no interaction and reflection in the individual component, abrupt variations and the black spots are not appeared in the Figure 21.

Conclusion

In our project we have obtained the measurement data for resultant field strength and polar plots for 50 points around Galle town. Using the measurement data, we obtained an analytical model of the resultant and individual field strength distribution that directed us to identify the signal distribution pattern, signal weak areas and CCI effects.

To obtain more accurate data, we have to switch off or change the operating tower frequency while measuring the data to measure the exact contribution from each tower operated at the same frequencies. Since switching off the antenna or changing the operating frequency of the tower is beyond to our limit, we manually filtered out data from polar plots to obtained individual component of field strengths in selected points. Even though it is very hard to identify that these readings are actual contributions directly from antennas, we use GPS coordinates of the towers to identify direct contributions from reflections.

In GSM 900 band, the channel bandwidth is 200 kHz. When we measured two close frequencies, the meter automatically gets adjusted to measure only one frequency, which has the higher field strength than the other. Because of this measurement difficulty, measurement of field strength at close frequencies in a single point was a real challenge during our field measurement. Due to that reason we had lost some data at a few points.

Finally we have plotted the contour maps of the resultant field strength and individual field strength. Although this project is limited to the data of Dialog Telekom network any wireless service provider can use this model for the ir future planning.

We have formulated an analytical equation from the radiation principle to predict field strength of a point using the field measurement data instead of using the surface software that uses the least square method to fit the curve. Thus this analytical equation could be used to predict the resultant and individual field strength in any arbitrary point. Further we have also demonstrated the validity of our analytical function by checking with the available measured data.

Presently, we are working on further extending our analytical model by integrating with user-friendly software to provide information to the general user.

Still we need to analyse the validity of the analytical function with the number of measurement. Hence we can propose the minimum number of measurement in order to have a required precision. It should also be tested in different conditions for identifying the geographical factors n and r_{max} expressed in equation (04) for further validation before taking a distinct conclusion about our analytical function.

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6.3

**Consumer Protection in Telecommunication services
Southern Province in Sri Lanka**

By

H.S.C Perera
Dean, Faculty of Management and Finance
University of Ruhuna
Matara
Sri Lanka

Introduction to the study

In early times, the caveat emptor (let the buyer beware) doctrine of law concerning the sales of goods, assumed that the consumer was responsible for protecting himself. He would do so by applying his intelligence and experience in negotiating the terms in any purchase (Agarwal, 1989). In that time, the consumer may have been able to protect himself since products were less sophisticated and could be inspected before purchased. However, now the conditions have changed. Many modern goods and services are essentially technological mysteries. Viewing the whole economy in purely in technical terms, no natural superiority can be assumed either for the market or for the planning.(Galbraith, 1979). In some places market responses still serve. But over a very large area such responses cannot be rely upon; the market must give way to more or less comprehensive planning of demand and supply.

In real life, products and services are complex and are in great varieties. Consumer knows little or nothing about these highly sophisticated goods. Combined with the growth of mass communication methods and more sophisticated marketing techniques, also makes consumers more susceptible to misleading claims which may be made by traders. (Harland, 1991).

On the other hand consumers are more affected by misleading advertisements and deceptive representation of the traders. Further, sales promotion schemes such as bargain sale, bait and switch selling, conducting promotional contests, etc... have a tendency to put the consumers at vulnerable position. Both advertising and rising levels of education help to create greater expectations of consumers. Thus all these unfair trade practices are also to be controlled and regulated to protect the interest of the consumers.

It was assumed that in a free enterprise system, goods and services would be produced under conditions of competition. But, it would be false to assume that a competitive economy is a natural state of affairs. In fact, if we adopt a policy of *laissez faire* competition would not continue intact for long. The truth is business men do not like to compete. Generally, the businessmen choose to collude rather than compete or to

acquire by amalgamation or whatever a control over specific markets, with one aim in mind namely, to fleece the consumer.

In viewing the antitrust policy as a device for protecting the consumer, we have to consider that nature of that protection. The consumer gains from the competition in terms of more and better goods and services, lower costs and prices, and better use of resources. The role of competition is to allow competitive forces free play. Competition so encouraged is likely not only to improve efficiency in domestic production and services but also in the infrastructure serving export or distributing imports. It should never be forgotten that competition is itself a prime, perhaps, the prime consumer protection. (Bannerman, 1982)

Tendencies in many countries towards privatization of areas of economic activity and liberalization of markets mean that where basic consumer protection laws are few or even non-existent or cannot be adequately enforced (Harland, 1991). So, consumers are even more vulnerable to unsafe or substandard goods and services and unscrupulous marketing practices.

There is now a greater recognition that consumer need to be protected not only from the effects of monopolistic and restrictive trade practices but also from practices which are resorted to mislead or dupe the consumer (Agarwal, 1989)

The present concept of consumer protection has enriched with this notion and following definitions illustrated the evidence.

Taking into account the interests and need of consumers in all countries particularly those in developing countries; recognizing that consumers often face imbalances in economic terms, educational levels, and bargaining power, and bearing in mind that consumer should have the right of access to non hazardous products and services as well as the importance of promoting just, equitable and sustainable economic and social development. (United Nation, 1986)

Further, this idea has justified by one influential writer on consumer protection. According to him, Consumer protection should be seen as an essential, part of economic and social policy-one which can lead to vital and concrete benefits to

governments and well being of their citizens. Thus measures are adapted to attempt to ensure

- Minimum levels of safety and quality
- Adequate and accurate information to enable consumers to make informed individual choices.
- That ethical standards are observed in the market place (Harland, 1991)

It is clear that, the above definitions of consumer protection policy has accompanied with both consumerism and as well as Environmentalism. Consumerism is an organized movement of citizens and government to strengthen the rights and power of buyers in relation to sellers. (Kotler, 1989)

Whereas consumerists focus on whether companies are efficiently serving consumer material wants, environmentalists focus on the costs imposed on the environment in serving these needs and wants. “Environmentalism is an organized movement of concerned citizen and government to protect and enhance people’s living environment. (Kotler, 1989).

Consumer protection policy is thus seen as ultimately concerned with basic issues of social and economic policy. It promotes “higher standards of living and conditions of economic and social progress and development”. So, it was recently noted that consumer protection is recognized throughout the Asia-Pacific region “as one of the manifestations of progressive social and economic policy aimed at enhancing the quality of life” (United Nations, 1989)

The above theories and concepts are very important to the industries like telecommunication, because telecommunication industry can be treated as one of highly competitive and technologically diversified industry. In Sri Lanka with the open economic policy people can enjoy with this service diversification through SLT, Suntel and Lanka Bell. They are following various strategies for their management as well as administrative activities, such as the strategies like marketing, operations, human resources etc... However like other sectors the government of Sri Lanka faced alarming questions with this industry also to establishment of fair trade and fair protection towards consumers. Hence, government established Telecommunications

Regulations Commission of Sri Lanka (TRCSL) under the telecommunication regulatory commission Act No. 25 of 1991 and amended Act No. 27 of 1996. (TRCSL Act No. 1996) and other relevant organizations to regulate the telecommunication services in terms of protect the rights of the consumers and well being of the citizen.

Still, there is a doubt in the society about their competition, their services, productivity and quality and consumer protection. With the request from the TRCSL the study was done to measure and predict are the consumers protected in relation to telecommunication services providers in Southern Province in Sri Lanka.

1.2 Objectives of the study

The main objective of this research is;

To measure the consumer protection activities of the services of Sri Lankan telecommunication services providers in terms of consumers rights: to have a physical safety, to inform, to choose the service and right to be heard.

Supportive objectives as follows

- To study the consumer protection activities of the services providers
- To identify the different positions bear by different service providers in the telecommunication market
- To understand whether service providers provide their services according to the rules and regulations of TRC and other.
- To provide materialize information for regularizing the telecommunication activities in Sri Lanka.

1.3 Scope and Methodology

The methodology adapted to this research is survey based method followed by a questionnaire. Survey was conducted in Matara district representing all divisional secretariats. All major telecommunication service providers namely Sri Lanka Telecom (SLT), Suntel and Lanka Bell were took into consideration at the sample. Further, to represent the population sample was selected based on the variables such as District population, Level of Education, Level of income, Market share of the three major services providers and their market segments (Cooperate, Household, and Religious). The sample of the telecommunication study comprises with 500 telecommunication customers of Matara district and the sample selected for the study is as follows.

Matara	70
Devinuwara	50
Hakmana, Kirinda puhulwella	85
Dickwella	75
Weligama, Welipitiya, Akuressa	75
Kotapola	40

Kamburupitiya, Mulatiyana, Pasgoda	55
Thihagoda	50

To investigate the primary data of the study interviews were conducted based on questionnaires. The questionnaire includes both open ended and closed ended symmetrical scale questions. Further, questionnaires were divided into two main sections namely general information and information relevant to the major variables. Through the general information data were gathered on the aspects of the customers' personal information, the service provider, type of the telephone, the segment of the market, awareness of the TRC, TRC activities and its implementations.

The major four variables namely right to have a physical safety, right to inform, right to choose the service and right to be heard and other consumer protection information were used to measure the level of consumer protection activities provided by the services providers.

The Secondary data collected form the reports, journals, magazines, manuals published by the Sri Lanka Telecommunication Regulation Commission and through text books relevant to the subject and the internet.

The data were analyzed qualitatively as well as quantitatively. The quantitative analysis of the data was based on the statistical analysis method called SPSS Model.

1.4 Significance of the Study

The significance of the study can be pointed out in terms of,

- Significance to the Telecommunication Regulation Commission of Sri Lanka

Through this study, the Telecommunication Regulation Commission can view telecommunication services providers in various perspectives. Thereby they can analysis, measure and understand the following scenarios.

- How each services provider are satisfying consumer protection activities?
- In what level these organizations are fulfilling the market needs on consumer protection.

- Are the services providers in line with the rules, regulations and with policies of telecommunication activities of Sri Lanka?

- Significance to the Service Providers

The service providers who are engaging in this industry can get important information through this study; such as availability of consumer protection activities, are they violate the consumer right in relation to telecommunication service. So, based on that information the existing companies are able to adjust their marketing mixes to match with customer desires.

- Significance to the Customers

The study opens the door to get a lot of information regarding the presently available telecommunication service providers as well as the current regulations such as existence of TRC and activities. And they can select the best service providers from the alternative service suppliers. In addition to that new customers are aware of what types of promotional methods each service provider use and they can pay their attention to those promotional areas in order to get more quality service.

- Significance to the new comers who are hoping to come to the industry

The new comers who are hoping to come to the Telecommunication industry can use this information as a feasibility study. They are able to know the position of existing service providers, customer attitudes towards each and every service provider etc.

- Significance to the economy as a whole

This study reveals how the infrastructure of the country has developed through this study. Further, the study will be helpful for the whole economy and the government to identify the areas of economic well being.

Results and Discussion

The consumer protection of telecommunications industry in Southern Province in Sri Lanka is analyzed under the following headings.

- General Information of Consumers
- The Reliability of the Study
- Right to have physical safety
- Right to inform
- Right to choose
- Right to be heard

General Information of Consumers

The telecommunications services in Southern Province comprise with three organizations including Sri Lanka Telecom, Suntel and Lanka Bell. There are about 89746 consumers who use telecommunications services in the province (TRC, Reports).

Southern province consists of three districts, namely, Galle, Matara and Hambantota. In this study, the researchers conducted survey only in Matara district. The researchers selected this district because of the convenience to approach. Matara district is one of the major districts in south and situated in between Galle and Hambantota. It consists with 16 divisional secretariats. The research was conducted in all 16 and the sample selected was 500. Table 01 and figure 01 provides a more detailed picture of the sample.

Table 01: Divisional Secretariat

Divisional Secretariat	Frequency	Percent	Valid Percent	Cumulative Percent
Devinuwara	50	10	10	10
Dikwella	75	15	15	25
Hakmana, Kirinda Puhulwella	85	17	17	42
Kamburupitiya, Mulatiyana, Pasgoda	55	11	11	53
Kotapola	40	8	8	61
Matara	70	14	14	75
Thihagoda	50	10	10	85
Weligama, Welipitya, Akurassa	75	15	15	100.0
Total	500	100.0	100.0	

Source: Survey, 2006

Type of the Service Provider

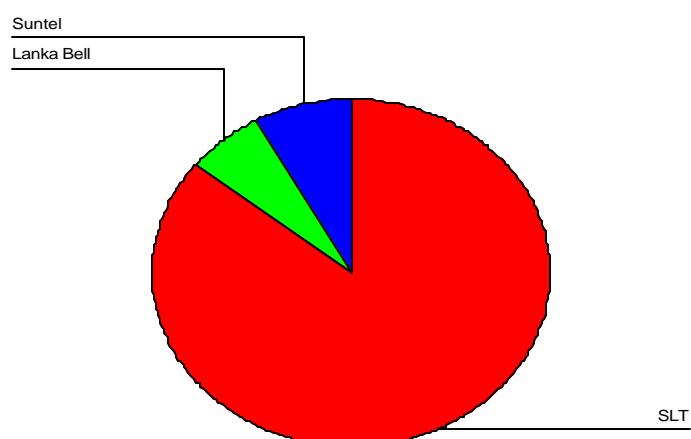
The type of the services providers are consisted of SLT, Suntel and Lanka Bell. According to the statistics provided by TRC, the major market share is owned by SLT and the rest has owned by Lanka Bell and Suntel respectively. The details of the type of service are given in Table 02 and Figure 01.

Table 02: Type of the service provider

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	SLT	429	85.8	85.8	85.8
	Lanka Bell	31	6.2	6.2	92.0
	Suntel	40	8.0	8.0	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 01: Type of the Service



Source: Survey, 2006

Type of the Phone

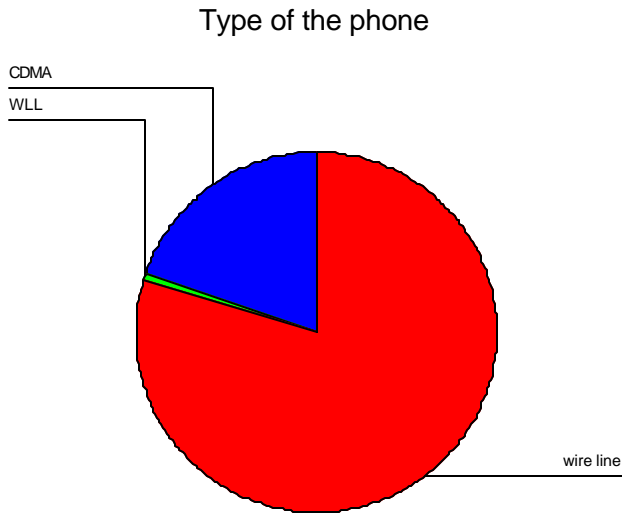
All telecom services providers are engaged in supplying three types of phones namely wire line, wire less line, CDMA, and other types. And, the study concentrated above four types. Table 03 and figure 02 illustrate the type of phones more clearly.

Table 03: Type of the phone

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	wire line	398	79.6	79.6	79.6
	WLL	4	.8	.8	80.4
	CDMA	98	19.6	19.6	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 02



Source: Survey, 2006

Customer Segments and Sample

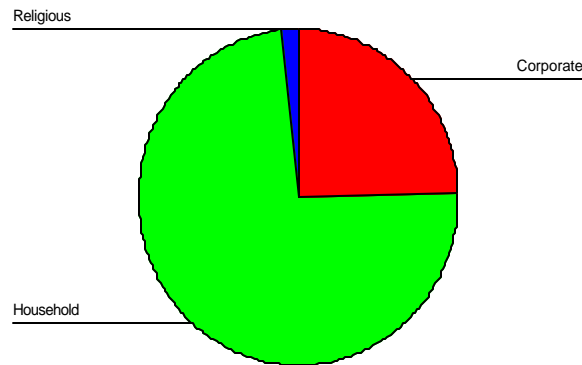
The study considered all three major segments such as, corporate, household and religious. Table 04 and figure 03 depict the data related to the segments.

Table 04: Customer Segments and Sample

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Corporate	124	24.8	24.8	24.8
	Household	368	73.6	73.6	98.4
	Religious	8	1.6	1.6	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 03: Customer Segments and Sample



Source: Survey, 2006

The Reliability of the Study

According to the statistics depicts in below the mean of the items of the questionnaire is equal 1.7096, that is in between the minimum (1.2220) and the maximum (2.3960) values. It shows us the questions are in line with the reliability of the study. Further, it says that trough the questions one can analyze the consumer protection in relation to the telecommunication services very effectively.

The reliability coefficient checked through the value Alpha. In this study the Alpha value is equal to 0.9199. This value implies that the study and the questionnaire is 92% reliable. Further, it is close to value 01 and as well as it is very close to the 100%.

RELIABILITY ANALYSIS - SCALE (ALPHA)

N of Cases = 500.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables	
	41.0300	108.1294	10.3985	24	
Item Means Variance	Mean	Minimum	Maximum	Range	Max/Min
	1.7096	1.2220	2.3960	1.1740	1.9607
.1194					
Item Variances Variance	Mean	Minimum	Maximum	Range	Max/Min
	.5337	.3133	.7948	.4814	2.5365
.0123					

Analysis of Variance

Source of Variation Prob.	Sum of Sq.	DF	Mean Square	F
Between People	2248.1896	499	4.5054	
Within People	5516.7083	11500	.4797	
Between Measures	1373.0159	23	59.6963	
165.3441 .0000				
Residual	4143.6924	11477	.3610	
Total	7764.8979	11999	.6471	
Grand Mean	1.7096			

Reliability Coefficients 24 items

Alpha = .9199 Standardized item alpha = .9222

TRC and its activities towards Consumer Protection

TRC and its activities were analyzed under the question No. 09- 20 of the questionnaire. Question no. 09- 12 were relevant to the general problems faced by the consumers and complaints made to any organizations in Sri Lanka and its response in relation to the consumer protection of consumers in telecommunication industry.

According to the Table 05, the 72% of consumers are having problems relevant to their telecommunication service. Out of that 95% have made complaints. However, only 28% received satisfactory answers. There the study made attention to analyze the question such as if there are problems, what are the actions that the consumers was taken. 97% agreed on that they have to inform to the service provider while only 1.5% agreed to inform to TRC. And 1% of the consumers do not know about the actions.

Table 05: Consumer Protection and Problems

Whether there were problems about the service					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	361	72.2	72.2	72.2
	No	139	27.8	27.8	100.0
	Total	500	100.0	100.0	
If yes, whether they have made complaints					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	344	95.3	95.3	95.3
	No	17	4.7	4.7	100.0
	Total	361	100.0	100.0	
If there are problems, what should be done					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inform Service Provider	487	97.4	97.4	97.4
	Inform TRC	8	1.6	1.6	99.0
	Inform Consumer Authority	2	.4	.4	99.4
	Don't know	3	.6	.6	100.0
	Total	500	100.0	100.0	
whether they receive a satisfactory response					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	101	28.0	28.0	28.0
	No	260	72.0	72.0	100.0
	Total	361	100.0	100.0	

Source: Survey, 2006

Awareness on TRC and Response

Question no: 13 to 15 are relevant to this aspect of the questionnaire. It was recognized that only 15% of customers knows about the existence of TRC while 85% of them are not having any idea on TRC or its activities. Out of customers who are having an idea about TRC only 8% had made complaints and 33% are satisfied with responses made by TRC in relation to their Telecommunication problems. Table 06 illustrates this information in more details.

Table 06: Awareness and Responses

Awareness on TRC					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	74	14.8	14.8	14.8
	No	426	85.2	85.2	100.0
	Total	500	100.0	100.0	

If know TRC, whether had a response from TRC					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	6	8.1	8.1	8.1
	No	68	91.9	91.9	100.0
	Total	74	100.0	100.0	

Whether they are satisfied with the response					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	2	33.3	33.3	33.3
	No	4	66.7	66.7	100.0
	Total	6	100.0	100.0	

Source: Survey, 2006

Existence of Consumer Protection Cooperation and Perception of Supporting to TRC and such Organization.

Question no. 16-20 deals with this and it was revealed that no consumer protection societies have been established so far in Matara district. However 26% are having intention to establish such organization. As far as the perception of supporting the organization in concern 91% revealed that when they want to inform the disconnection they are willing to get the support from TRC and other Organization. Further study analyzed the consumer knowledge on consumer protection activities and 90% of them disclosed that they have no idea about consumer protection activities made by TRC and other organizations.

Table 07 depicts the details.

Table 07: Existence of Consumer Protection Cooperation and Perception of Supporting to TRC and such Organization.

Whether there is a Corporation of Consumers					
		Frequency	Percen	Valid Percent	Cumulative Percent
Valid	Yes	1	.2	.2	.2
	No	499	99.8	99.8	100.0
Total		500	100.0	100.0	

If there aren't whether they Wish to Establish					
		Frequency	Percen	Valid Percent	Cumulative Percent
Valid	Yes	132	26.4	26.4	26.4
	No	368	73.6	73.6	100.0
Total		500	100.0	100.0	

Situations for Consumers to Support Service Providers					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inform bad maintenance of cables	37	7.4	7.4	7.4
	Inform disconnections	457	91.4	91.4	98.8
	Informing dangerous situations	6	1.2	1.2	100.0
Total		500	100.0	100.0	

Knowledge on the actions to Protect Consumers					
		Frequency	Percen	Valid Percent	Cumulative Percent
Valid	Yes	51	10.2	10.2	10.2
	No	449	89.8	89.8	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Right to Have a Physical Safety

As far as sovereignty of the consumers is concerned, consumers' right to have physical safety is very important. Right to have physical safety were reviewed in terms of; service providers' consideration of mental and physical problems, arranging cables and systems safely, and protection of consumer and company's awareness programs on safety procedures. The study deeply analyzed the above variables separately and results show that 43% of the consumers agreed that services providers consider about their physical safety, while nearly 40% hold a moderate idea and approximately only 16% reply negatively on this aspect. Table 08, and figure 04, table 09, figure 05, table 10 figure 06, depicts the above information in more detail. But, the

level of educating on safety procedures was not satisfactory since 51% of consumers hold a negative idea on that. Further, 16% of the consumers agreed on that aspect.

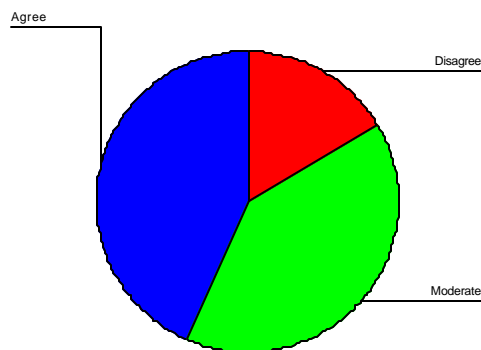
Table 08: Consideration of mental and physical problems

		Frequency	Percen	Valid Percent	Cumulative Percen
Valid	Disagree	82	16.4	16.4	16.4
	Moderate	201	40.2	40.2	56.6
	Agree	217	43.4	43.4	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 04

Consideration of mental and physical problems



Source: Survey, 2006

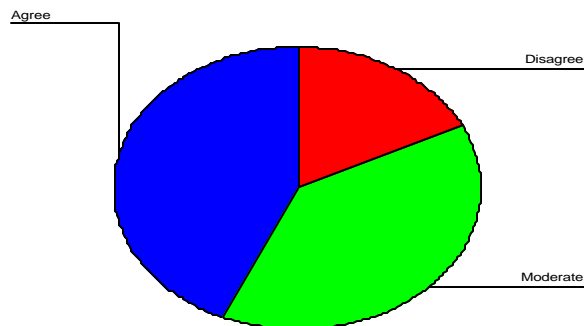
Table 09: Arranging cables and systems safely

		Frequency	Percen	Valid Percent	Cumulative Percen
Valid	Disagree	89	17.8	17.8	17.8
	Moderate	194	38.8	38.8	56.6
	Agree	217	43.4	43.4	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 05:

Arranging cables and systems safely



Source: Survey, 2006

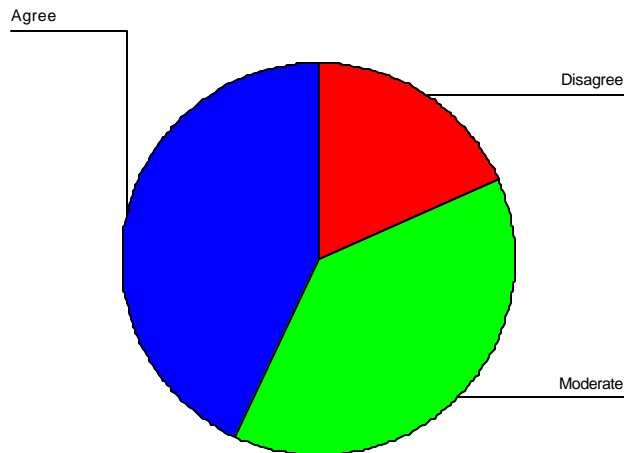
Table 10: The phone protects the consumer (Especially ear)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	91	18.2	18.2	18.2
	Moderate	194	38.8	38.8	57.0
	Agree	215	43.0	43.0	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 06:

The phone protects the consumer (Specially ear)



Source: Survey, 2006

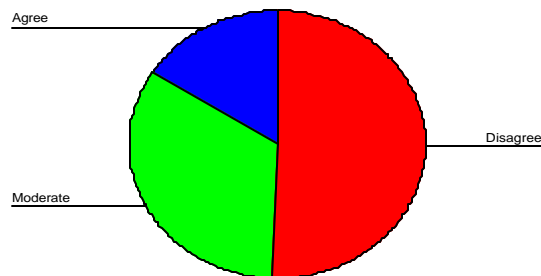
Table 11: Companies have educated on safety procedures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	253	50.6	50.6	50.6
	Moderate	166	33.2	33.2	83.8
	Agree	81	16.2	16.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 07

Companies have educated on safety procedures



Source: Survey, 2006

Right to Inform

The right to inform can be defined as to be protected against the fraudulent, deceitful or misleading information, advertising, labeling or other practices and to be given facts needed to make an informed choice (Dassanayake, 1990). In this connection study deeply analyzed these concepts through 14 variable such as provides information as per regulations, awareness of response on customer needs by the external operator, awareness of new connections in relevant duration, right to have compensations if service is not provided duly, educate on how to use the phone effectively, educate on durations of malfunctions and repairs, educate on price changes, educate on added services and other facilities, provide correct information when customer goes to service place, educate on how to complain if there are problems educate on TRC, its services and functions, educate on how to complain at TRC and educate on new and introducing services.

As far as services providers' provision of information as per regulations is concerned, 65% of consumers disagree and revealed that the service organizations are not providing them the relevant information as per regulations while 26% hold a moderate and only 9% of customers agreed with that idea. Table 13 and figure 05 depict the above factor in more detail

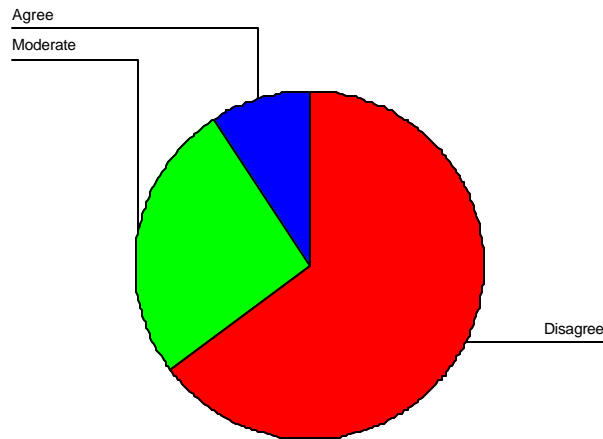
Table 13: Provides Information as per Regulations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	323	64.6	64.6	64.6
	Moderate	131	26.2	26.2	90.8
	Agree	46	9.2	9.2	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 05:

Provides information as per regulations



Source: Survey, 2006

Awareness of external operators and directory operators respond within 30 seconds is concerned, 82% of the customers mention that they were not informed this decision and where only 13% agreed that they were informed. Table 14, figure 06, table 15, figure 07 narrate the above factor in more details.

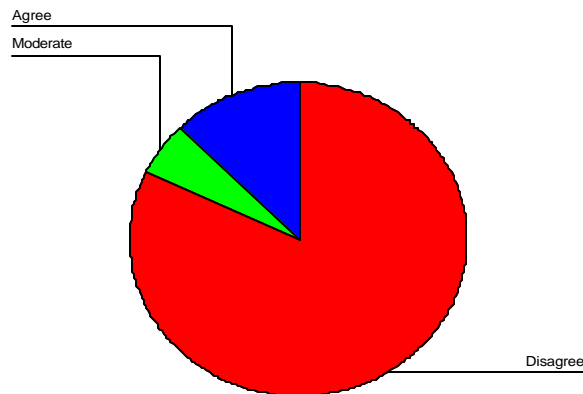
Table 14: External operator should Respond within 30 sec.s

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	410	82.0	82.0	82.0
	Moderate	27	5.4	5.4	87.4
	Agree	63	12.6	12.6	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 06

External operator should respond within 30 secs



Source: Survey, 2006

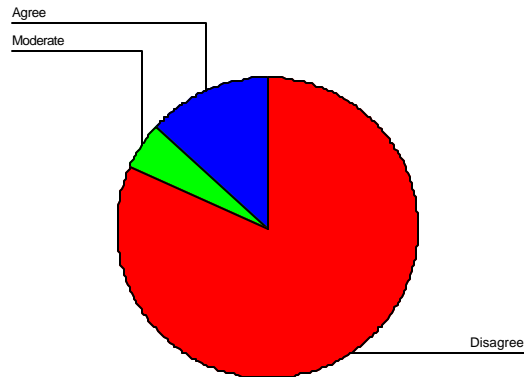
Table 15: Directory Operator should Respond within 30secs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	409	81.8	81.8	81.8
	Moderate	25	5.0	5.0	86.8
	Agree	66	13.2	13.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 07:

Directory operator should respond within 30secs



Source: Survey, 2006

Awareness on new connections in due time period and right to have compensation if service is not provided duly are concerned 59% of the customers revealed that they were not known about that decisions while nearly 13% hold a moderate idea. However, 29% of customers have pointed out that they were already informed about the above decisions. Table 16, figure 08, table 17 and figure 09 present more details.

Table 16: New connections should be Provided in Relevant Duration

		Frequency	Percent	Valid Percent	Cumulative Percent
	Disagree	295	59.0	59.0	59.0
	Moderate	59	11.8	11.8	70.8
	Agree	146	29.2	29.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

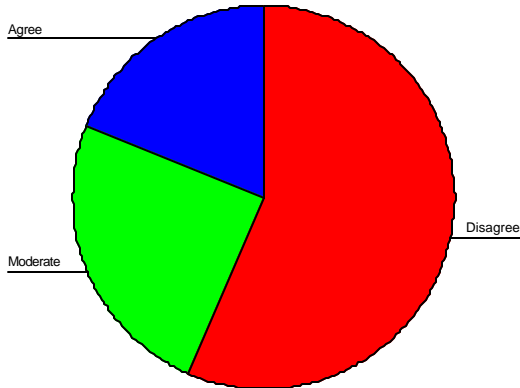
Table 18: Educate on how to use the Phone Effectively

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	282	56.4	56.4	56.4
	Moderate	123	24.6	24.6	81.0
	Agree	95	19.0	19.0	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 10:

Educate on how to use the phone effectively



Source: Survey, 2006

Educate customers on the duration of repairs in disconnections and malfunctions. Table 19 and figure 11 show that 68% of consumers were not informed such clues where 11% agreed.

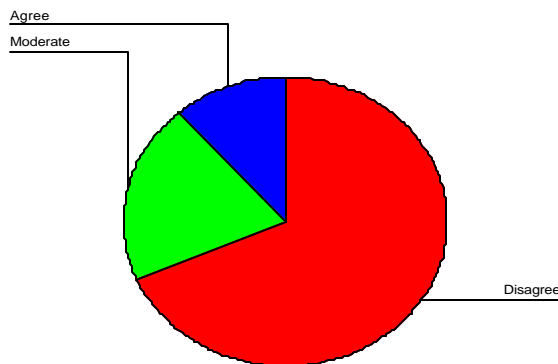
Table 19: Educate on the Durations of Malfunctions and Repairs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	342	68.4	68.4	68.4
	Moderate	101	20.2	20.2	88.6
	Agree	57	11.4	11.4	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 11

Educate on the durations of malfunctions and repairs



Source: Survey, 2006

Educate on price changes, added services and other facilities are concerned 48% of customers disagree in this relation where 15% are agreed. Table 20, table 21, figure 12 and figure 13 provide illustrative explanations.

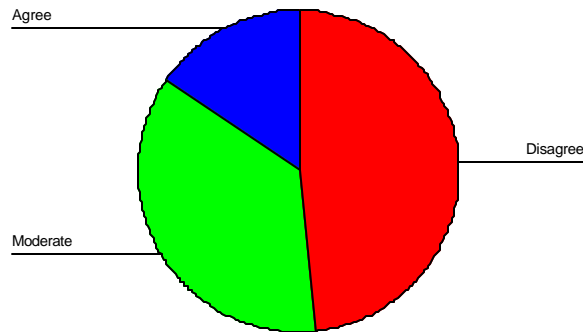
Table 20: Educate on Price Changes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	242	48.4	48.4	48.4
	Moderate	181	36.2	36.2	84.6
	Agree	77	15.4	15.4	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 12:

Educate on price changes



Source: Survey, 2006

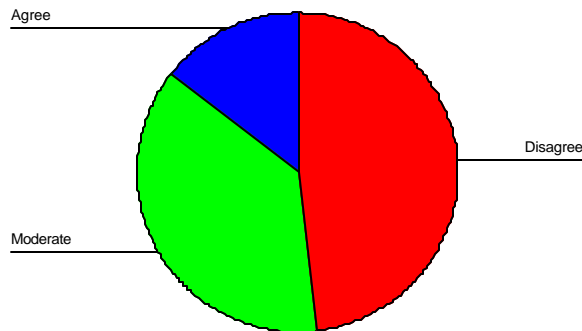
Table 21: Educate on Added Services and Other Facilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	240	48.0	48.0	48.0
	Moderate	188	37.6	37.6	85.6
	Agree	72	14.4	14.4	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 13

Educate on added services and other facilities



Source: Survey, 2006

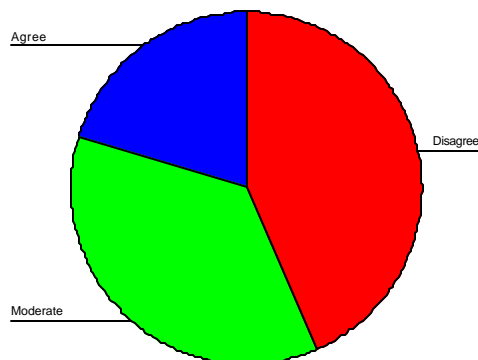
The research paid special attention on how the telecommunication service providers are providing correct information when customer comes to them. It was found that 43% are not happy with the service where 20% are agreed. Table 22 and figure 14 depict more details.

Table 22: Provide Correct Information when they go to Service Place

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	216	43.2	43.2	43.2
	Moderate	183	36.6	36.6	79.8
	Agree	101	20.2	20.2	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 14: Provide Correct Information when they go to Service Place



Source: Survey, 2006

Finally, the study made an investigation on educate customers on how to complain, educate on TRC, its services, functions and how to make a complaint to TRC and as well educate the customers on new inventions.

It was recognized that around 71%-80% are not educated on above activities. However, in the case of new inventions only 18% are agreed that they were educated on new inventions and innovations.

Table 23, figure 15, table 24, figure 16, table 25, figure 17 and table 26 and figure 18 demonstrated the details more clearly.

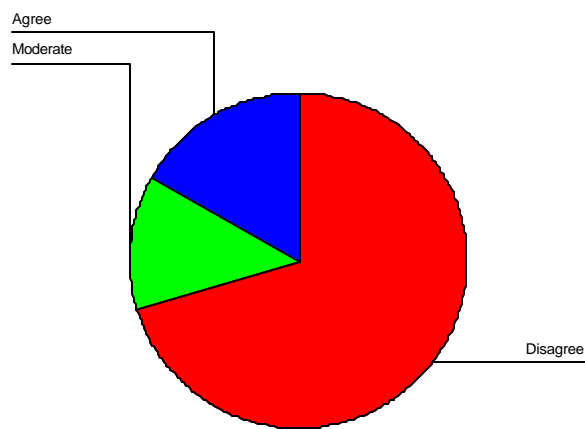
Table 23: Educate on how to complain if there are Problems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	352	70.4	70.4	70.4
	Moderate	64	12.8	12.8	83.2
	Agree	84	16.8	16.8	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 15:

Educate on how to complain if there are problems



Source: Survey, 2006

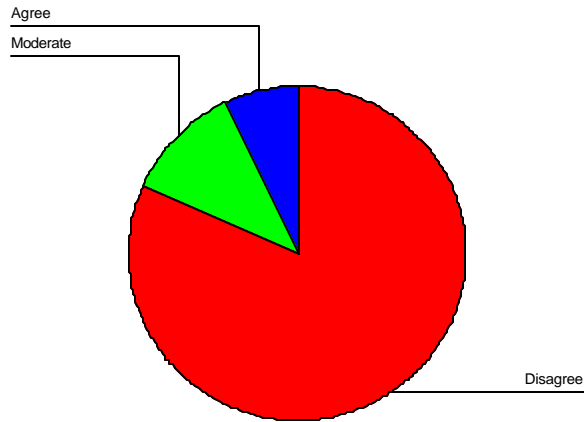
Table 24: Educated on TRC, its Services and Functions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	409	81.8	81.8	81.8
	Moderate	56	11.2	11.2	93.0
	Agree	35	7.0	7.0	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 16:

Educated on TRC, its services and functions



Source: Survey, 2006

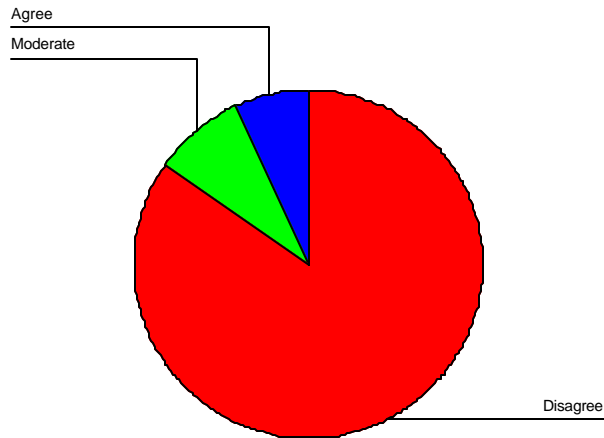
Table 25: Educated on how to Complain at TRC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	424	84.8	84.8	84.8
	Moderate	41	8.2	8.2	93.0
	Agree	35	7.0	7.0	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 17:

Educated on how to complain at TRC



Source: Survey, 2006

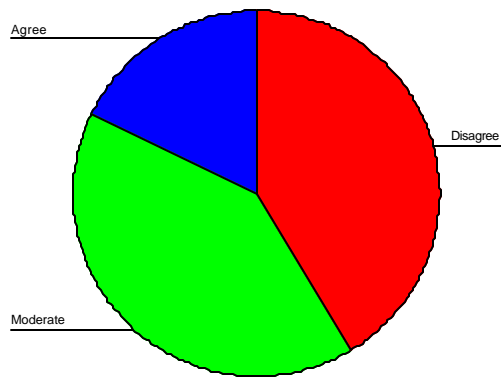
Table 26: Educates on new and Introducing Services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	207	41.4	41.4	41.4
	Moderate	204	40.8	40.8	82.2
	Agree	89	17.8	17.8	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 18:

Educates on new and introducing services



Source: Survey, 2006

Right to Choose

This concept can be defined as to be assured, wherever possible, access to a variety of products and services at competitive prices. If competition is not workable, assurance of satisfactory quality and service at fair price are questionable (Dassanayake, 1990). The study revealed this concept through services providing at different prices, obtainability of services without influences, providing reasonable services with good manner, providing instructions and information to choose the services, provide instructions on how to choose the service as per standards.

It is happy to that around 40%-52% customers are having right to choose the services at different prices without any influences. Thereby, researchers found that all telecommunications services providers are in line with price differentiation with product differentiation. Table 27, figure 19, table 28, and figure 20 depict detailed information.

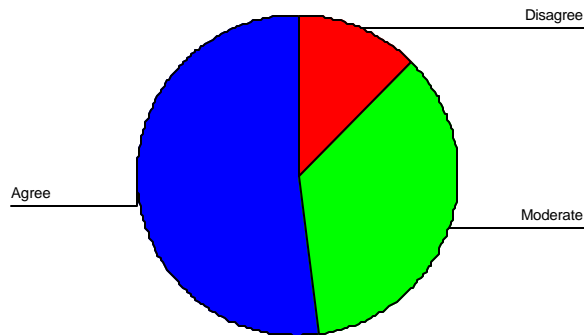
Table 27: Services are Provided at Different Prices to Choose

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	63	12.6	12.6	12.6
	Moderate	176	35.2	35.2	47.8
	Agree	261	52.2	52.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 19:

Services are provided at different prices to choose



Source: Survey, 2006

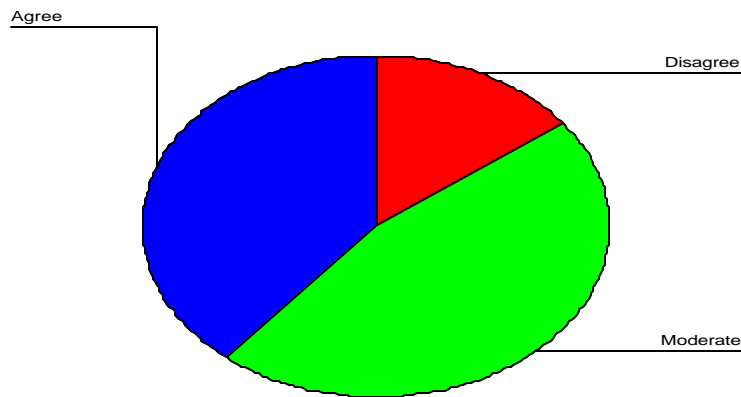
Table 28: Services can be Obtained Competitively without Influences

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	74	14.8	14.8	14.8
	Moderate	232	46.4	46.4	61.2
	Agree	194	38.8	38.8	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 20:

Services can be obtained competitively without influence



Source: Survey, 2006

To have better choice customers should be provided with a reasonable service in a responsible manner. Study checked out that whether telecommunications service providers are engaged with these activities and recognized that only 25% of the

customers are provided a reasonable service in a reasonable manner. Table 29 and figure 21 illustrate this information very clearly.

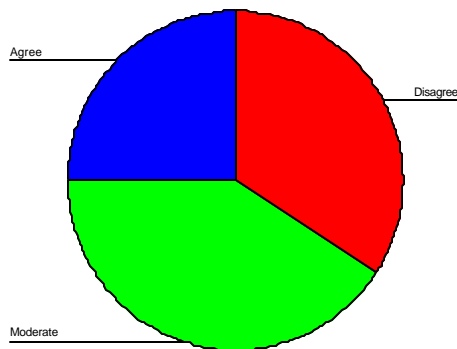
Table 29: Provides a Reasonable Service in a Reasonable Manner

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	171	34.2	34.2	34.2
	Moderate	204	40.8	40.8	75.0
	Agree	125	25.0	25.0	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 21:

Provides a reasonable service in a reasonable manner



Source: Survey, 2006

Further, the study went into detailed inquiry about the services providers' activities on providing instructions and information to choose the services and provide instructions on how to choose as per standards. It seems that those organizations are not providing the instructions and information to choose the service and only 13% agreed with this regard and only 12% are agreed with the instruction on how to choose as per standards. Table 30, figure 22, table 31 and figure 23 lay down more information.

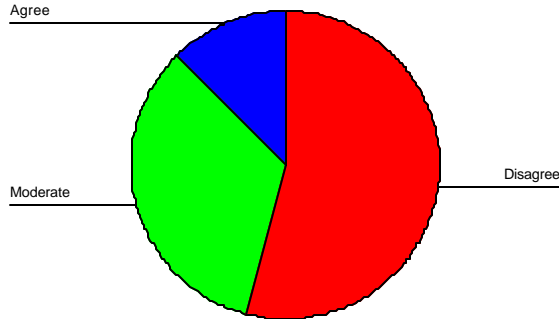
Table 30: Provides Instructions and Information to Choose the Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	271	54.2	54.2	54.2
	Moderate	166	33.2	33.2	87.4
	Agree	63	12.6	12.6	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 22:

Provides instructions and information to choose the service



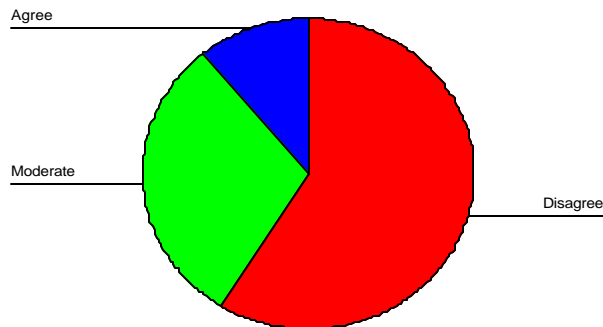
Source: Survey, 2006

Table 31: Provide Instructions on how to Choose as per Standards

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	294	58.8	58.8	58.8
	Moderate	150	30.0	30.0	88.8
	Agree	56	11.2	11.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 23: Provide Instructions on how to Choose as per Standards



Source: Survey, 2006

Right to be Heard

To be assured this right consumer interests will receive full and sympathetic consideration in the formation of government policy and fair and expedition treatment in the administrative organization (Dassanayake, 1990).

Thereby the concept was analyzed through; complaints can be made to TRC against the service providers, complaints made when service is unsatisfactory, services provided to protect consumers in relation to hearing them, getting ideas from consumers to develop standards, providing assistance to get redress, providing assistance to get compensation by TRC, customer expectation to change the manner of solving the complaints by TRC.

Among above variables only 23% consumers agreed that complaints can be made to TRC against the service provider. It seems that the customers' knowledge on TRC activities are and its existence influencing to this percentage. Because, most of the customers (60%) had not complained to TRC. The study identified that educating customers of their activities is a current need and a responsibility of TRC. Table 33 and figure 24 depict more information.

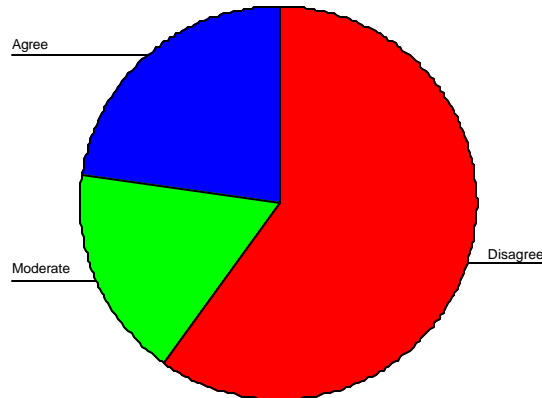
Table 33: Complaints can be made to TRC against the service provider

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	299	59.8	59.8	59.8
	Moderate	87	17.4	17.4	77.2
	Agree	114	22.8	22.8	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 24:

Complaints can be made to TRC against the service provider



Source: Survey, 2006

However, 41% of the customers agreed and 24% moderately agreed that they are able to complain to the service provider and or other source of complain. Table 34 and figure 25 illustrate this more clearly when service is unsatisfactory.

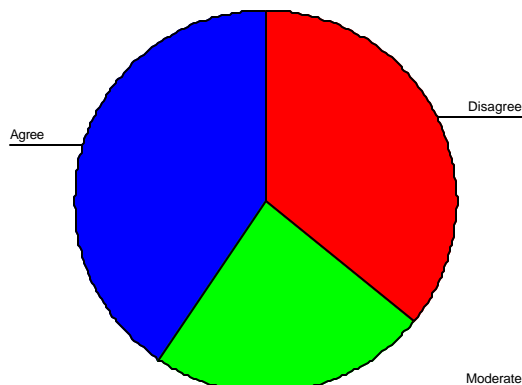
Table 34: Complaints can be made when service is unsatisfactory

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	179	35.8	35.8	35.8
	Moderate	118	23.6	23.6	59.4
	Agree	203	40.6	40.6	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 25:

Complaints can be made when service is unsatisfactory



Source: Survey, 2006

Study analyses that the service providers generally satisfy the right to be heard need of the customers of telecommunications services. Even though according to table 35 and figure 26 only 17% of customers are agreed in this regard. It seems that through right to be heard is very important to protect the consumers since they are unhappy with the present activities and situation. Not only that, 81% of the customers complained that their ideas are not taken into consideration by the services provider or TRC when developing standards. Table 36 and figure 27 provide particulars.

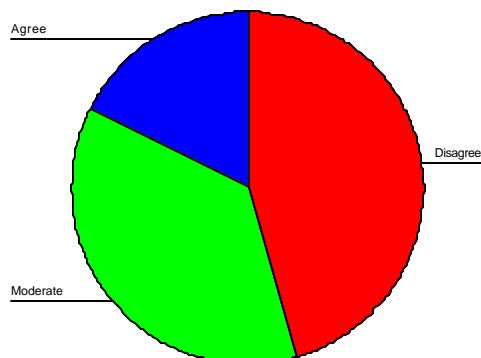
Table 35: Services provided are satisfactory

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	228	45.6	45.6
	Moderate	184	36.8	82.4
	Agree	88	17.6	100.0
Total	500	100.0	100.0	

Source: Survey, 2006

Figure 26:

Services provided are satisfactory



Source: Survey, 2006

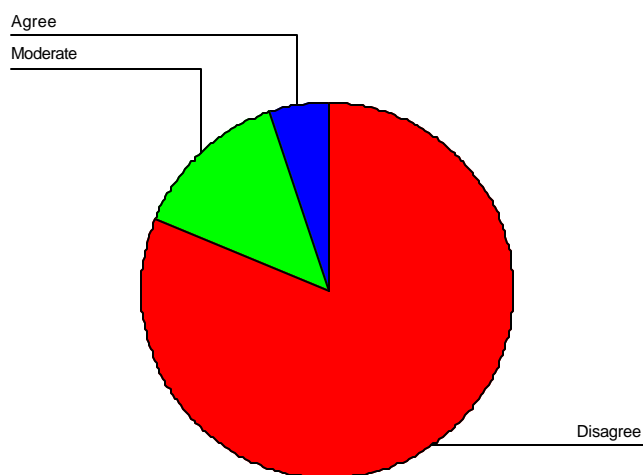
Table 36: Institutes get the ideas from consumers and develop standards

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	406	81.2	81.2	81.2
	Moderate	69	13.8	13.8	95.0
	Agree	25	5.0	5.0	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 27:

Institutes get ideas from consumers



Source: Survey, 2006

Further, the study investigates the activities made by the service providers towards complaints, as well as of the compensations on violation of rights of the customers. However, most of the customers (only 14%, 8% respectively agreed) disagreed with that services provider has acted fairly on the complaints and consumers got compensation on violation of their rights. It seems though there are number of consumer protection organizations existing, their activities are very limited to protect the compensation needs of the customers. Table 37, figure 28, table 38 and figure 29 gives more clear picture.

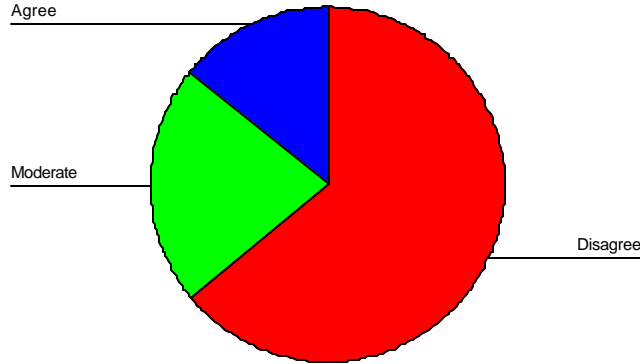
Table 37: Service provider has acted fairly on the complaints

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	319	63.8	63.8	63.8
	Moderate	110	22.0	22.0	85.8
	Agree	71	14.2	14.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 28:

Service provider has acted fairly on the complaints



Source: Survey, 2006

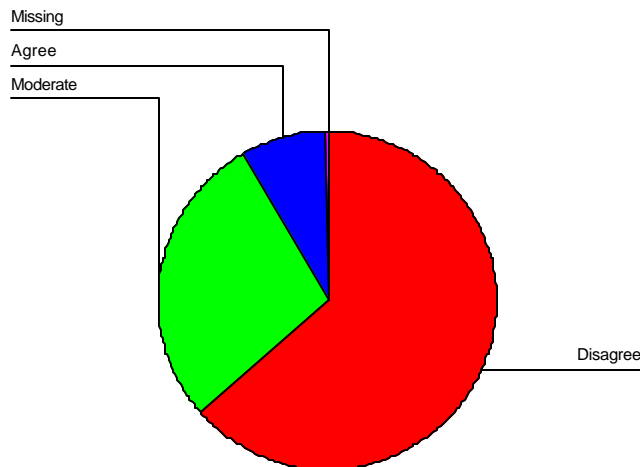
Table 38: TRC acts for consumer to get compensations on violation of rights

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	319	63.8	63.8	63.8
	Moderate	140	28.0	28.0	91.8
	Agree	41	8.2	8.2	100.0
Total		500	100.0	100.0	

Source: Survey, 2006

Figure 29:

TRC acts for consumer to get compensations



Source: Survey, 2006

It was analyzed the customers' expectation to change the manner of solving the complaints by TRC. 81% are disagreed or moderate in this concern because they do

not know about the TRC and its activities. However it should be mentioned that most of the customers thought that TRC is one of the branches of Sri Lanka Telecom; table 39 and figure 30 provides more details.

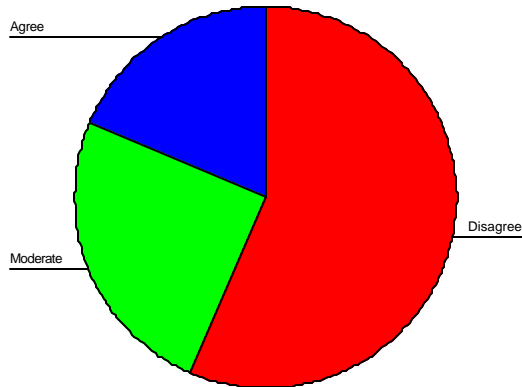
Table 39: Expects a change in the manner of solving the complaints

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	282	56.4	56.4	56.4
	Moderate	125	25.0	25.0	81.4
	Agree	93	18.6	18.6	100.0
	Total	500	100.0	100.0	

Source: Survey, 2006

Figure 30:

Expects a change in the manner of solving the complaint



Source: Survey, 2006

Conclusion

This research was conducted to measure the consumer protection of the telecommunications services of Southern Province, Matara district in Sri Lanka with the support of the Telecommunications Regulatory Commission (TRC), Sri Lanka.

Research was carried out among all the divisional secretariats in Matara district and the sample was 500. The questionnaire was used to measure the level of consumer protection in the telecommunications services quality of Sri Lanka Telecom, Lanka Bell and Suntel through right to have physical safety, right to choose, right to inform, right to be heard.

It seems that these organizations are not having thorough understanding about the consumer rights, rules, regulations and policies in this field concern. Thereby, study can emphasize that these organizations should be educated in consumer protection aspects as well as social responsibility of this field. This is current need as well as a responsibility of TRC.

Finally, it can be concluded that if the services organizations want to achieve their long term vision while surviving in the market place they have to consider and activate consumer protection activities. Such as right to have a physical safety, right to be informed, right to be heard and the right to choose. Thereby these organizations can ensure high standard living of the citizens as well as the sustainable development of the economy.

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6.4

**Services Quality and Telecommunications Services in the
Southern Province in Sri Lanka**

By

H.S.C Perera
Dean, Faculty of Management and Finance
University of Ruhuna
Matara
Sri Lanka

Background to the Study

Sri Lankan Telecommunication industry has played a major role in modern communication activities of the people. In the past there were limited numbers of people who use this service. However, during the last two decades several service providers entered into the market and as a result a large number of people in Sri Lanka consume the telecommunication services.

At present there is a huge competition in the market among the various local telecommunication providers and they play different positions and different aspects in the current market. Hence, suppliers of services, who often face stiff competition, sometimes appear to have a very different set of concerns. Many owners and managers complain about how difficult it is to make a profit, to find skilled and motivated employees, or to please customers.

Fortunately, some suppliers know how to please their customers while also running the productive, profitable operations, staffed by pleasant and competent employees (Lovelock, 2004). There the service organizations have to consider services characteristics such as intangibility, Inseparability, Variability and Perishability because the strategies of services are link with those four characteristics than physical products.

To be successful in the market place marketers must manage their services marketing mix efficiently and effectively. In addition to the major marketing mix, there are another three P's required namely People, Process and the Physical environment of the service. Because most services are provided by people, the selection, training, and motivation of employees should exhibit competence, a caring attitude, responsiveness, initiative, problem-solving ability, and goodwill. Companies also try to demonstrate their service quality through physical evidence and presentation. For instance, a telecommunication company may develop an attentive style of dealing with customers that realizes its intended customer value proposition, whether it is cleanliness, speed, or some other benefit. Finally, service companies can choose among different processes to deliver their service.

As far as service quality is concerned, it can be identified under two bases as manufacturing based components of quality and service based components of quality where Manufacturing based components of quality included Performance, Features, Reliability, Conformance, Durability, Serviceability, Aesthetic and Perceived quality and Service Based Components included five quality components as Tangibles, Reliability, Responsiveness, Assurance and Empathy. These service based components are considered as the requirements of the customers(Kotler, 2004).

It seems in Sri Lanka the above mentioned major telecommunication services providers are practicing all above concepts differently.

Unfortunately, customers are not always happy with the quality and value of the services they receive. People complain about late deliveries, incompetent personnel, inconvenient service hours, needlessly complicated procedures, long queues, and a host of other problems. In this connection this research will answer the questions such as;

What are the customers required quality criteria of selecting the telecommunication service?

How different telecommunication services providers fulfilling these requirements with their marketing strategies?

Are the activities relevant to the quality of these services organizations matched with the customer expectations as well as TRC expectations?

Objectives of the study

The main objective of this research is;

To measure the quality of the service of Sri Lankan telecommunication services providers in terms of their reliability, responsiveness, assurance, empathy and tangibles and other factors to predict customer satisfaction in relation to quality of the service.

Supportive Objectives as Follows

- To study the customer quality requirement criteria of selecting the services.
- To identify the different positions play by different marketers in the telecommunication market
- To understand whether service providers provide their services according to their promises
- To provide materialize information for regularizing the telecommunication activities in Sri Lanka.

Scope and Methodology

The methodology adapted to this research is survey based method followed by a questionnaire. Survey was conducted in Matara district representing all divisional secretariat and all major telecommunication service providers.

Further, to represent the population sample was selected based on the variables such as District population, Level of Education, Level of income, Market share of the three major services providers and their market segments (Cooperate, Household, and Religious). The sample of the telecommunication study comprises with 500 telecommunication customers of Matara district and the sample selected for the study is as follows.

Matara	70
Devinuwara	50
Hakmana, Kirinda puhulwella	85
Dickwella	75
Weligama, Welipitiya, Akuressa	75
Kotapola	40
Kamburupitiya, Mulatiyana, Pasgoda	55
Thihagoda, Malimbada	50

To investigate the primary data of the study interviews were conducted based on questionnaires. The questionnaire includes both open ended and closed ended symmetrical scale questions. Further, questionnaires were divided into two main sections namely general information and information relevant to the major variables. Through the general information data were gathered on the aspects of the customers' personal information, the service provider, type of the telephone, and the segment of the market.

The major five variables namely Reliability, Responsiveness, Assurance, Empathy, Tangibles and other quality factors were used to measure the level of services quality provided by the services providers.

The Secondary data collected form the reports, journals, magazines, manuals published by the Sri Lanka Telecommunication Regulation Commission and through text books relevant to the subject and the internet.

The data were analyzed qualitatively as well as quantitatively. The quantitative analysis of the data was based on the statistical analysis method called SPSS Model.

Significance of the study

The significance of the study can be pointed out in terms of,

- Significance to the Telecommunication Regulation Commission of Sri Lanka

Through this study, the Telecommunication Regulation Commission can view telecommunication services providers in various perspectives. Thereby they can analysis, measure and understand the following scenarios.

-How each services provider are satisfying customer expectations on services quality?

-In what level these organizations are fulfilling the market needs on services quality and

-Are the services providers in line with the rules, regulations and with policies of telecommunication activities of Sri Lanka?

- Significance to the Service Providers

The service providers who are engaging in this industry can get important information through this study; such as customer attitudes toward their service quality, changes in customer behavior patterns during the last time period, current trends in the market field etc. So, based on that information the existing companies are able to adjust their marketing mixes to match with customer desires.

- Significance to the Customers

The study opens the door to get a lot of information regarding the presently available telecommunication service providers as well as the current regulations such as existence of TRC and activities. And they can select the best service providers from the alternative service suppliers. In addition to that new customers are aware of what types of promotional methods each service provider use and they can pay their attention to those promotional areas in order to get more quality service.

- Significance to the new comers who are hoping to come to the industry

The new comers who are hoping to come to the Telecommunication industry can use this information as a feasibility study. They are able to know the position of existing service providers, customer attitudes towards each and every service provider etc.

- Significance to the economy as a whole

This study reveals how the infrastructure of the country has developed through this study. Further, the study will be helpful for the whole economy to identify the employment of the industry, contribution to the Gross Domestic Product, etc..

Results and Discussion

The services quality of telecommunications industry in southern province in Sri Lanka is analyzed under the following headings.

- The Reliability of the Study
- General Information of Consumers
- Reliability and Services Quality
- Assurance and Services Quality
- Responsiveness and Services Quality
- Assurance and Services Quality
- Empathy and Services Quality
- Tangibles and Services Quality
- Other Related Factors and Services Quality

The Reliability of the Overall Study

The services quality of the telecommunications services providers are evaluated under the six variables mentioned at the introduction and the researchers tried to measure the overall reliability of the study.

RELIABILITY ANALYSIS - SCALE (ALPHA)

N of Cases = 491.0

Statistics for	Mean	Variance	Std Dev	N of Variables
Scale	63.1487	400.1717	20.0043	33

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	1.9136	1.5092	2.3381	.8289	1.5493	.0308

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.5566	.4255	.6576	.2321	1.5454	.0032

Analysis of Variance

Source of Variation	Sum of Sq.	DF	Mean Square	F	Prob.
Between People	5941.9438	490	12.1264		
Within People	3541.0909	15712	.2254		
Between Measures	483.3158	32	15.1036	77.4500	.0000
Residual	3057.7751	15680	.1950		
Total	9483.0347	16202	.5853		
Grand Mean	1.9136				

Reliability Coefficients 33 items

Alpha = .9839 Standardized item alpha = .9838

In line with the above statistical data, the mean value of the scale is 1.9136 and it spans between minimum 1.5092 and maximum 2.3381. The range is 0.8289 and those results show that the questions of the study are complying with each other throughout all the variables. The Alpha value of the study equals to .9839, it is very close to the value 1.00 and it depicts that the reliability of the study is very high (98%).

General Information of Consumers

Southern province consists of three districts, namely, Galle, Matara and Hambantota. In this study, the researchers conducted survey only in Matara district. The researchers selected this district because of the convenience to approach. Matara district is one of the major districts in south and situated in between Galle and Hambantota. It consists with 16 divisional secretariats. The research was conducted in all 16 and the sample selected was 500. Table 01 provides a more detailed picture of the sample.

Table 01 Divisional **Secretariat**

Divisional Secretariat	Frequency	Percent	Valid Percent	Cumulative Percent
Devinuwara	50	10	10	10
Dikwella	75	15	15	25
Hakmana, Kirinda Puhulwella	85	17	17	42
Kamburupitiya, Mulatiyana, Pasgoda	55	11	11	53

Kotapola	40	8	8	61
Matara	70	14	14	75
Thihagoda	50	10	10	85
Weligama, Welipitya, Akurassa	75	15	15	100.0
Total	500	100.0	100.0	

Source: Survey Data 2006.

Type of the Phone

All telecom services providers are engaged in supplying three types of phones namely wire line, wire less line, CDMA, and other types. And, the study concentrated above four types. Table 03 and figure 02 illustrate the type of phones more clearly.

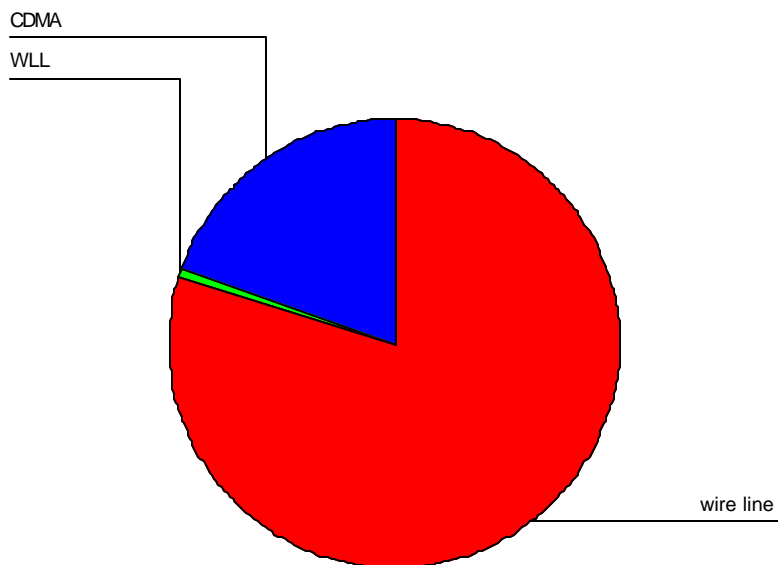
Table 03: *Type of the phone*

Valid		Frequency	Percent	Valid Percent	Cumulative Percent
	wire line	398	79.6	79.6	79.6
	WLL	4	.8	.8	80.4
	CDMA	98	19.6	19.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 01

Figure 02 Type of the phone



Source: Survey Data 2006.

Customer Segments and Sample

The study considered all three major segments such as, corporate, household and religious. Table 04 and figure 03 depict the data related to the segments.

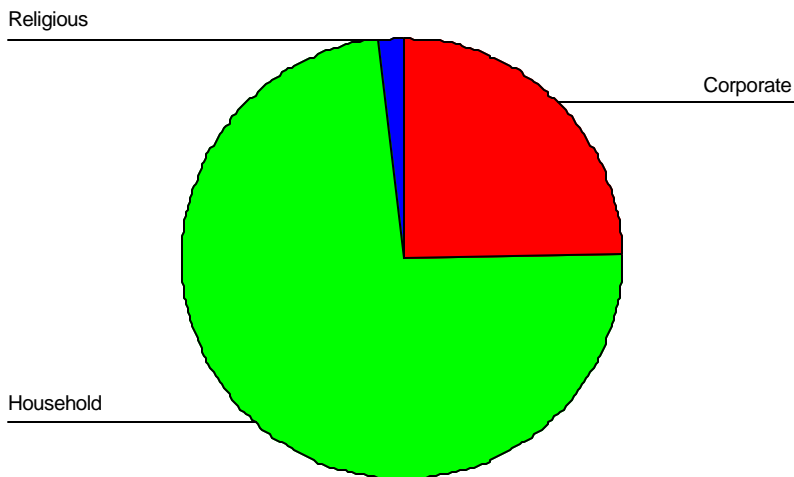
Table 04: Customer Segments and Sample

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Corporate	124	24.8	24.8	24.8
	Household	368	73.6	73.6	98.4
	Religious	8	1.6	1.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 03:

Customer Segments and Sample



Source: Survey Data 2006.

The Reliability and the Services Quality

The reliability and services quality was checked by using three sub variables such as; service is provided as agreed, solve the problems satisfactorily, and credibility. It was disclosed that generally the telecommunications service providers are not in line with reliability.

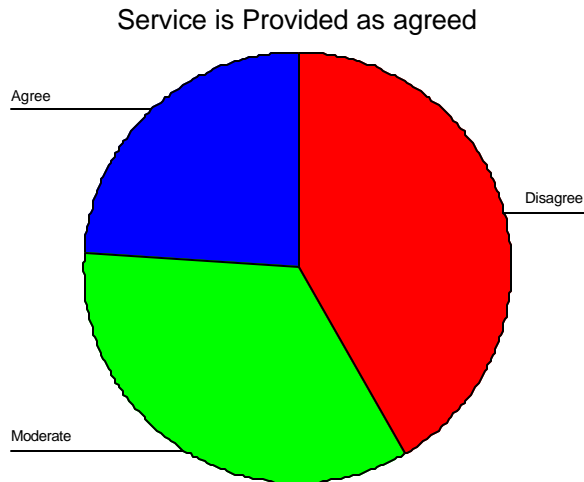
These organizations are not keeping with their promise (24% agreed, 42% disagreed, other 34% moderate). Not only that, but even the satisfaction towards solving problems are also in negative manner (agree 26%, moderate 35%, disagreed 39%) and credibility too it is shown as 29% agreed, 38% moderate, 33% disagreed. Table 05, figure 04, table 06, and figure 05, table 07, figure 06 reflect those in detail.

Table 05: Service is provided as agreed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	209	41.8	41.8	41.8
	Moderate	172	34.4	34.4	76.2
	Agree	119	23.8	23.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 04:



Source: Survey Data 2006.

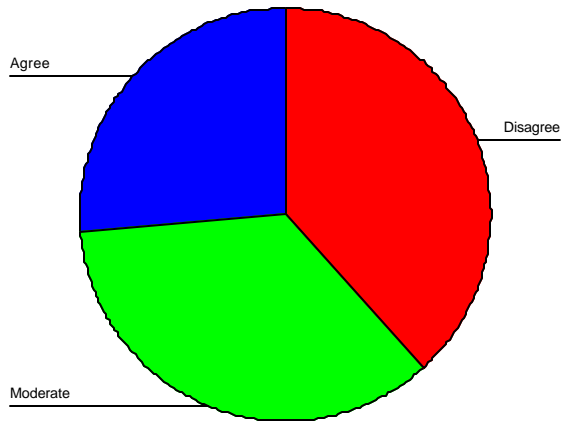
Table 06: Solve the Problems Satisfactorily

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	192	38.4	38.4	38.4
	Moderate	176	35.2	35.2	73.6
	Agree	132	26.4	26.4	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 05:

Solve the Problems Satisfactorily



Source: Survey Data 2006.

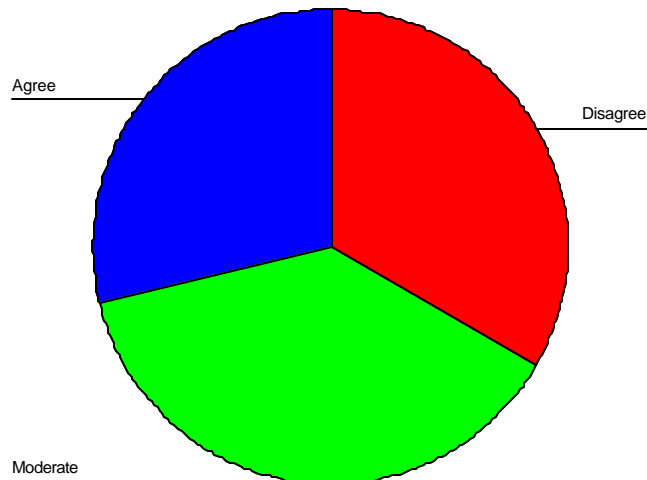
Table 07: Credibility of the Service Provider

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	166	33.2	33.2	33.2
	Moderate	190	38.0	38.0	71.2
	Agree	144	28.8	28.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure06

Credibility of the Service Provider



Source: Survey Data 2006.

Responsiveness and Quality

Responsiveness of the telecommunications services are viewed in terms of; quality of effective procedures for problem solving and transaction, time taken for services, dedication of employees, time for customer services, make aware and educate on essential services, make aware and educate on major policy changes.

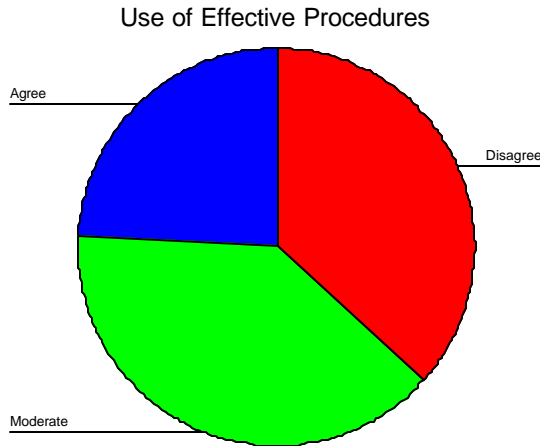
Study deeply analyzes above variables separately and results shows that most of the consumers are not happy with the responsiveness of their services in general. Table 09 and figure 07 shows the availability of procedures for problem solving and transaction activities are more towards negative (disagree 37%, moderate 39%, agree 24%). The time taken for various services is also very weak. Table 09 and figure 07 narrate this situation clearly (44% disagree, 34% moderate, 22% agree)

Table09-Use of Effective Procedures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	183	36.6	36.6	36.6
	Moderate	196	39.2	39.2	75.8
	Agree	121	24.2	24.2	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 07



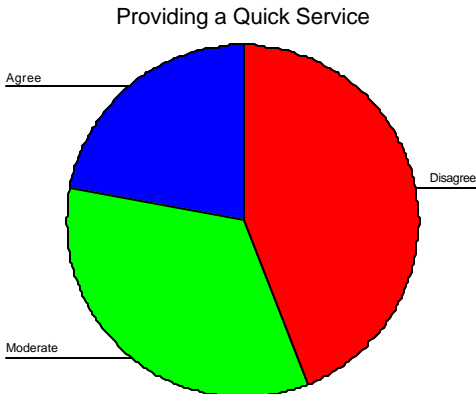
Source: Survey Data 2006.

Table 10 - Providing a Quick Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	219	43.8	43.8	43.8
	Moderate	171	34.2	34.2	78.0
	Agree	110	22.0	22.0	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 08



Source: Survey Data 2006.

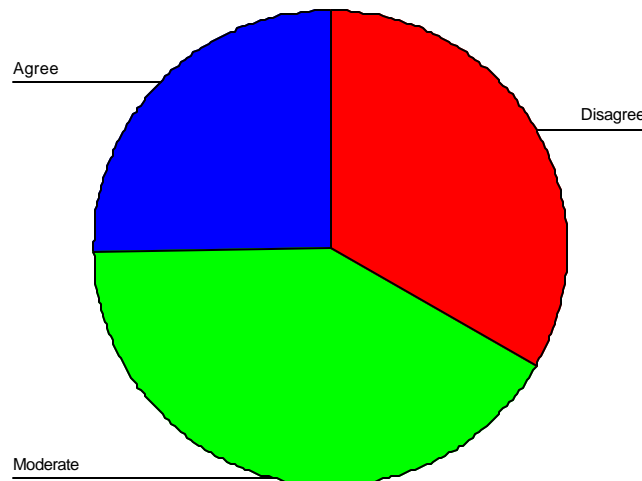
Table 11 and figure 09 mark out the dedication of employees' time for customer services and it shows the degree of dedication of employees are inadequate to fulfill the customers' expectations (disagree 33%, moderate 41%, agree 26%)

Table 11 - Dedication of the Staff

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	166	33.2	33.2	33.2
	Moderate	207	41.4	41.4	74.6
	Agree	127	25.4	25.4	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 09 Dedication of the Staff



Source: Survey Data 2006.

Table 12 and figure 10 illustrate the activities that has been taken into make aware and educate the consumers on changes of essential services and it also close to negative direction (disagree 40%, moderate 40%, agree 20%)

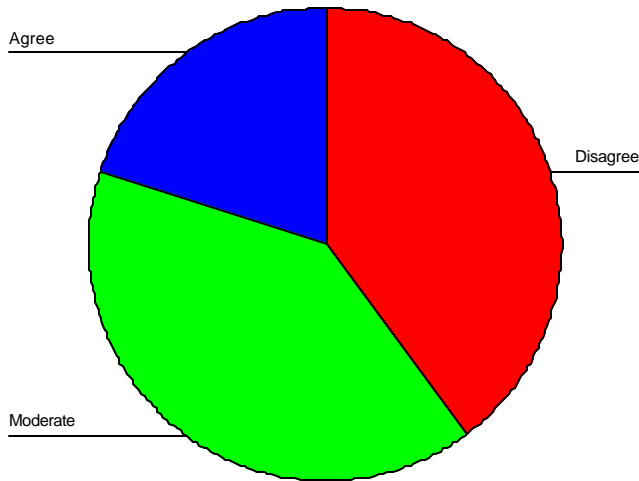
Finally, it was taken into consideration the responsiveness towards making awareness and educates customers on major policy changes. It was recognized that these organizations pay very less attention regarding those issues (disagree 49%, moderate 33% agree 18%). Table 13 and figure 11 shows this situation in detail.

Table 12- Educate on the Changes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	199	39.8	39.8	39.8
	Moderate	201	40.2	40.2	80.0
	Agree	100	20.0	20.0	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure10 Educate on the Changes



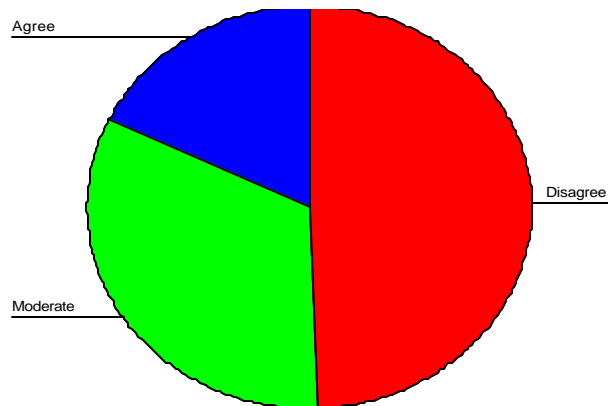
Source: Survey Data 2006.

Table 13-*Educate on the major policy changes*

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	247	49.4	49.4	49.4
	Moderate	164	32.8	32.8	82.2
	Agree	89	17.8	17.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 11 Educate on the major policy changes



Source: Survey Data 2006.

Assurance and Quality

The quality assurance of the services were viewed through five sub variables such as knowledge of workers who providing services, trust in communication, provide relevant information timely, dealing without doubt and risk, providing bills accurately.

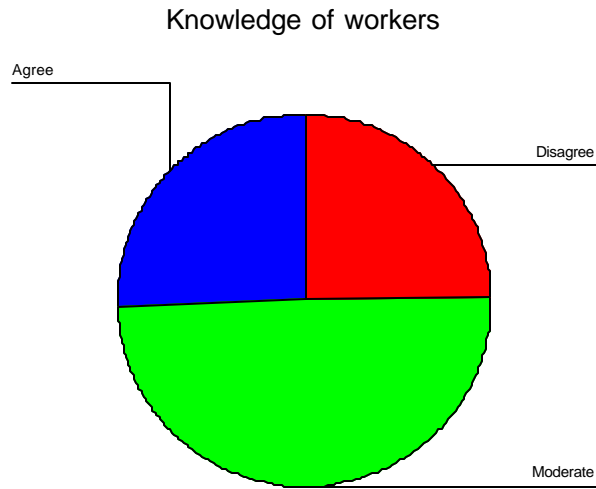
As far as assurance of services qualities are concerned most of the customers hold the idea that these organizations are providing moderate services. However, the percentage of disagreements ranges between 25%-34%. Table 15, figure 12, table 16, figure 13, table 17 , figure 14, table 18, figure 15, table 19, and figure 16 describe more details on assurance of services quality.

Table 15-Knowledge of workers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	123	24.6	24.6	24.6
	Moderate	249	49.8	49.8	74.4
	Agree	128	25.6	25.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 12



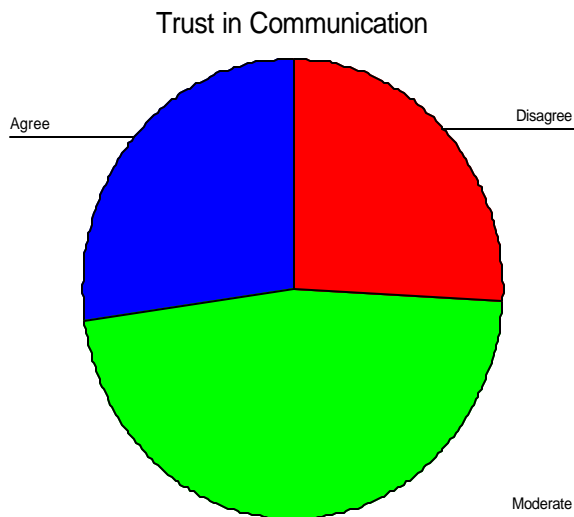
Source: Survey Data 2006.

Table 16 Trust in Communication

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	129	25.8	25.8	25.8
	Moderate	235	47.0	47.0	72.8
	Agree	136	27.2	27.2	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 13



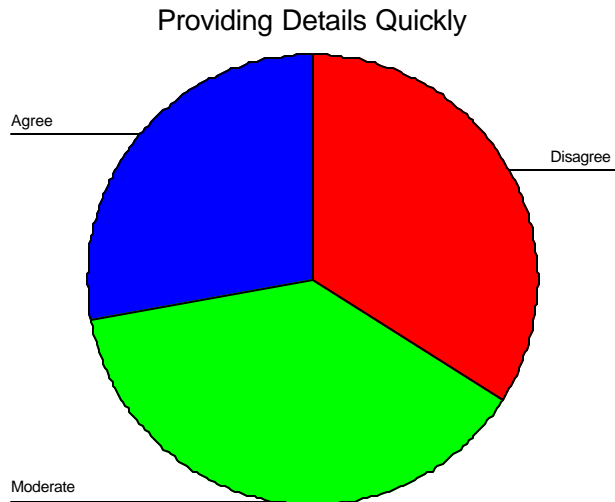
Source: Survey Data 2006.

Table 17 - Providing Details Quickly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	170	34.0	34.0	34.0
	Moderate	191	38.2	38.2	72.2
	Agree	139	27.8	27.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 14



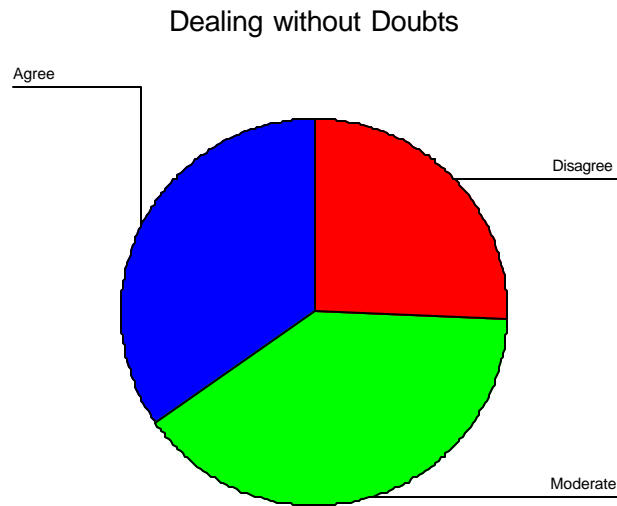
Source: Survey Data 2006.

Table 18 - Dealing without Doubts

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	128	25.6	25.6	25.6
	Moderate	198	39.6	39.6	65.2
	Agree	174	34.8	34.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 15



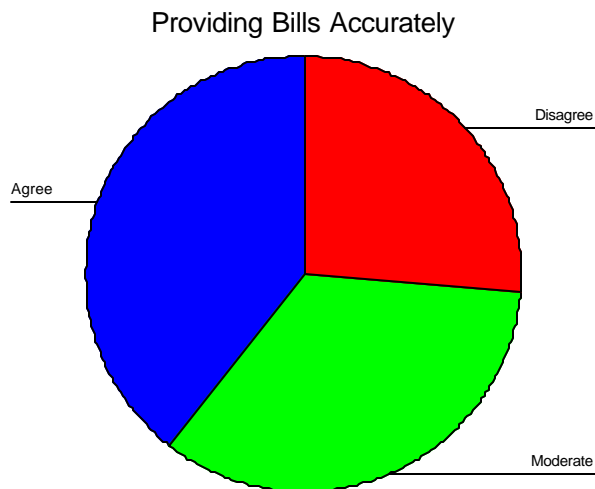
Source: Survey Data 2006.

Table 19 - Providing Bills Accurately

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	132	26.4	26.4	26.4
	Moderate	171	34.2	34.2	60.6
	Agree	197	39.4	39.4	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 16



Source: Survey Data 2006.

Empathy of the Service

The empathy can be defined as the provision of caring individualized attention to customers (Kotler, 2004). It is highly linked with the services quality because one of the characteristics of services is inseparability. Hence, the study deeply analyzed this factor through four variables: paying attention for the needs of the customers, providing timely information when needed, collaboration and support of employees for customer transactions, eager to satisfy the needs quickly.

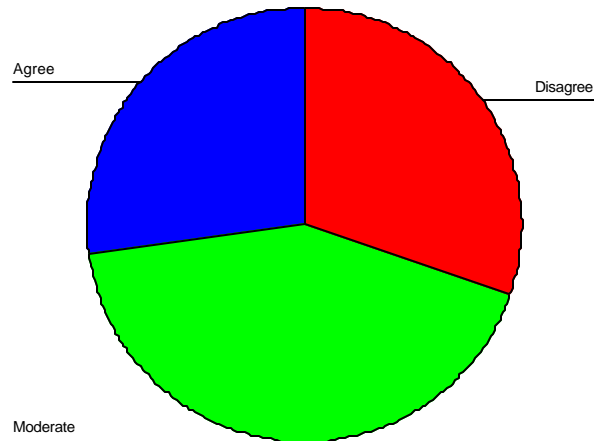
It was realized that these organizations are moderately satisfying the quality aspect but in relation to the eagerness to satisfy the need quickly is more towards negative. Table 21, figure 17, table 22, figure 18, table 23, figure 19, table 24 and figure 20 explain that information more comprehensively.

Table 21 -Paying the Attention for the Needs of the Customers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	152	30.4	30.4	30.4
	Moderate	212	42.4	42.4	72.8
	Agree	136	27.2	27.2	100.0
Total		500	100.0	100.0	

Source: Survey Data 2006.

Figure 17: Paying the Attention for the Needs of the Customers



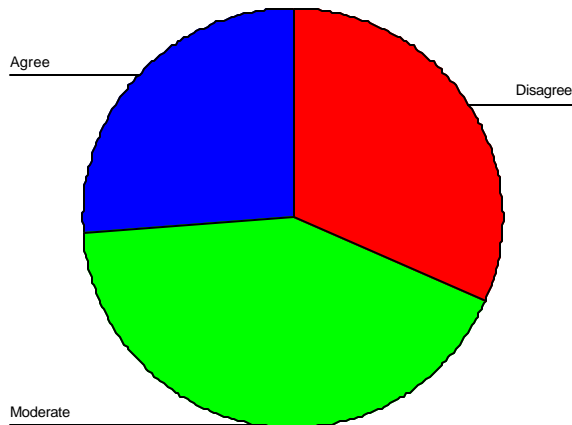
Source: Survey Data 2006.

Table 22 -Providing Timely Information Where Needed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	157	31.4	31.4	31.4
	Moderate	213	42.6	42.6	74.0
	Agree	130	26.0	26.0	100.0
Total		500	100.0	100.0	

Source: Survey Data 2006.

Figure 18: Providing Timely Information Where Needed



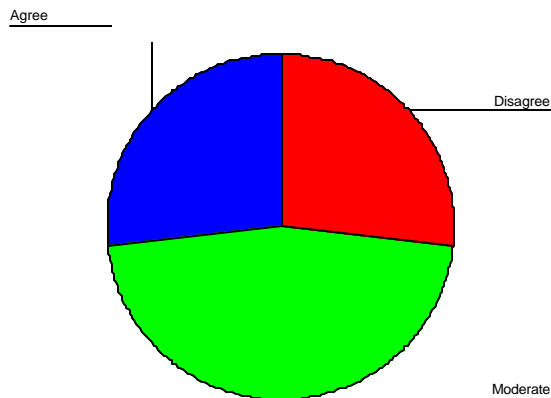
Source: Survey Data 2006.

Table 23-Collaboration and Support of Employees for Customer Transactions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	133	26.6	26.6	26.6
	Moderate	234	46.8	46.8	73.4
	Agree	133	26.6	26.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 19: Collaboration and Support of Employees for Customer Transactions



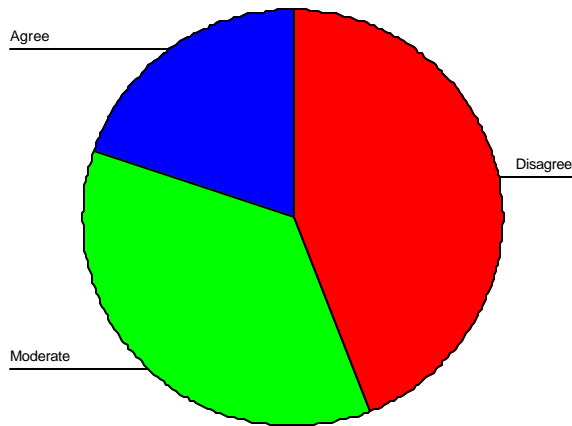
Source: Survey Data 2006.

Table 24 - Eager to Satisfy the Need Quickly

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	219	43.8	43.8	43.8
	Moderate	182	36.4	36.4	80.2
	Agree	99	19.8	19.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 20:
Eager to Satisfy the Need Quickly



Source: Survey Data 2006.

Tangibles and Services Quality

The tangibles can be defined as the appearance of physical facilities, equipment, personnel and communication materials. To compare with other organizations, tangibles are very important and for service providers. In this connection study analyzes five factors of tangibility, namely, availability of services encounters, attractive environment with relevant instructions and information with the organization, use modern equipment, attentive environment when the demand is high, and enough physical services and facilities.

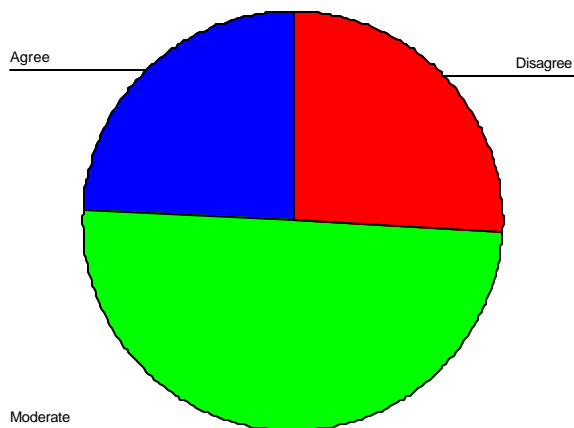
It was revealed that the availability of the tangibles is in moderate. Further it is highlighted that the level of disagreement is comparatively low. Table 26, figure 21, table 27, figure 22, table 28, figure 23, table 29, figure 24, table 30 and figure 25 are describing the availability of tangibles in a descriptive manner.

Table 26 - Availability of Consumer Service Counters

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	129	25.8	25.8	25.8
	Moderate	250	50.0	50.0	75.8
	Agree	121	24.2	24.2	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 21: Availability of Consumer Service Counters



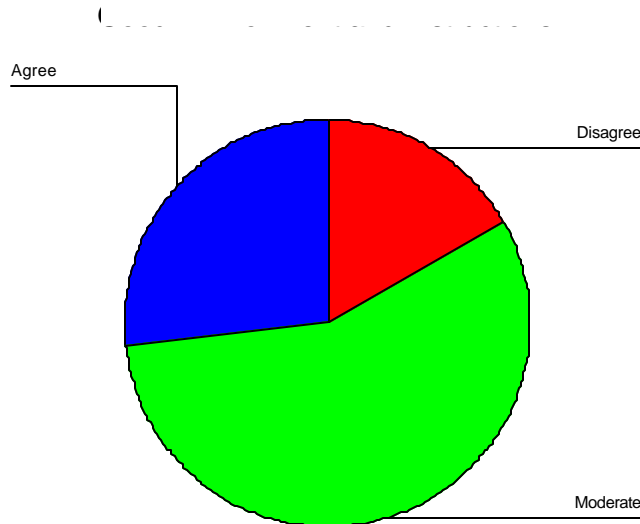
Source: Survey Data 2006.

Table 27 - Environment with Relevant Information and Instructions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	84	16.8	16.8	16.8
	Moderate	283	56.6	56.6	73.4
	Agree	133	26.6	26.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 22: Environment with Relevant Information and Instructions



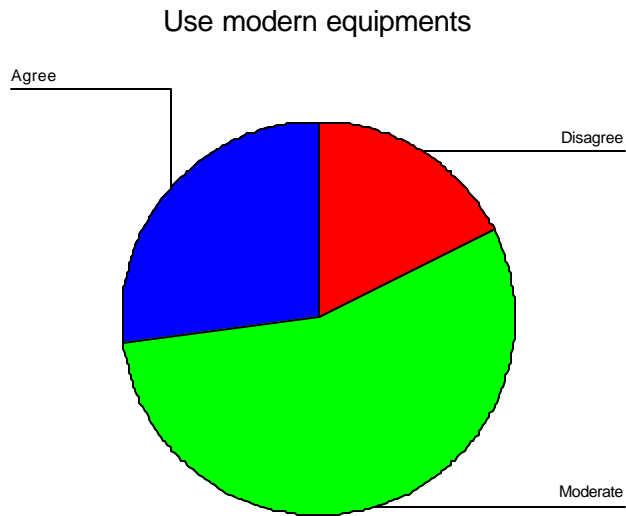
Source: Survey Data 2006.

Table 28 - Use modern equipments

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	88	17.6	17.6	17.6
	Moderate	277	55.4	55.4	73.0
	Agree	135	27.0	27.0	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 23



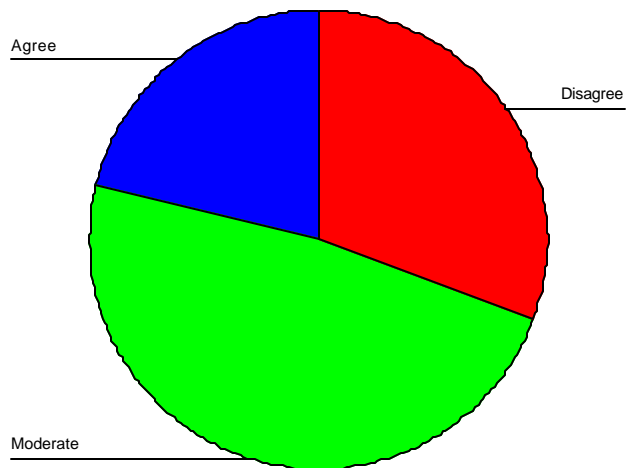
Source: Survey Data 2006.

Table 29 - Attentive Environment when High Demand

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	153	30.6	30.6	30.6
	Moderate	242	48.4	48.4	79.0
	Agree	105	21.0	21.0	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 24: Attentive Environment when High Demand



Source: Survey Data 2006.

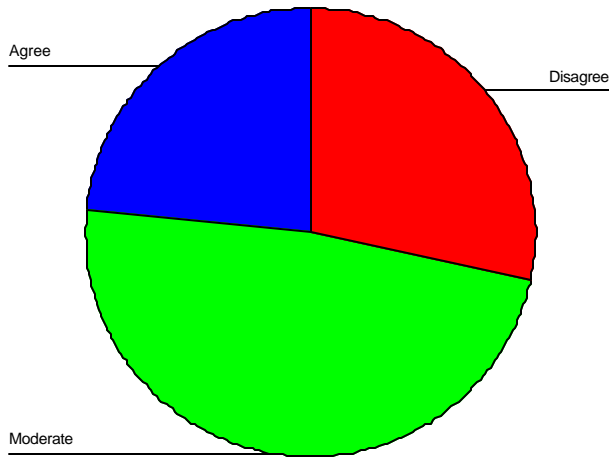
Table 30 - Enough Physical Services and Facilities

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	141	28.2	28.2	28.2
	Moderate	243	48.6	48.6	76.8
	Agree	116	23.2	23.2	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 25

Enough Physical Services and Facilities



Source: Survey Data 2006.

Other Factors Related to the Service Quality

The study goes beyond the major factors of the services quality and deeply analyzed all other services quality factor. The researchers believe that in addition to the five major variables there will be other important services quality factors. Hence, researchers pay attention to the variables such as job done right the first time, fast action on complaints, prompt warranty work, able to do any job needed, service availability when needed, courteous and friendly service, perform only necessary work, low price on service, convenient to home, convenient to work, and sending out maintenance notices.

The consumers of telecommunications organizations in southern province highly disagree with the factors such as job done right the first time, fast action on complaints, prompt warranty work, low price on service, and sending out maintenance notices. However, they are moderate with the factors such as able to do any job needed, courteous and friendly service and perform only necessary work.

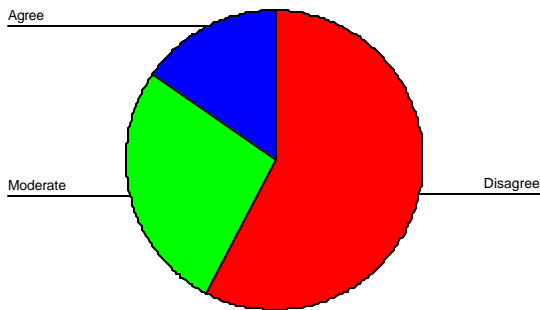
It is important to mention that most of the customers are satisfied with two factors, namely, convenient to home and convenient to work. Table 32, figure 26, table 33, figure 27, table 34, figure 28, table 35, figure 29, table 36, figure 30, table 37, figure 31, table 38, figure 32, table 39, figure 33, table 40, figure 34, table 41, figure 35 and table 42, figure 36 illustrate these variables broadly.

Table 32 - Job done right the first time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	287	57.4	57.4	57.4
	Moderate	137	27.4	27.4	84.8
	Agree	76	15.2	15.2	100.0
Total		500	100.0	100.0	

Source: Survey Data 2006.

Figure 26: **Job done right the first time**



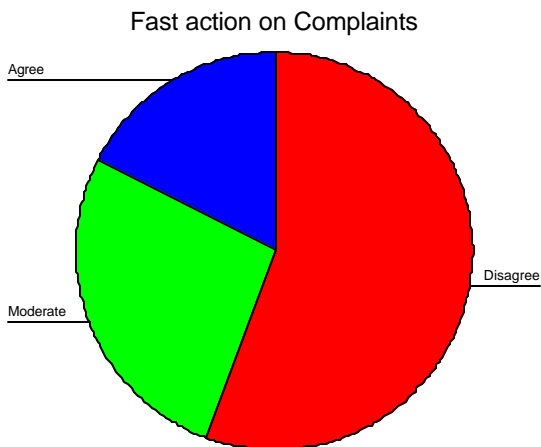
Source: Survey Data 2006

Table 33 - Fast action on Complaints

		Frequency	Percent	Valid Percent	Cumulative Percent
	Disagree	278	55.6	55.6	55.6
	Moderate	135	27.0	27.0	82.6
	Agree	87	17.4	17.4	100.0
Total		500	100.0	100.0	

Source: Survey Data 2006

Figure 27



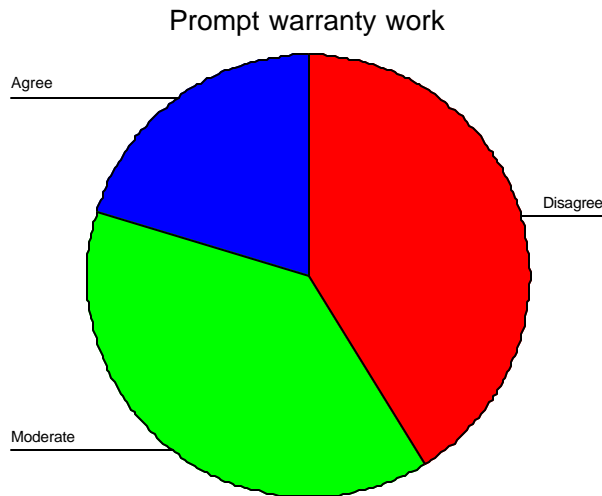
Source: Survey Data 2006.

Table 34 - Prompt warranty work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	206	41.2	41.2	41.2
	Moderate	193	38.6	38.6	79.8
	Agree	101	20.2	20.2	100.0
Total		500	100.0	100.0	

Source: Survey Data 2006.

Figure 28



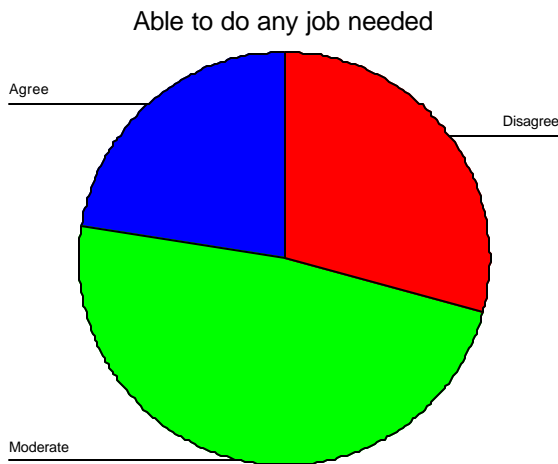
Source: Survey Data 2006.

Table 35 - Able to do any job needed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	146	29.2	29.2	29.2
	Moderate	241	48.2	48.2	77.4
	Agree	113	22.6	22.6	100.0
Total		500	100.0	100.0	

Source: Survey Data 2006.

Figure 29



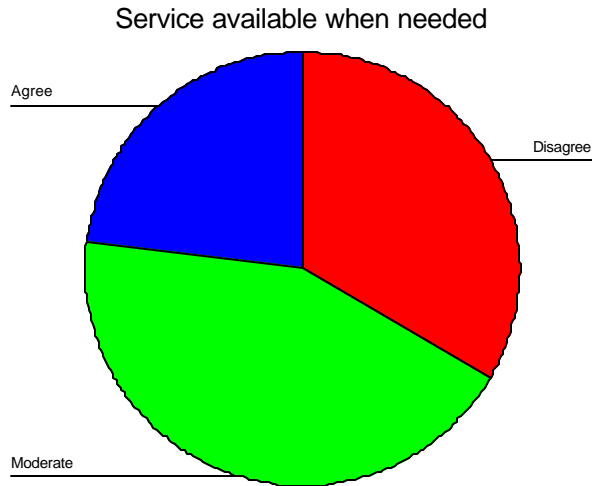
Source: Survey Data 2006.

Table 36 - Service available when needed

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	166	33.2	33.2	33.2
	Moderate	219	43.8	43.8	77.0
	Agree	115	23.0	23.0	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 30



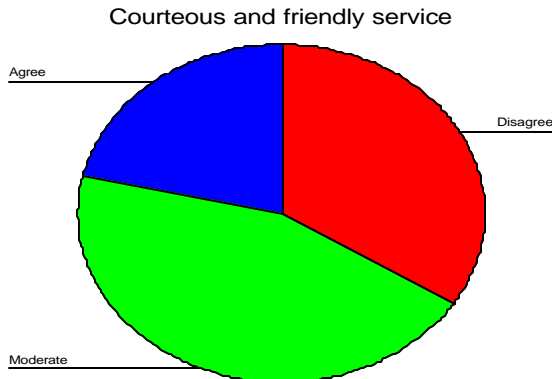
Source: Survey Data 2006.

Table 37 - Courteous and friendly service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	170	34.0	34.0	34.0
	Moderate	223	44.6	44.6	78.6
	Agree	107	21.4	21.4	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 31



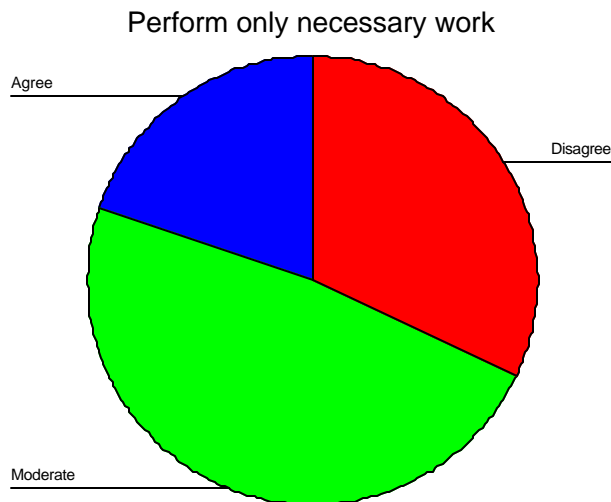
Source: Survey Data 2006.

Table 38 - Perform only necessary work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	160	32.0	32.0	32.0
	Moderate	242	48.4	48.4	80.4
	Agree	98	19.6	19.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure32



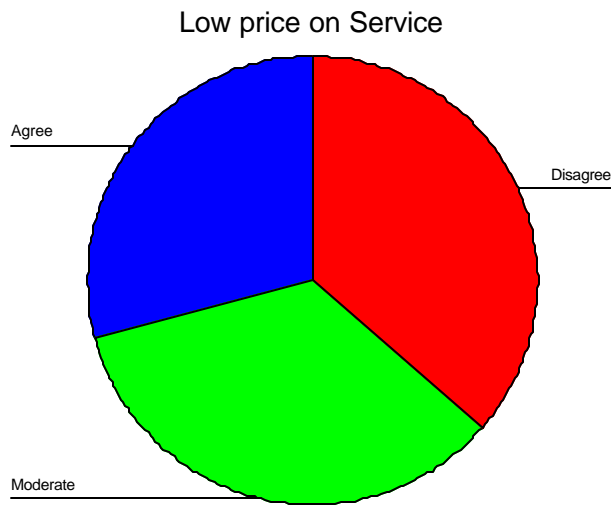
Source: Survey Data 2006.

Table 39 - Low price on Service

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	182	36.4	36.4	36.4
	Moderate	172	34.4	34.4	70.8
	Agree	146	29.2	29.2	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 33



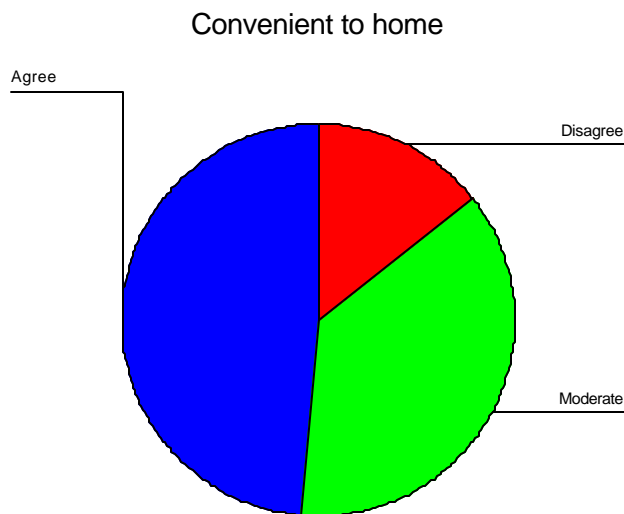
Source: Survey Data 2006.

Table 40 - Convenient to home

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	72	14.4	14.4	14.4
	Moderate	185	37.0	37.0	51.4
	Agree	243	48.6	48.6	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 34



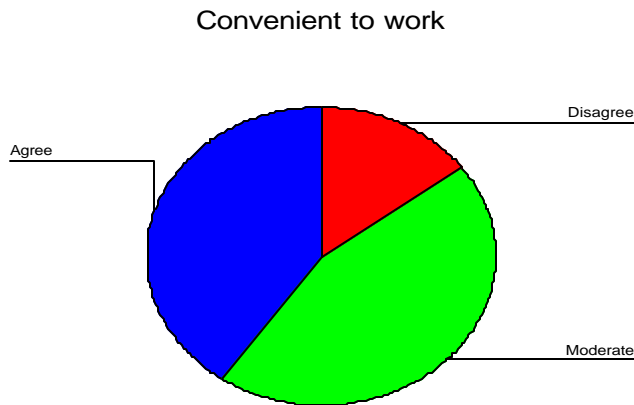
Source: Survey Data 2006.

Table 41 - Convenient to work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	74	14.8	14.8	14.8
	Moderate	224	44.8	44.8	59.6
	Agree	202	40.4	40.4	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 35



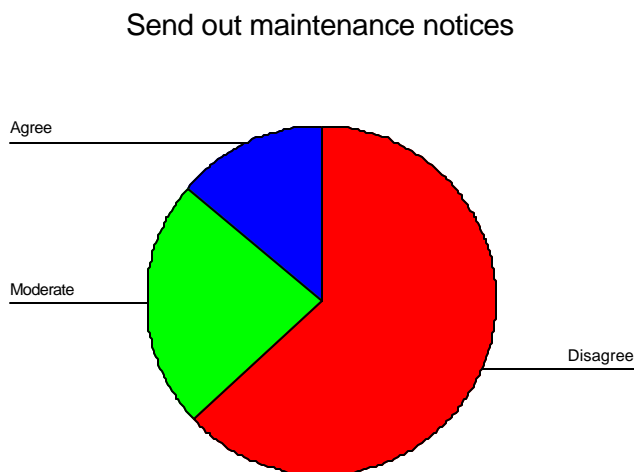
Source: Survey Data 2006.

Table 42 - Send out maintenance notices

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disagree	315	63.0	63.0	63.0
	Moderate	116	23.2	23.2	86.2
	Agree	69	13.8	13.8	100.0
	Total	500	100.0	100.0	

Source: Survey Data 2006.

Figure 36:



Source: Survey Data 2006.

Conclusion

This research was conducted to measure the services quality requirements of customers of the telecommunications services of Southern Province, Matara district in Sri Lanka with the support of the Telecommunications Regulatory Commission (TRC), Sri Lanka.

Research was carried out among all the divisional secretariats in Matara district and the sample was 500. The questionnaire was used to measure the telecommunications services quality of Sri Lanka Telecom, Lanka Bell and Suntel through reliability, responsiveness, empathy, assurance, tangibles and other factors.

Specially, the services quality of Sri Lanka Telecom is not up to the expected level of customers. Most of the customers are highly dissatisfied with their services quality.

However, it is important to mention that SLT is still considered as the market leader. Therefore, their market share is still larger in all segments. But it is to be noted that the 97% of the customers of other two organizations are satisfied with the services quality delivered by them and it shows huge increment of their market share. Specially, the new users are tended to consume the services of those newly established organizations (Suntel and Lanka Bell). It shows that these two organizations are high competitive oriented towards their market leader thereby customers can enjoy the services with high quality.

Finally it can be concluded that the services quality is highly affecting to the customer expectations of the requirements of services quality. The organizations who are improving services quality factors such as reliability, responsiveness, assurance, empathy, tangibles and some of other related factors (mentioned in the study) can enjoy competition as well as can achieve healthy market share.

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Forecasting Demand for Telecommunication Services in Sri Lanka: A Case Study of Matara District

Prepared by

W.I.C.S. Gunasinghe, P. Vitanage and K.H Nandasiri

Department of Economics, University of Ruhuna, Sri Lanka

Funded by Telecommunication Regulatory Commission (TRC) in Sri Lanka

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Executive Summary

The current research attempts to investigate all possible factors that could directly or indirectly affect on the demand for telecommunication services in Matara district based on a sample consisting of 600 customers. Customers were interviewed using structured questionnaires and were obtained data from consumers living in each local secretariat divisions in relevant electorates in the district. Customers were selected based on a random basis under following categories; those who have mobile phone, those who have fixed phone and those who do not have fixed or mobile phone. However, we use simple exponential growth model too to forecast fixed phone, mobile phone and fixed & mobile phone demand in Sri Lanka for the 2006-2008 period.

According to our study following facts are found;

- At the end of 2008; 9.6 millions people in Sri Lanka will have mobile phones, the number of customers who have fixed phones will be 1.4 millions.
- Mobile phone services with less cost will be more attractive for relatively fixed income earners and non-income earners.
- There is not a considerable mobile phone usage among the people aged below 18 and over 60 years.
- Mobile phone services with less cost will be more attractive for low income earners or these types of customers can tend to demand services that can be maintained from their relatively low salary.
- Introduction of group service packages will be more attractive.
- Need of introduction of strategies to improve the satisfactory level of mobile phone services.
- The grater coverage can not only attract potential customers but also it refrains the existing customers from being discontinued the services for which they have already registered.
- Ability to obtain calls for customers in any moment (from any place) can lead not only to attract potential customers towards the use of mobile phone in the future but also to prevent the existing customers from being discontinued the services for which they have already registered.

- There is a sever drawback of mobile phone companies regarding their effort to knowing customers of the services available in the phone.
- 10% -15% customers have experienced the following difficulties in the case of local calls. Those are Echo, Cracking, Uneven Voice Levels, Blank and Congestion.
- 80% of customers say bills are neither accurate nor inaccurate. However, this is a stern matter to be concerned because customers' inability to respond positively for the question asked implies some sort of doubts in their minds on the process of calculations of bills.
- As 19% of them are still doubt about costs incurred in prepaid cards it will be useful for mobile phone service companies to make transparency of calculations of prepaid card so that they can attract future customers for their services.
- 47% of customers said that they can spend a 200-500 LKR monthly expenditure for calls. Also, there are 35% of customers seeking to spend a 500-1000 LKR per month for their calls. Overall, 82% of customers are in a position to spend 200-1000 LKR per month for their calls.
- 99% of customers in the sample did not complain on errors in bills (in case of mobile phone) in the previous year.
- 45% of customers satisfy with actions taken to solve problems with regard to bills while 49% of them do not give any response. But there are 6% of customers who had not satisfied at all.
- 40% of customers have highlighted tariff in the first priority as an area to be given priority to develop for a better service. Even in the second priority, around 30% of customers have given higher places for maintains and tariff.
- 72% of customers are of the view that reduction of tariff is needed to a better service.
- 38% of customers have indicated that exemption fees from incoming calls can be a good sign of a better service. 66% of customers say that improving of coverage can help to a better service.
- 55% of customers do not have SCAs while 45% of them have obtained SCAs when they bought their phone.

- 60% of customers are not aware of the facilities in the fixed phone
- More than 184 customers experience clear voice when they obtain local calls. But when they obtain IDD calls from fixed phone, around 181 of them experience unclear voices.
- 30% of customers of the sample experience always all the difficulties indicated in the questionnaire when they obtain local calls. However, 50% of customers do not experience any of technical troubles in their phone lines.
- 51% of customers of the sample did not experience breakdowns. But, 49% of customers have experienced such breakdowns when they obtain calls.
- 63% of breakdowns are reported due to line breaks/errors while 19% such breaks have occurred as a result of rainy weather conditions.
- 79% of breakdowns are corrected after 3 days. There is only 7% of breakdowns recovered in one day.
- 36% of customers who satisfy with the recovered service. But 64% of customers do not satisfy with the service recovered.
- 60% of customers satisfy with the inquiries noticed by the relevant phone company. But 40% of customers do not satisfy with companies' awareness to investigate inquiries made by customers.
- 78% of customers do not satisfy with immediate process taken to recover the service by relevant phone companies. 22% of customers, a considerably low value, satisfy with companies' awareness to take immediate actions to recover the service.
- 83% of customers are confident of the calculation of bills accurately. But 14% of customers do not agree to the idea that companies calculate bills accurately.
- Overall, 75% of customers are in a position to spend 500-2000 LKR per month for their calls. But there are still 19% of customers who can not spend more than 500 LKR per month.
- 69% of customers say that calculations of bills are clear. Also, there are 28% of customers saying directly that they are doubts on the process of calculations of bills.
- 79% of customers did not complain on errors in bills (on fixed phone) in the previous year. But there are 17% of customers who have complained.

- 42% of customers satisfy with actions taken to solve problems related to bills while 33% of them do not have any response. But there are 25% of customers who had not satisfied at all.
- 72% of customers have TDs while 28% of them do not have TDs. 45% of customers have SCAs (in case of fixed phone) while 35% of them do not remember of SCAs. Also 20% of customers do not have such SCAs.
- 71% of them are not aware of what informations are in SCAs. But 29% customers have indicated that they know the conditions of SCAs.
- 50% of customers have highlighted maintains (in case of fixed phone) in the first priority for a better service.
- In the second priority, 35% of customers have said tariff should be reduced in order to utilize a better service and around 22% of customers have given higher places for maintains and quality as well.
- 28% of customers are of the view that developing of maintain process has been an essential one for better service. Also, according to their views, low charges are needed to introduce to utilize the service better. 14% and 10% of customers have indicated that developments of quality of service and coverage are also important.
- 60% and 26% people are expecting to access for fixed phone and mobile phone services respectively.
- Almost more than 60% of people who do not have phone obtain calls from post offices and public telephone boxes. Therefore, it is essential to develop service conditions of both post offices and public telephone boxes.

1. Introduction

Telecommunication service providers, outside telecommunication companies who are seeking to enter into the market and telecommunication regulatory commission (TRC) of Sri Lanka as the governor of the telecommunication services in Sri Lanka are interested in forecasting of the demand for telecommunication services in Sri Lanka. In case of firm managers, forecasting of such a service will help them to understand how and to what extent customers will interest with their services in the future. This intern helps managers to allocate or reallocate resources effectively among such services that seemed to be more profitable in the market. Also, understanding about future market for their products will facilitate managers to assess or change their business strategies employed both in production and marketing process. It is also noted that such a forecasting process will help to identify areas to be developed and to be given priority in order to provide a better service.

Following these line of reasoning, the current research attempts to investigate all possible factors that could directly or indirectly affect on the demand for telecommunication services in Matara district based on a sample consisting of 600 customers. In the analysis it is intended to use only bar charts and pie charts. Although we could use some econometric techniques, we do not hope to estimate such models like Logistic/Probit models because the primary idea of TRC was to conduct a research to investigation the type of market for telecommunication services in Matara district based on simple visualization techniques. The objectives of this study are twofold; first objective is to forecast the demand for telecommunication services and the second one is to make some contribution to the national development by means of providing information for telecommunication service providers and TRC to make appropriate policy decisions.

The remaining structure of the study is organized as following; section two is devoted to discuss an overview of the trend of the demand for telecommunication services in Sri Lanka. Section three discusses structure of the sample and methodology of the cross section study. In section four we discuss results and finally present concluding remarks.

2. An Overview of the Trend of the Demand for Telecommunication Services in Sri Lanka: Projections for 2006-2008

After liberalization policies introduced to telecommunication industry in 1991 and in 1996, it is obvious that there has been a considerable upward growth in the industry. This was mainly due to the fact that the other competitors (Suntel Ltd and Lanka Bell) with Wireless Local Loop (WLL) were allowed to enter into the market. As a result of this SLTL's monopoly power in fixed-line telephone services has ended since 1996. They have provided more than 1.1 million fixed telephone connections as at the end of September 2005. In economic point of view, a change of an industry from a monopolistic market to a competitive market yields many benefits not only for the customers but also for the economy as a whole. One major benefit is the low price for their services and the higher capacity to meet consumer demand on a competitive basis.

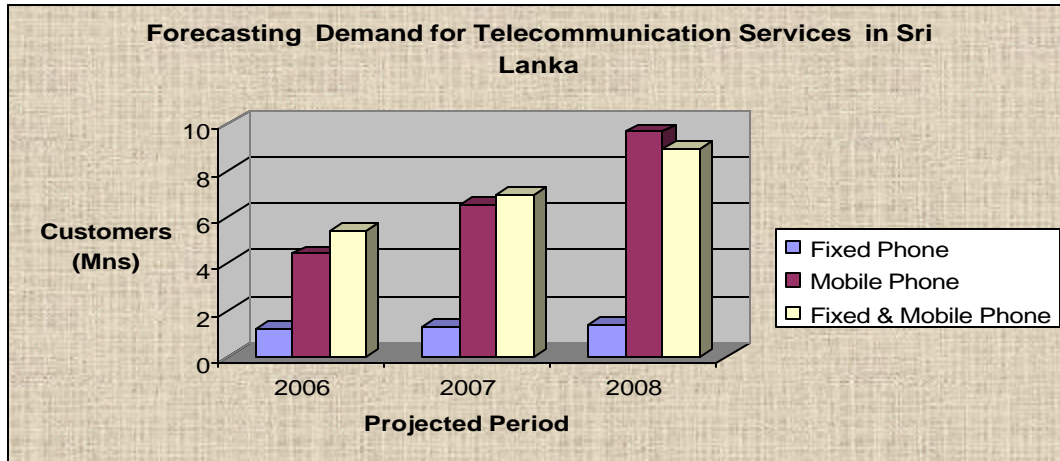
In case of the mobile phone market, there are four operators (Celltel Lanka (Pvt) Ltd., Dialog Telekom Ltd., Mobitel (Pvt) Ltd., and Hutchison Telecommunications Lanka (Pvt) Ltd.) providing mobile phone services in Sri Lanka. They have provided more than 3.08 million mobile connections as at the end of September 2005.

We use simple exponential growth model to forecast fixed phone, mobile phone and fixed & mobile phone demand in Sri Lanka for the 2006-2008 period. The first graph shows projections for the potential fixed phone usage for the period concerned.

According to the simple exponential growth model (see Figure 01), it is very clear that at the end of 2008, 9.6 millions people in Sri Lanka will have mobile phones. Very interesting feature of this model is that the slow growth of the category of fixed phone usage and at the end of 2008 the number of customers who have fixed phones will be 1.4 millions.

It should be noted that these forecasting values based on a simple exponential growth model will depend on the condition that all the factors affecting to the demand for telecommunication services will not be changed rapidly over the period concerned.

Figure 01



Source: Authors calculations based on previous figures from Telecommunication Regulatory Commission (2000-2005) in Sri Lanka

3. Structure of the Sample and Methodology of the Cross Section Study

As the main objective of this project is to evaluate and forecast the nature of the demand for telecommunication services in the Matara District, 600 consumers were interviewed using structured questionnaires and students were advised to collect data from consumers living in each local secretariat divisions in relevant electorates in the district. Customers were selected based on a random basis under each category. The questionnaire given for those who have 'fixed phones' contained 28 main questions which covered all the factors need to analysis the potential future demand of the fixed phone market. The number of questions asked in the second category was 25. But in each questionnaires there were more than 10 sub questions come under some main questions. In case of the third category, there were 18 main questions.

Following table shows the distribution of these responders among 7 electorates in Matara district.

Table 3.1 Sample Structure of the Survey

Electorates	Those who have 'fixed' phones	Those who have 'mobile' phones	Those who do not have 'fixed/mobile' phones	Total
1 Daniyaya	25	25	25	75
2 Akurassa	25	25	25	75
3 Kamburupitiya	30	30	30	90
4 Hakmana	30	30	30	90
5 Matara	30	30	30	90
6 Weligama	30	30	30	90
7 Dickwella	30	30	30	90
Total				600

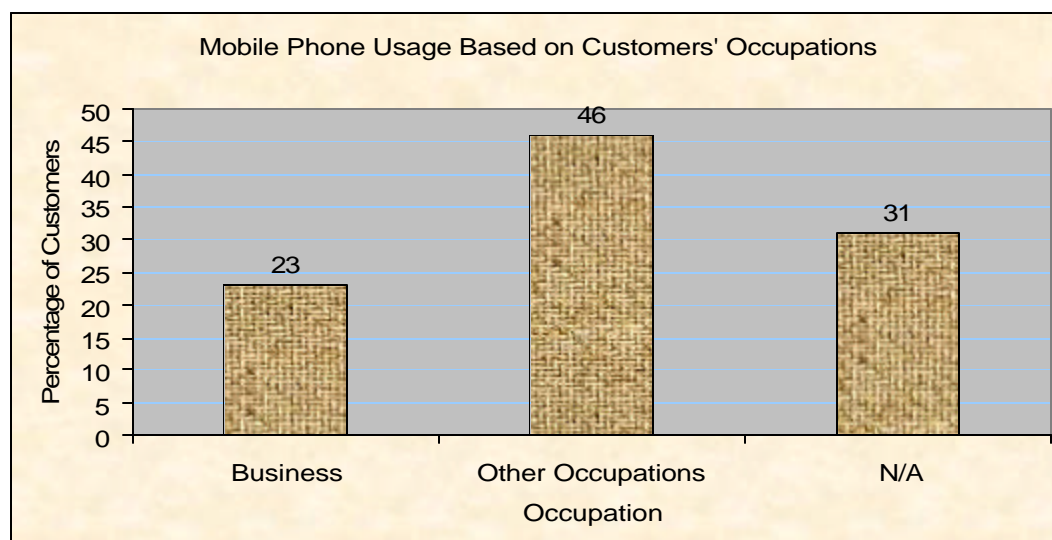
Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

We use bar and pie charts to assess our results. We occasionally use charts with percentage data as those are very easy to explain the results.

4. Results

4.1 Charts obtained for those who have mobile phones.

Figure 02

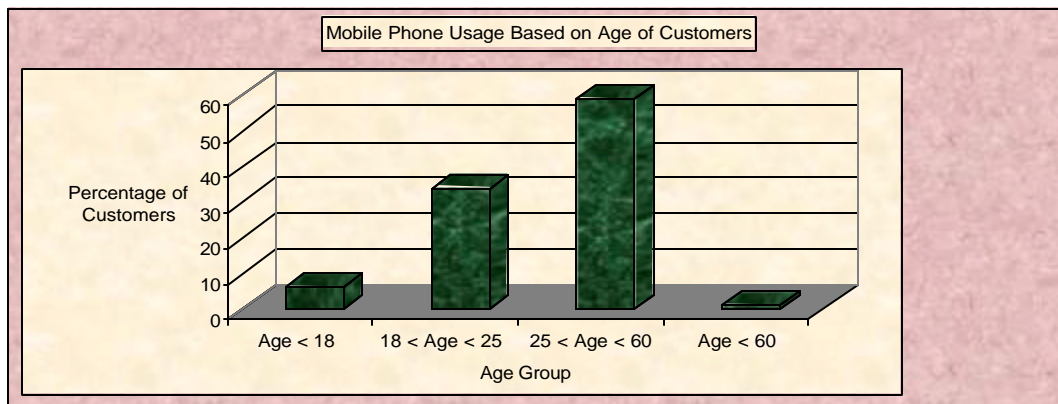


Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 02 shows that 23 percent of people whose occupation is business use mobile phone while 46 percent of those who are in other occupations. But 31% of customers

who have mobile phone do not have jobs. This implies that the mobile phone services with less cost will be more attractive for relatively fixed income earners (46%) and non-income earners (26%).

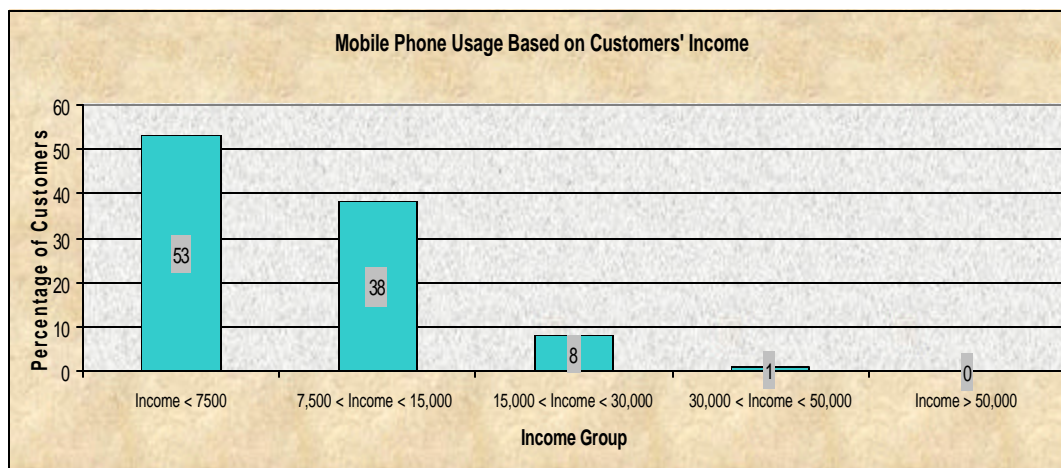
Figure 03



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 03 shows more than 50 percent of customers, whose age range is between 25-60, have mobile phone while 30 percent of those who are in 18-25 ages. There is not a considerable mobile phone usage among the people aged below 18 and over 60 years.

Figure 04

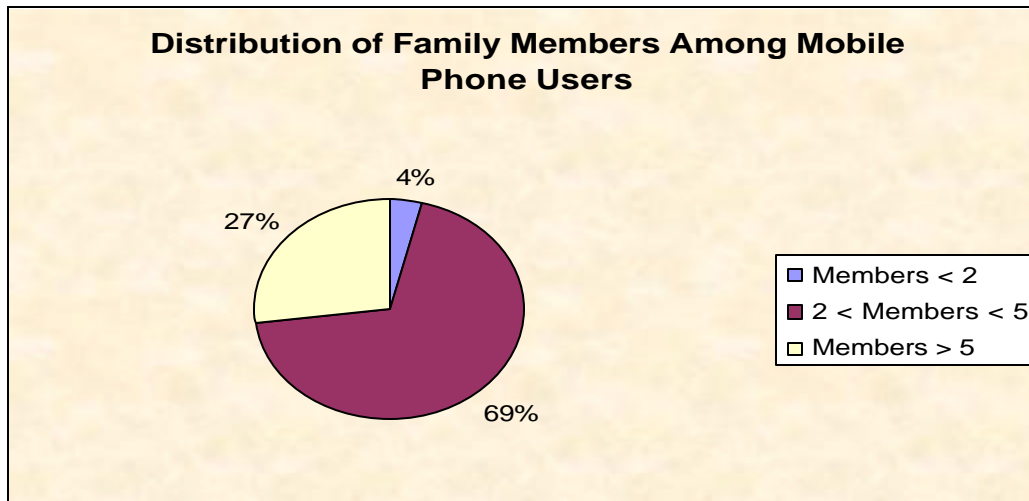


Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 04 shows more than 50 percent of customers, whose income is below 7500 LKR, use mobile phone while 38 percent of those who are in 7500-15000 income level. Therefore, more than 88% of people who have mobile phones are less than monthly income of 15000 LKR. This implies that the mobile phone services with less

cost will be more attractive for these types of customers or these types of customers can tend to demand services that can be maintained by their relatively low salary.

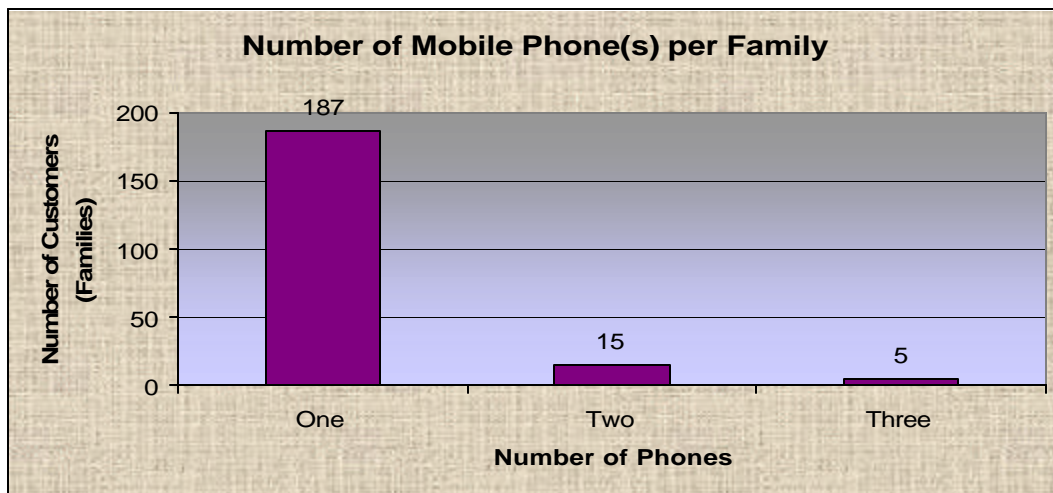
Figure 05



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 05 shows that 69 percent of customers who use mobile phone have 2-5 family members and 27% of those have more than 5 family members. But there are only 4% of customers who have less than 2 family members. This result provides valuable information to mobile service providers regarding the possible future market where introduction of group service packages will be more attractive. This is further confirmed in Figure 6 below where 93% of families have only one mobile phone.

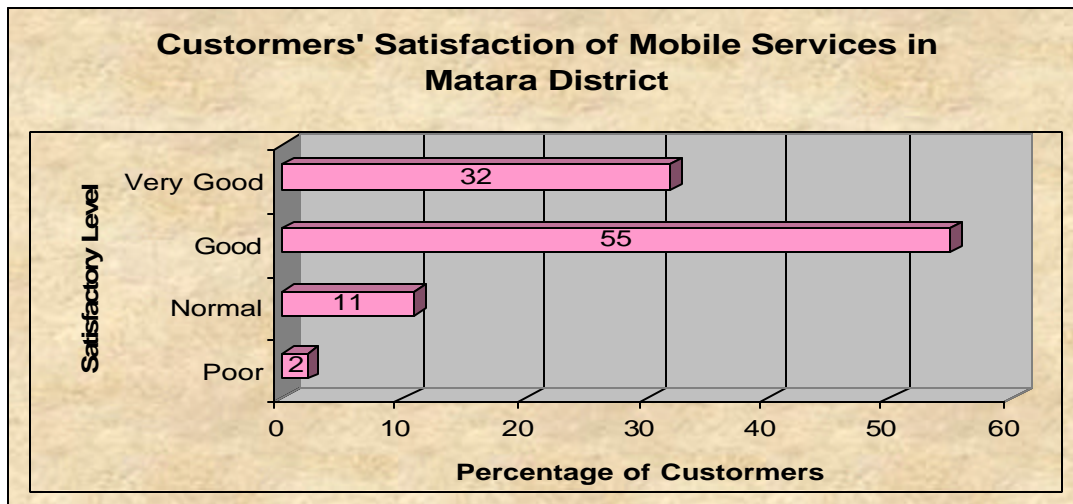
Figure 06



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 07 below shows that 32 percent of customers who have mobile phone have ranked the quality of mobile phone service as “very good” while 55% of them have satisfied with “good”. It is well known that customers’ satisfaction about any type of goods or services in a market is a reflection of the future demand for those goods or services. Therefore it is vital for mobile companies, which operate in the Matara district, to consider this information seriously and then introduce some strategies to improve the satisfactory level of their services.

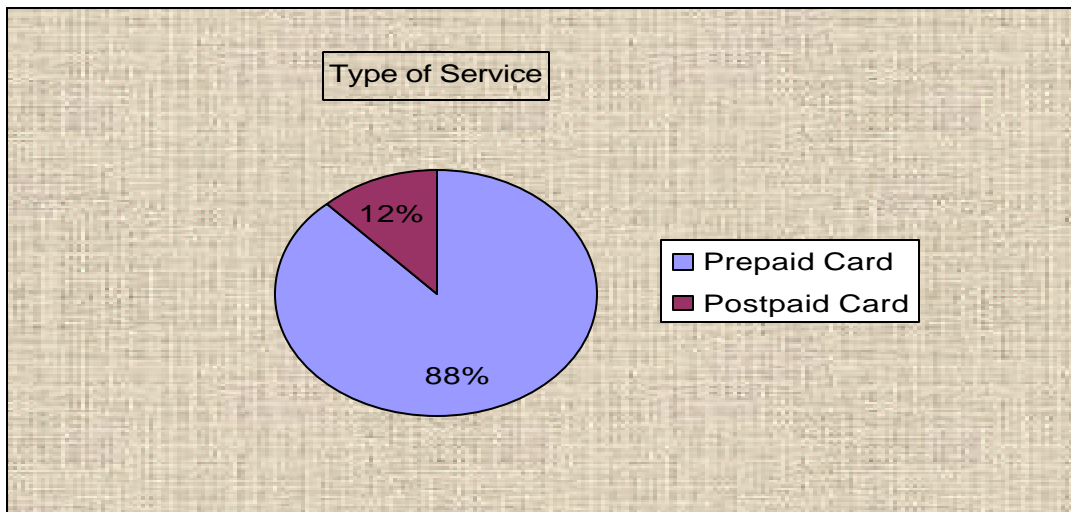
Figure 07



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 08

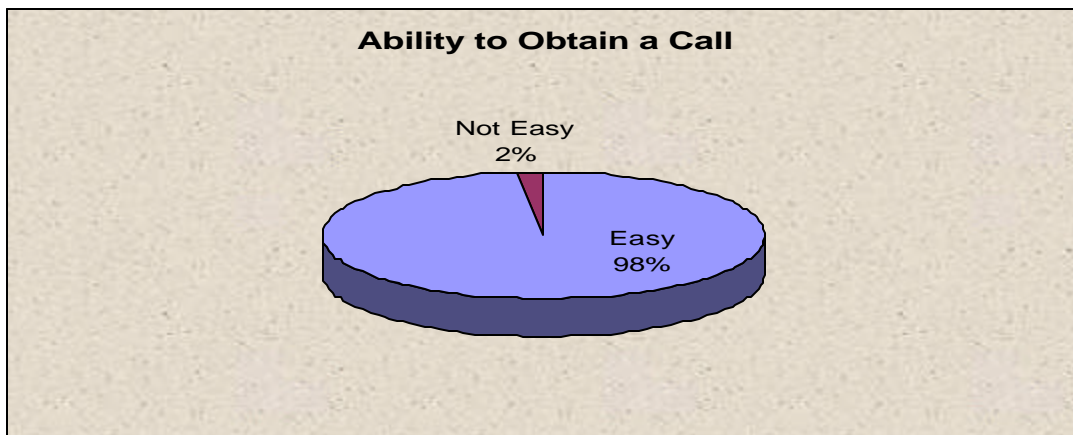
Figure 09



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 09 above shows that 88% of customers use prepaid card and only 12% of them use postpaid card. This implies that most of customers who have mobile phone like to pay by prepaid card than postpaid card. Figure 10 below shows that 98% of customers who use mobile phone have confirmed that they can obtain calls easily. But there are 2% of customers who said that it is not easy to get calls from their phone when they want to have calls. Ability to obtain calls for customers in any moment is an indicator of the quality and coverage of services. This can lead not only to attract potential customers towards the use of mobile phone in the future but also to refrain the existing customers from being discontinued the services for which they have already registered.

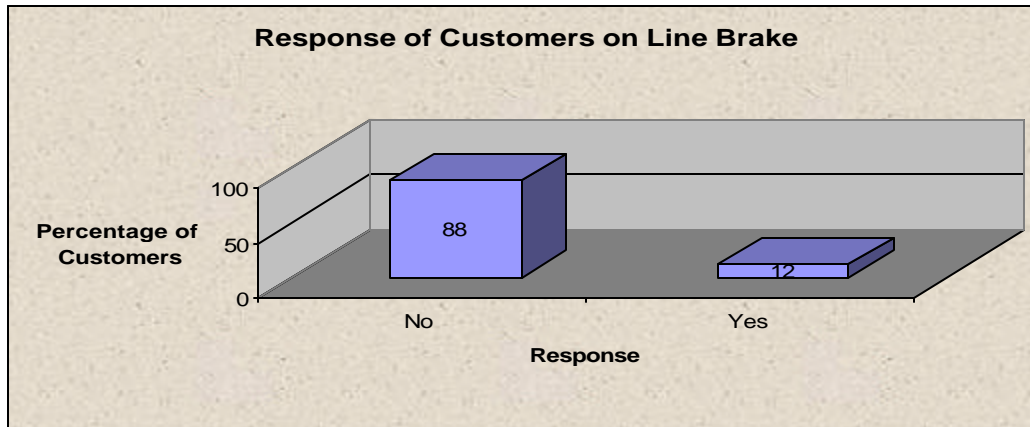
Figure 10



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 11 below shows that 88% of customers who use mobile phone have confirmed that they do not experience any line breaks when they get calls. However, there are 12% of customers who experience such line breaks.

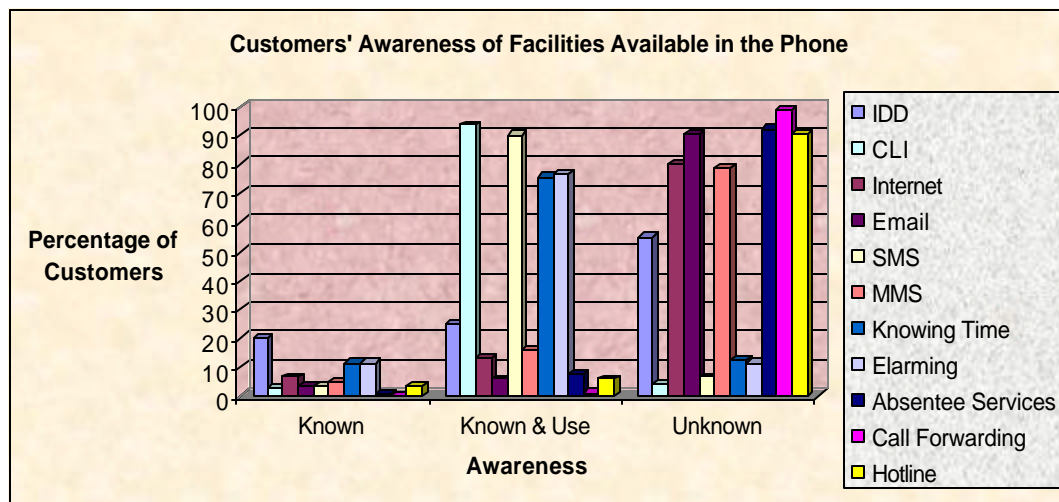
Figure 11



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

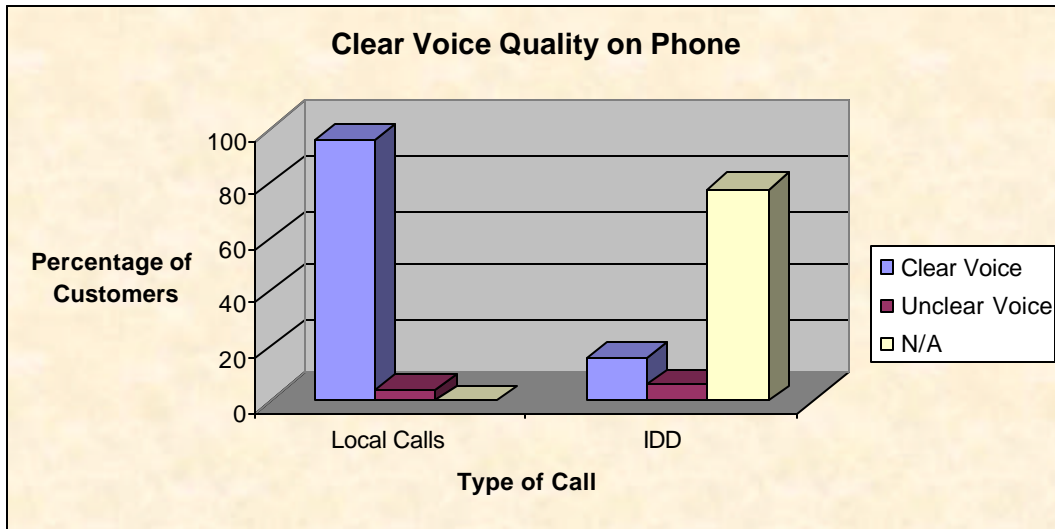
Figure 12 below shows customers' awareness of the facilities available in the phone. According to the figure given below more than 70% of customers are aware only of the CLI as well as SMS services, and they are aware of the use of their phones for the purpose of knowing time and alarming. Majority of customers do not know other facilities indicated in the figure. This is a sever draw back of mobile phone companies regarding their effort to knowing customers of the services available in the phone. For example, if customers are aware of the use of internet from their mobile phone, this implies that there could be a grater utilization of the service.

Figure 12



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna

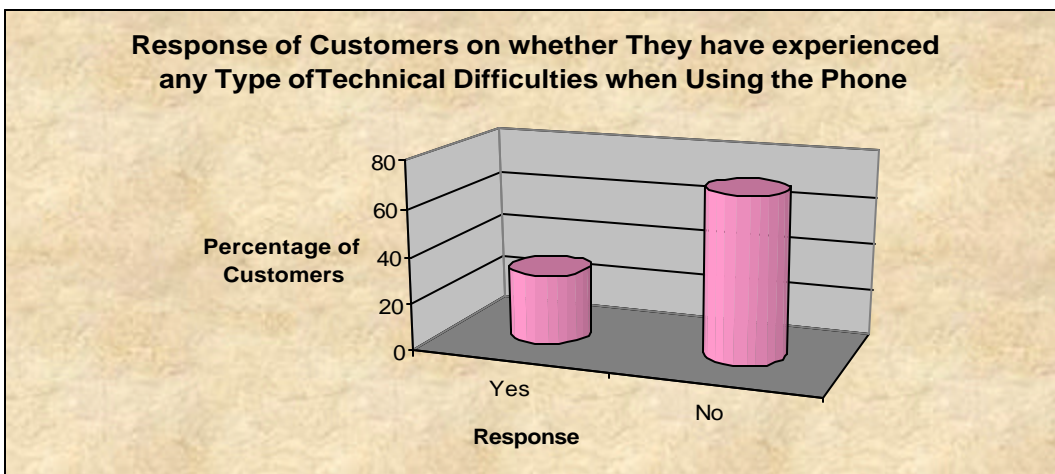
Figure 13



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

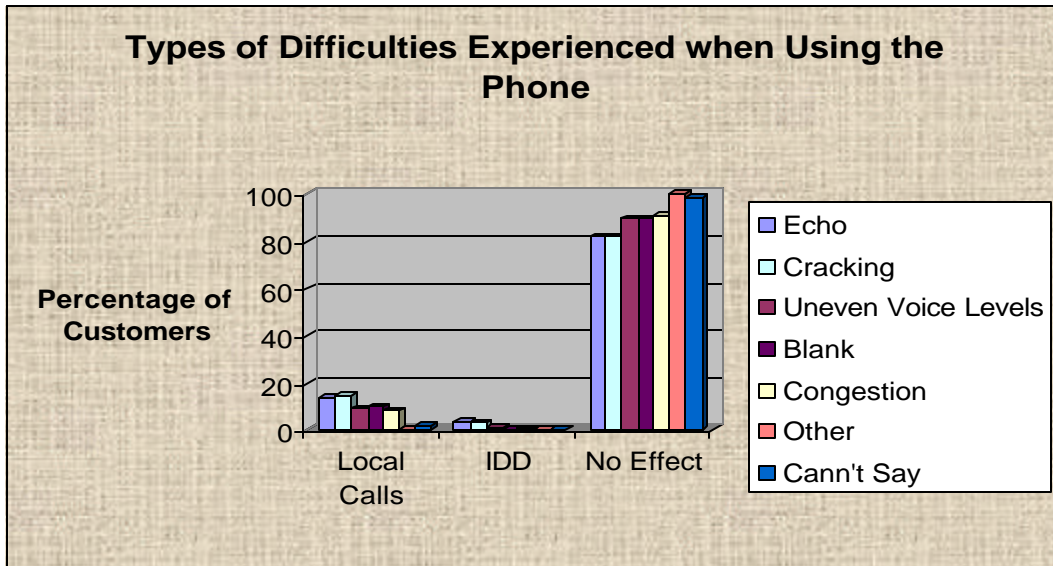
Figure 13 above shows that more than 95% of customers experience clear voice when they get local calls. But when they get IDD calls, around 5% of them experience unclear voices. It also reveals that more than 70% of customers do not get IDD calls. Figure 14 below shows that 60% of customers do not experience any types of technical difficulties when they use their phone. But more than 20% of customers are still having any of technical troubles in their phone lines.

Figure 14



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

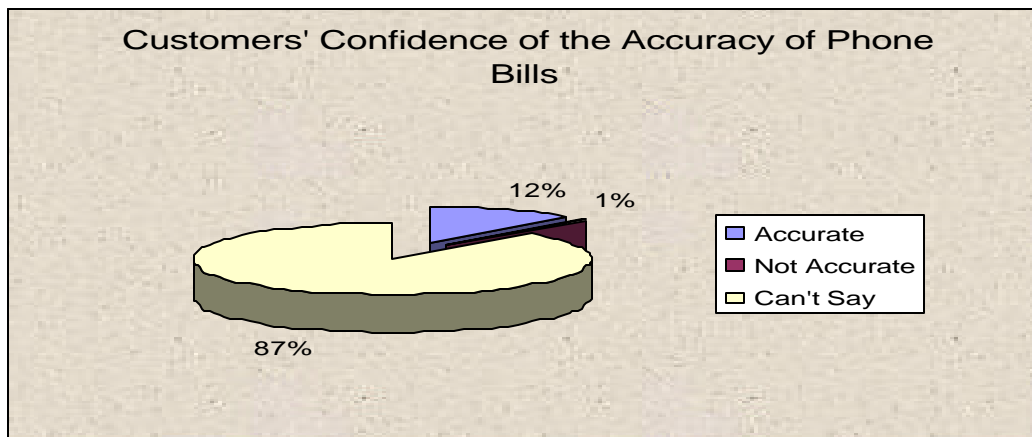
Figure 15



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 15 above shows types of difficulties faced by customers when they use their phone. It is very clear that more than 80% of customers do not have any types of experiences indicated in the figure. But 10%-15% customers have experienced the following difficulties in the case of local calls. Those are Echo, Cracking, Uneven Voice Levels, Blank and Congestion. However, in the case of IDD calls these difficulties have been a very low. This may be mainly due to the fact that there was a very few who engages in IDD calls. It is also noted that around 98% of customers have responded that they can't say or they are not aware of these types of difficulties however.

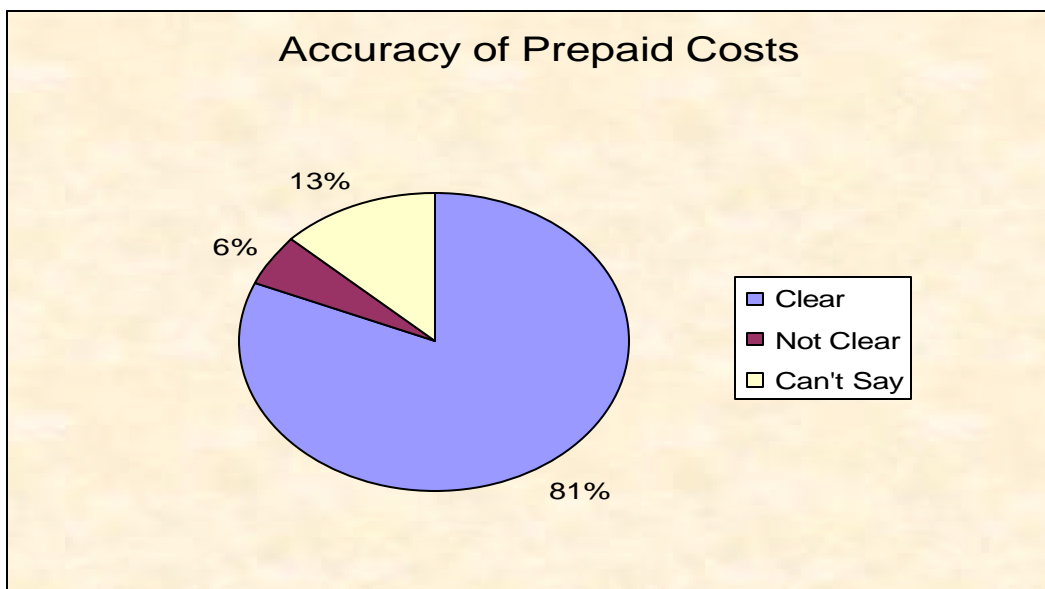
Figure 16



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 16 above shows customers' confidence of the accuracy of phone bills. According to the pie chart given above, 80% of customers say bills are neither accurate nor inaccurate. However, this is a serious matter to be concerned because customers' inability to respond positively for the question rose implies some sort of doubts in their minds on the process of calculations of bills. This will badly affect on the demand for such services in the market in the future. Also, there are 12% of customers saying directly that they do not have any doubts on the process of calculations of bills.

Figure 17



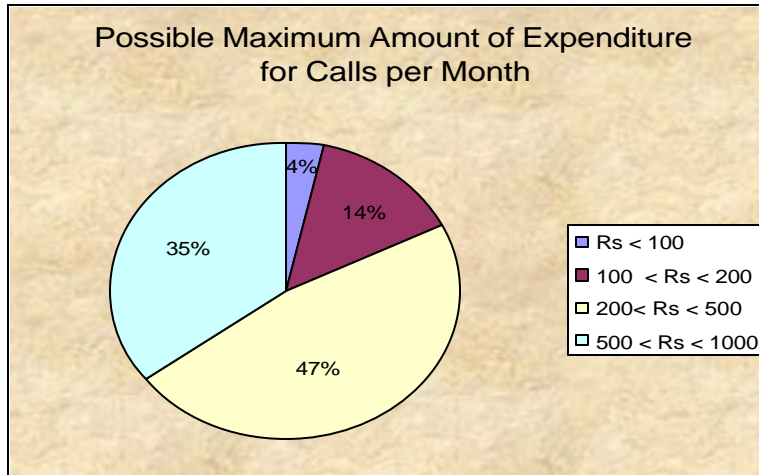
Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 17 above shows customers' responses about accuracy of costs incurred in prepaid cards. According to the pie chart given above, 81% of customers say prepaid costs are clear while 6% of them say prepaid costs are not clear. 13% of customers highlight they can not come to a clear decision. However, as 19% of them are still doubt about this process it will be useful for mobile phone service companies to make transparency of calculations of prepaid card so that they can attract future customers for their services.

Figure 18 below shows possible maximum amount of expenditure that customers can bear for calls per month. According to the pie chart given below, 47% of customers

said that they can spend a 200-500 LKR monthly expenditure for calls. Also, there are 35% of customers seeking to spend a 500-1000 LKR per month for their calls. Overall, 82% of customers are in a position to spend 200-1000 LKR per month for their calls.

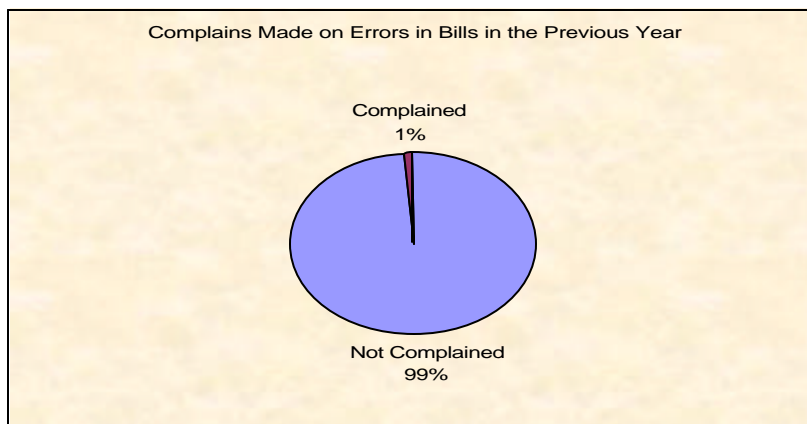
Figure 18



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

Figure 19 below shows complains made by customers on errors in bills in the previous year. Results based on our survey for 200 mobile phone users in Matara district revel that 99% of customers did not complain on errors in bills in the previous year. But there are 1% of customers who had complained.

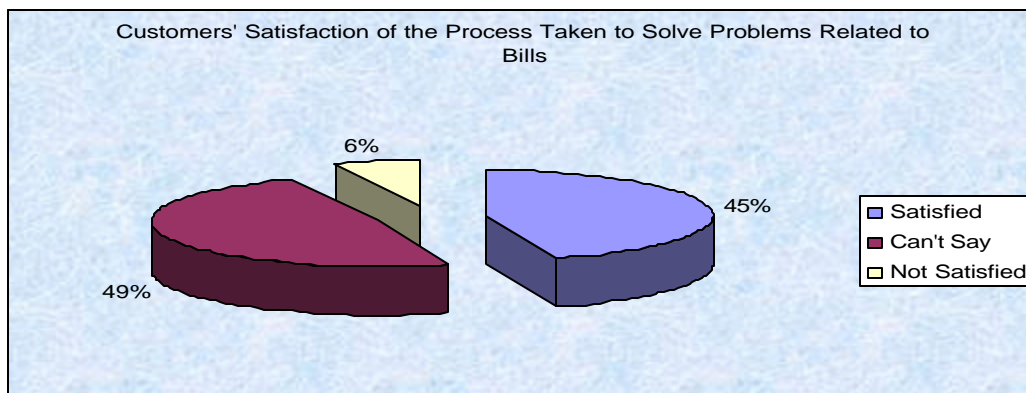
Figure 19



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

Figure 20 below provides information on customers' satisfaction of the process taken to solve problems related to bills. The figure reveals that 45% of customers satisfy with actions taken to solve problems while 49% of them do not give any response. But there are 6% of customers who had not satisfied at all.

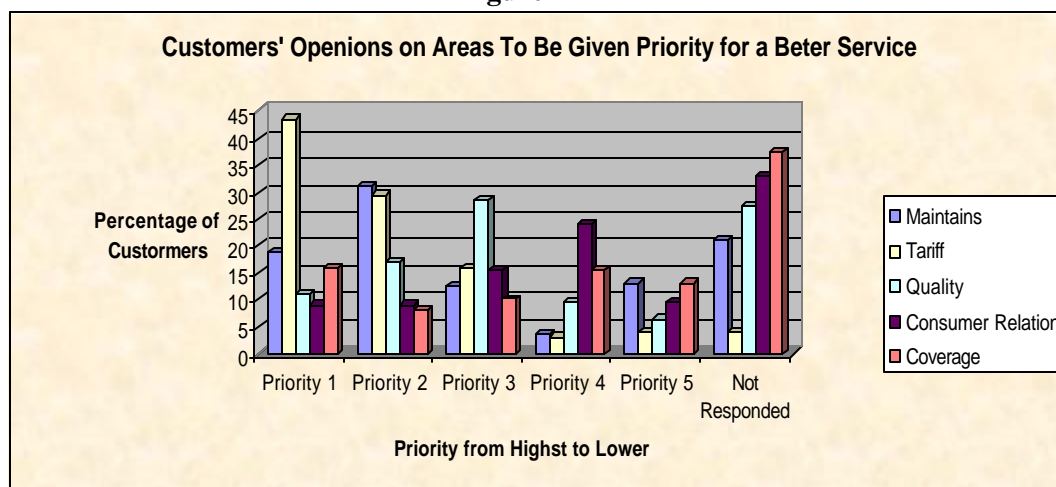
Figure 20



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 21 below provides information on customers' opinions on areas to be given priority to develop for a better service. The figure reveals that more than 40% of customers have highlighted tariff in the first priority. Other categories being included in the first priority are maintains (18%), coverage (15%), quality (10%) and consumer relation (8%) respectively. Even in the second priority, around 30% of customers have given higher places for maintains and tariff

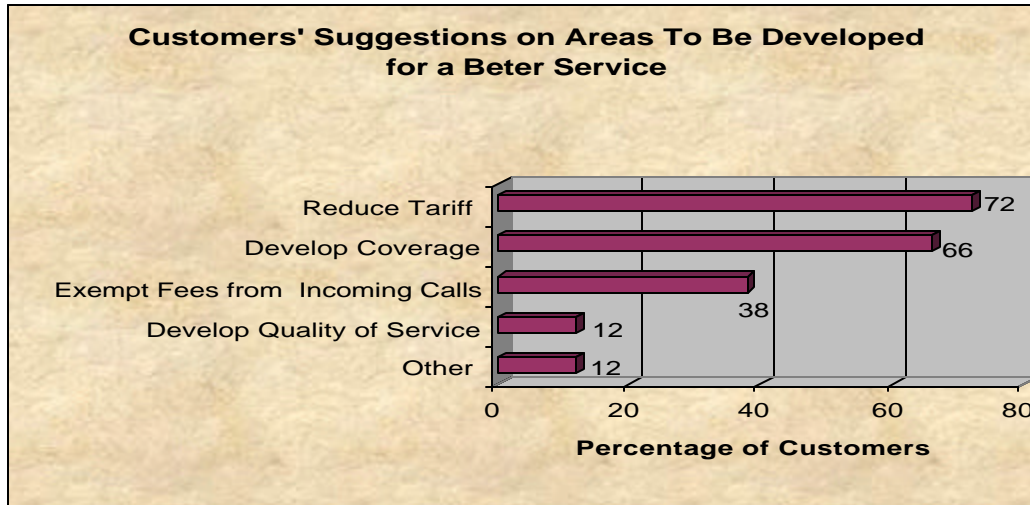
Figure 21



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 22 below indicates customers' suggestions on areas to be developed for a better service. According to the information in the figure, it is clear that 72% of customers are of the view that reduction of tariff is needed to a better service. Also, 38% of customers have indicated that exemption fees from incoming calls can be a good sign of a better service. 66% of customers say that improving of coverage can help to a better service.

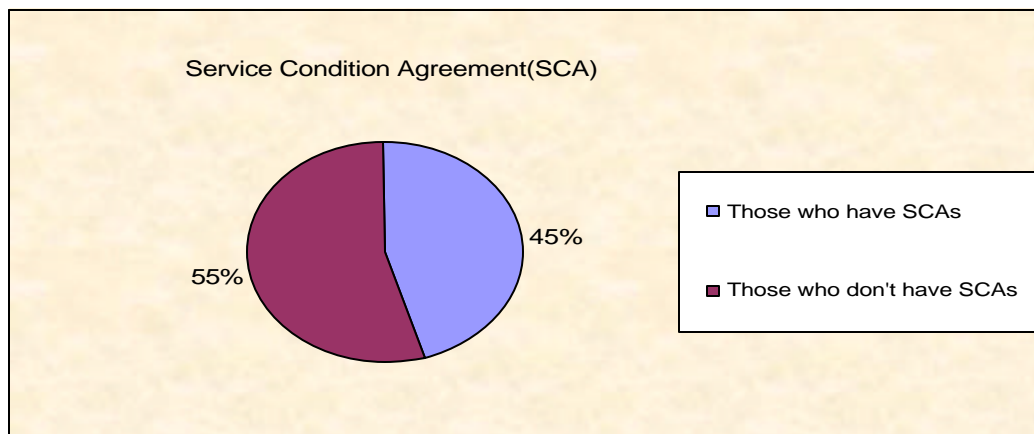
Figure 22



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 23 below provides information on service condition agreements (SCA) which are provided by mobile phone companies when customers buy their phone. According to the information in the pie chart given below, 55% of customers do not have SCAs while 45% of them have obtained SCAs when they bought their phone.

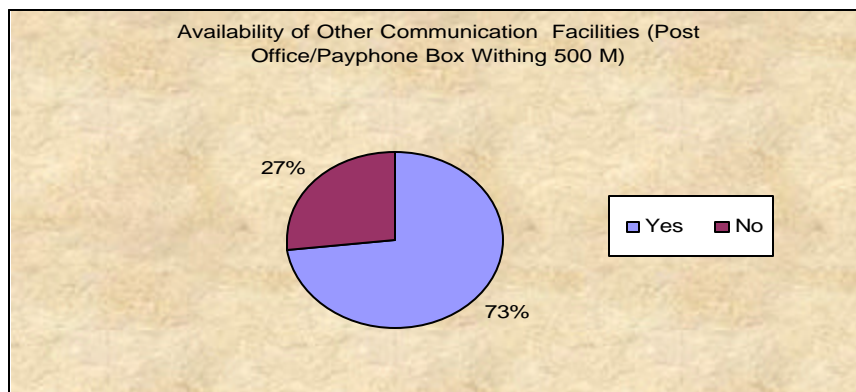
Figure 23



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna.

Figure 24 below provides information on the availability of other communication facilities within 500 Meters. According to the information in the pie chart given below, 73% of customers have either a post office or a pay phone box within 500 meters from their home. But 27% of customers do not have such facilities within the distance concerned.

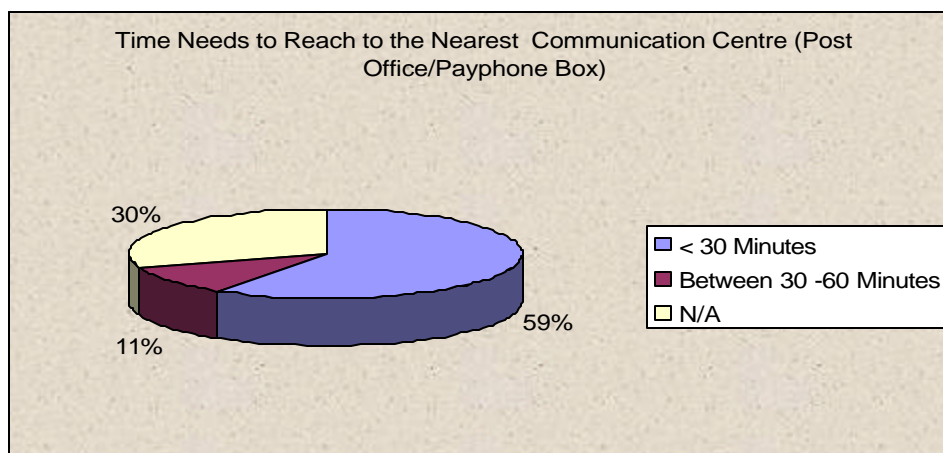
Figure 24



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

Figure 25 below provides information on the time needs to reach to the nearest communication centre. According to the information in the pie chart given below, 59% of customers spend less than 30 minutes while for 30% of them it is not applicable.

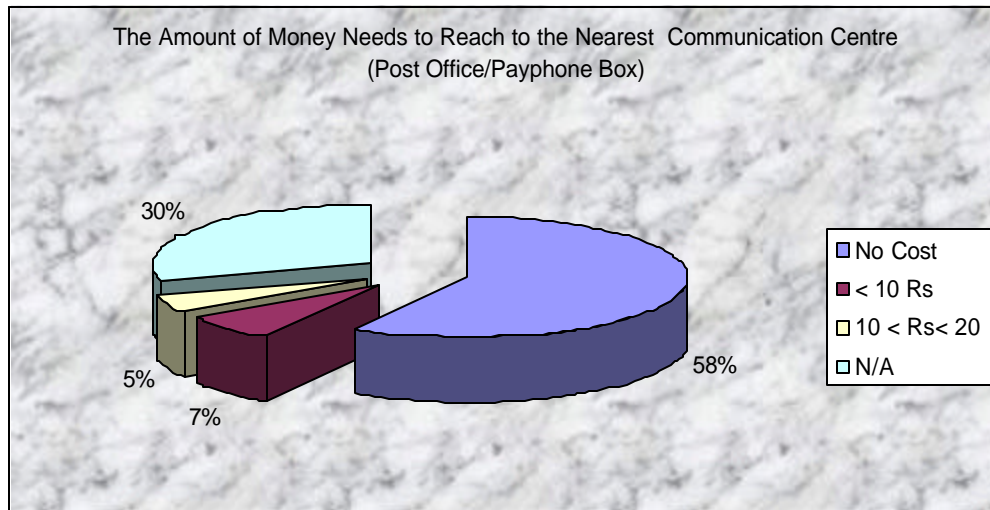
Figure 25



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

Figure 26 below provides information on the amount of money needs to reach to the nearest communication centre. According to the information in the pie chart given below, 58% of customers do not need money while for 30% of them it is not applicable.

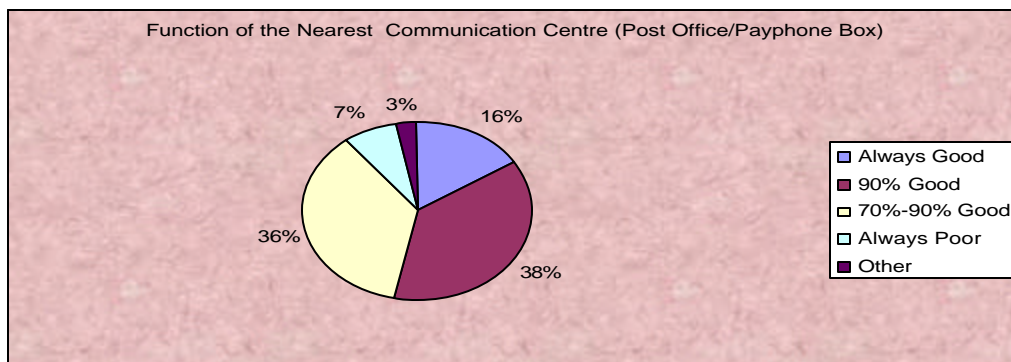
Figure 26



Source: Market Survey 2006 (for Matara District)- Department of Economics University of Ruhuna.

Figure 27 below provides information on the function of the nearest communication centre. According to the information in the pie chart given below, 38% of customers say that its condition is about 90% good while 16% of them say that it operates always well. However, 7% of customers indicate that its condition is always poor. This implies that if the conditions of payphone boxes are improved, there is another potential source of the demand for telecommunication services.

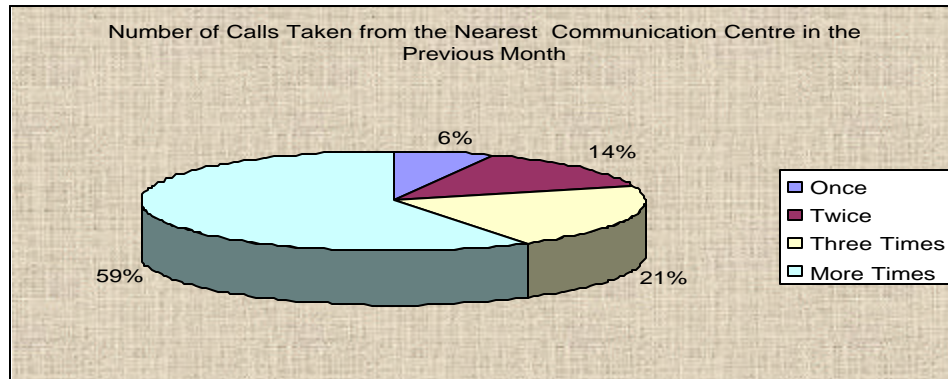
Figure 27



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

Figure 28 below provides information on the number of calls taken from the nearest communication centre in the last month. According to the information in the pie chart given below, 59% of customers have obtained calls more times from their nearest communication centre while 21% of customers have obtained calls three times.

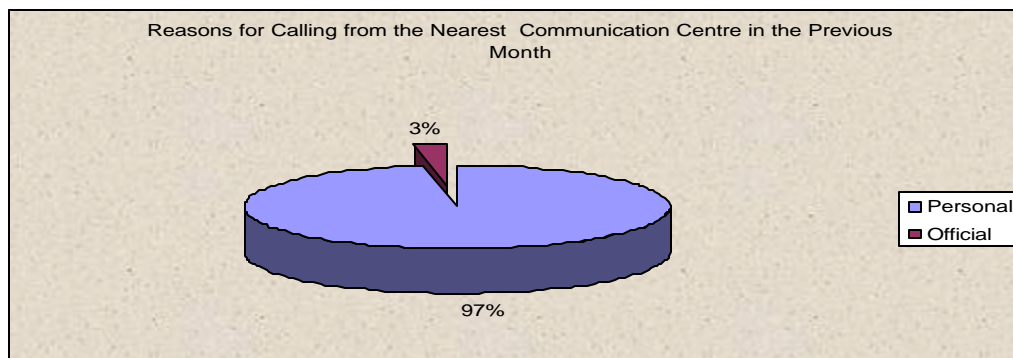
Figure 28



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

Figure 29 below provides information on reasons for calling from the nearest communication centre in the last month. According to the information in the pie chart given below, 97% of customers have obtained personal calls while 3% of customers have obtained calls for official purposes.

Figure 29



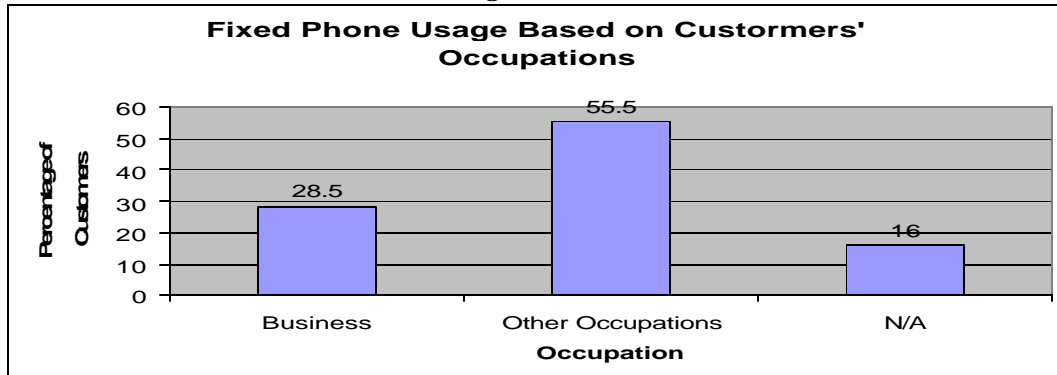
Source: Market Survey 2006 (for Matara District)- Department of Economics University of Ruhuna.

Charts obtained for those who have fixed phones.

Figure 30 shows that 29 percent of people whose occupation is business have ‘fixed phone’ while 56 percent of those who are in other occupations. But 16% of customers who have fixed phone do not have jobs. This implies that the fixed phone services

with less cost will be more attractive for relatively fixed income earners (56%) and non-income earners (16%).

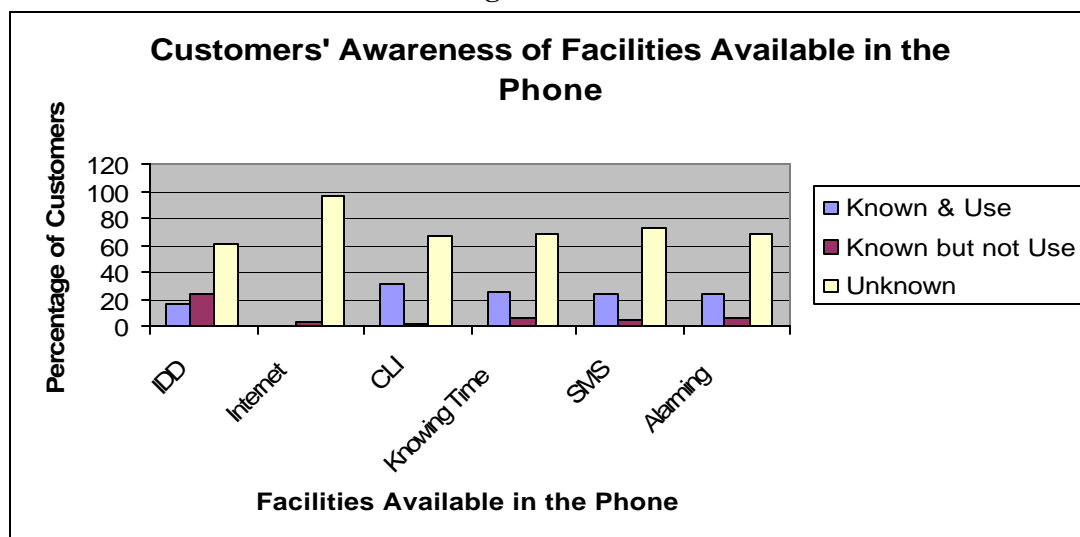
Figure 30



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna.

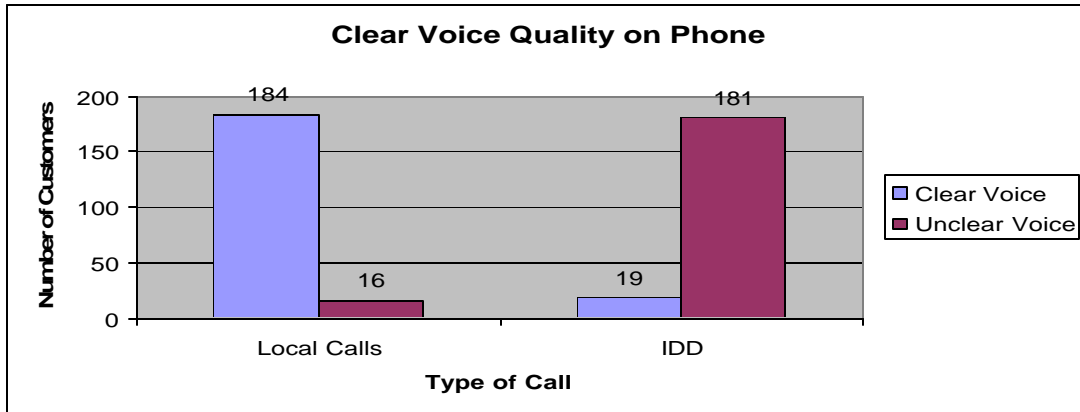
Figure 31 below shows customers' awareness of the facilities available in the phone. According to the figure given below more than 60% of customers are not aware of the facilities indicated in the figure. Except internet, nearly 20% of customers are aware of the use of their phones for the purpose utilizing facilities available in the phone. Majority of customers do not know other facilities indicated in the figure. This is a sever drawback of fixed providers regarding their effort to knowing customers of the services available in the phone. For example, if customers are aware of the use of internet from their phone, it could be a grater utilization of the service

Figure 31



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

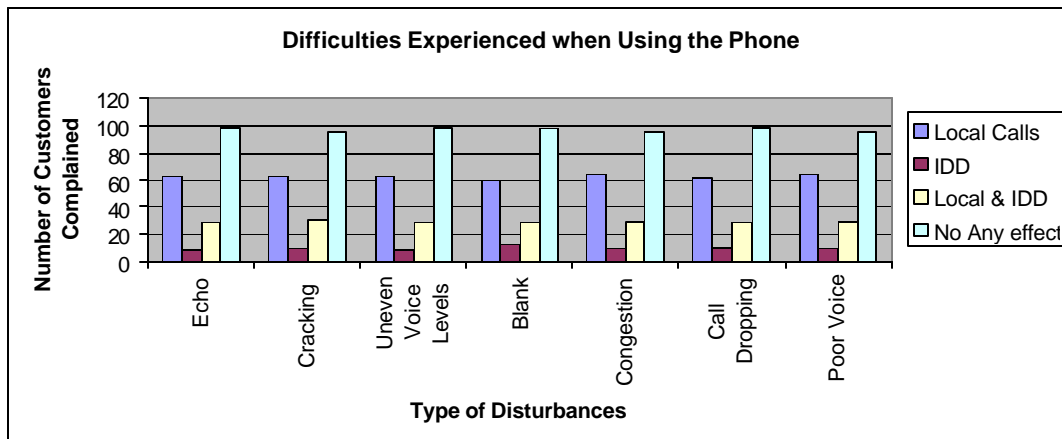
Figure 32



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 32 above shows that more than 184 customers experience clear voice when they obtain local calls. But when they obtain IDD calls, around 181 of them experience unclear voices. It also reveals that 16 customers experience unclear voices when they obtain local calls. Only 19 customers do not have such troubles in IDD calls. Figure 33 below shows those 60 customers of the sample (30%) experience always all the difficulties indicated in the figure when they obtain local calls. More than 20 customers have faced all these difficulties when they obtain both local as well as IDD calls. It is also noted that the reason for very few values for local calls relative to IDD calls is that there were very few customers who got IDD calls. However, 50% of customers (100 in number) do not experience any of technical troubles in their phone lines.

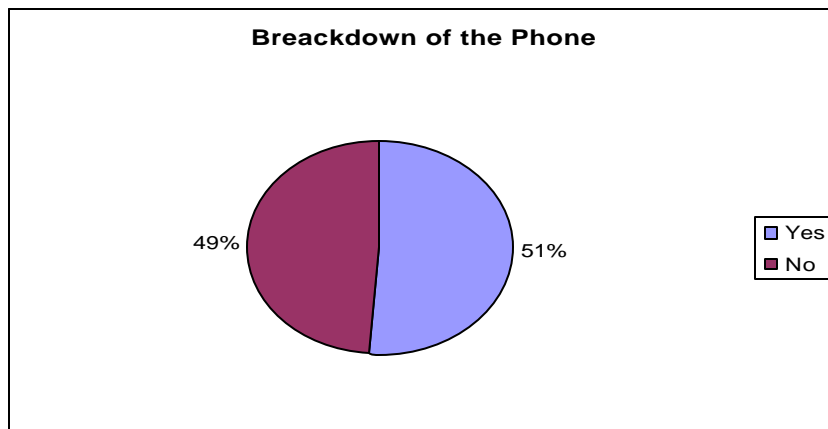
Figure 33



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 34 below shows customers' responses on breakdowns of their phone. According to the pie chart given below, 51% of customers of the sample did not experience breakdowns. But, 49% of customers, which is a higher percentage, have experienced such breakdowns when they obtain calls.

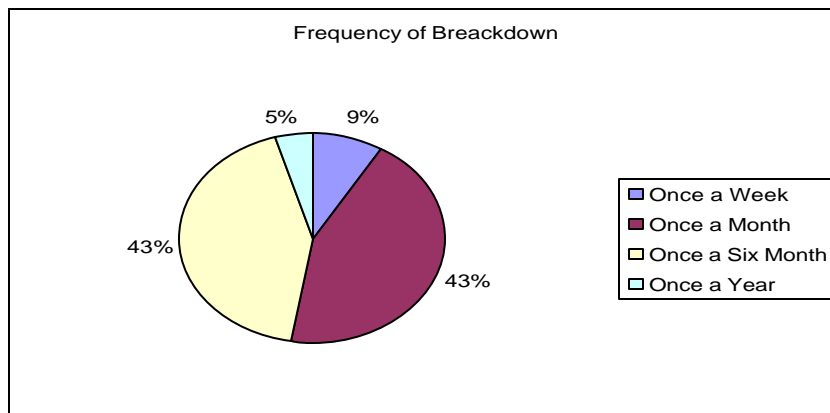
Figure 34



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 35 below shows customers' responses on frequency of breakdowns of their phone lines. The pie chart shows that 43% of breakdowns are reported once a month while the same percentage is reported from the category in which breakdowns are reported as once a six month. 9% breakdowns are reported once a week. 5% breakdowns are reported once a year.

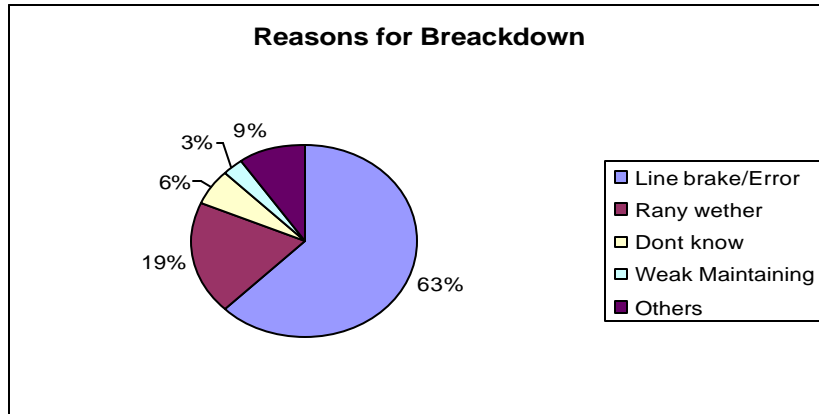
Figure 35



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 36 below shows customers' responses on reasons of breakdowns of their phone lines. The pie chart shows that 63% of breakdowns are reported due to line breaks/errors while 19% such breaks have occurred as a result of rainy whether conditions.

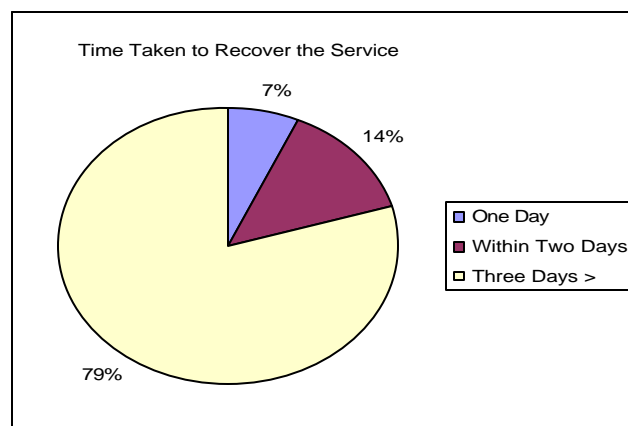
Figure 36



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 37 below shows customers' responses on the time taken to recover the relevant service. The pie chart shows that 79% of breakdowns are corrected after 3 days. There is only 7% of crackdowns recovered in one day.

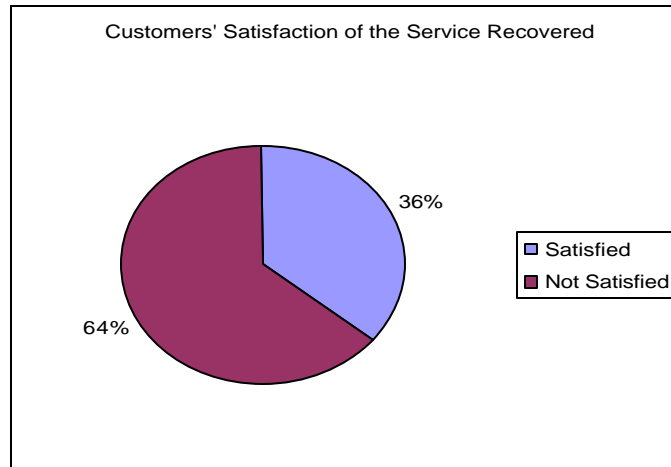
Figure 37



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 38 below shows customers' satisfaction on the services recovered. According to the pie chart given below, there are 36% of customers who satisfy with the recovered service. But 64% of customers do not satisfy with the service recovered.

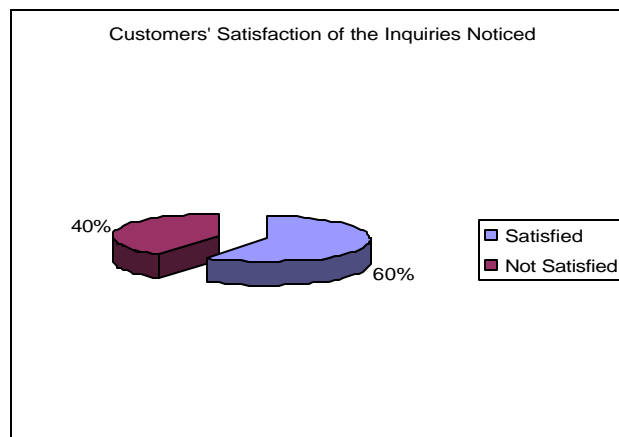
Figure 38



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 39 below shows customers' satisfaction of the inquiries noticed. According to the pie chart given below, there are 60% of customers satisfy with the inquiries noticed by the relevant phone company. But 40% of customers do not satisfy with companies' awareness to investigate inquiries made by customers.

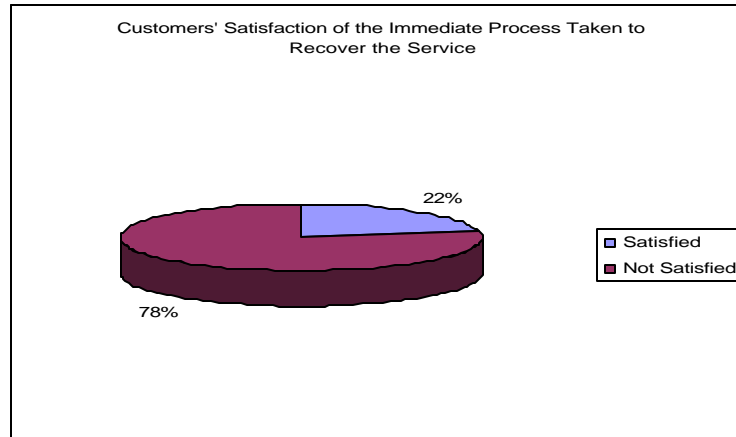
Figure 39



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 40 below shows customers' satisfaction of the immediate process taken to recover the service. According to the pie chart given below, there are 78% of customers who do not satisfy with such a process taken by relevant phone companies. But 22% of customers, a considerably low value, satisfy with companies' awareness to take immediate actions to recover the service.

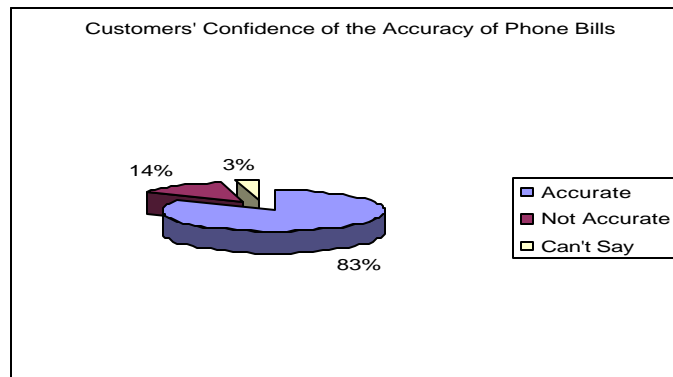
Figure 40



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 41 below shows customers' confidence of the accuracy of bills. According to the pie chart given below, there are 83% of customers who are confident of the calculation of bills accurately. But 14% of customers do not agree to the idea that companies calculate bills accurately.

Figure 41

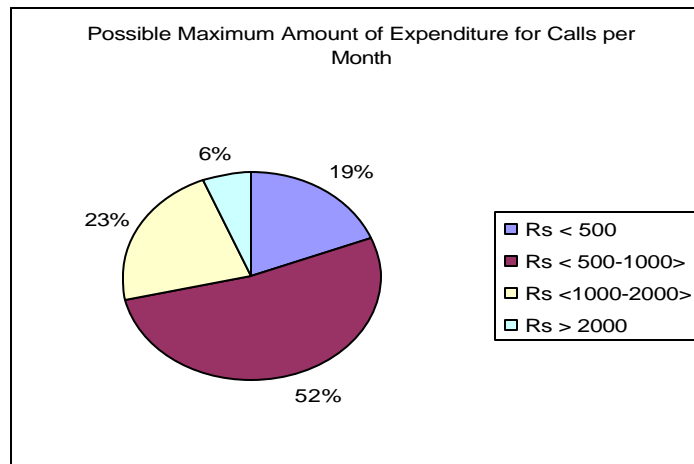


Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 42 below shows possible maximum amount of expenditure that customers can bear for calls per month. According to the pie chart given below, 52% of customers

said that they can spend a 500-1000 LKR monthly expenditure for calls. Also, there are 23% of customers seeking to spend a 1000-2000 LKR per month for their calls. Overall, 75% of customers are in a position to spend 500-2000 LKR per month for their calls. But there are still 19% of customers who can not spend more than 500 LKR per month.

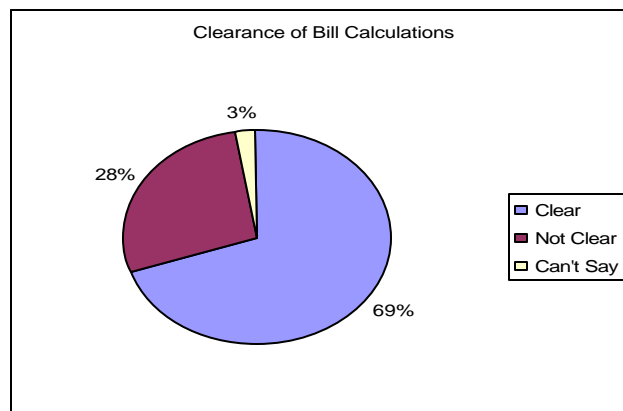
Figure 42



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 43 below shows customers' confidence of the accuracy of phone bills. According to the pie chart given below, 69% of customers say that calculations of bills are clear. Also, there are 28% of customers saying directly that they are doubts on the process of calculations of bills. However, this is a matter to be concerned because customers' doubts on the process of calculations of bills will badly affect on the demand for such services in the market in the future.

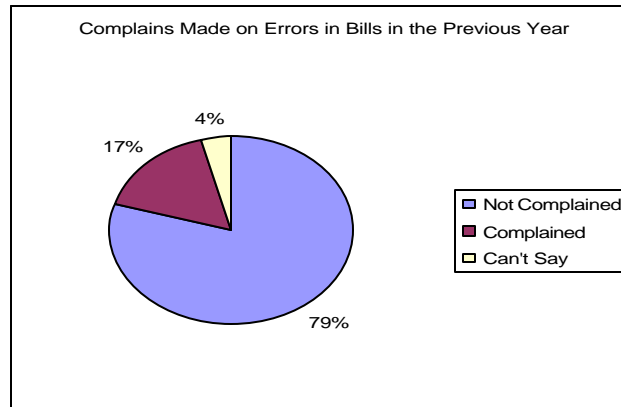
Figure 43



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 44 below shows complains made by customers on errors in bills in the previous year. Results based on our survey for 200 fixed phone users in Matara district reveal that 79% of customers did not complain on errors in bills in the previous year. But there are 17% of customers who have complained.

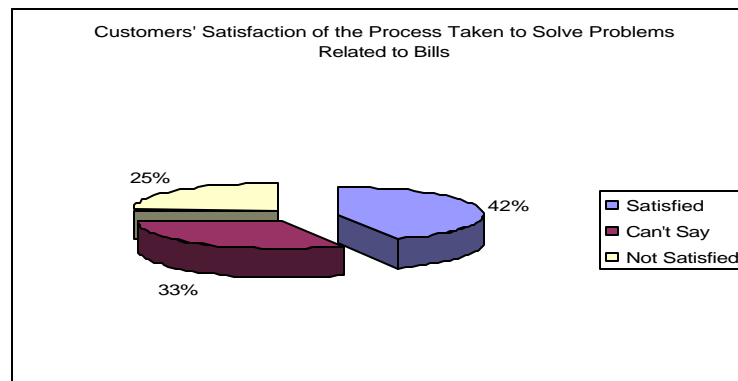
Figure 44



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 45 below provides information on customers' satisfaction of the process taken to solve problems related to bills. The figure reveals that 42% of customers satisfy with actions taken to solve problems while 33% of them do not have any response. But there are 25% of customers who had not satisfied at all.

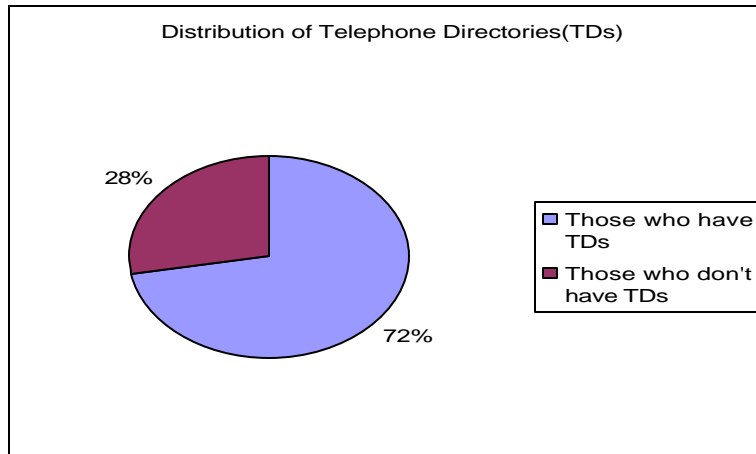
Figure 45



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 46 below provides information on distribution of telephone directories (TDs). According to the information in the pie chart given below, 72% of customers have TDs while 28% of them do not have TDs.

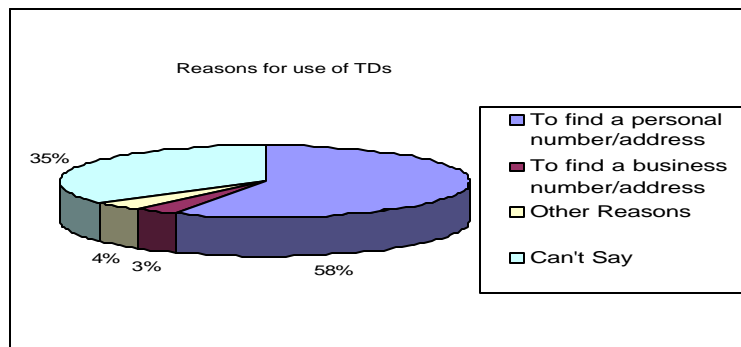
Figure 46



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 47 below provides information on reasons for use of telephone directories (TDs). According to the information in the pie chart given below, 58% of customers have used TDs to find personal numbers/addresses. 7% of customers have used TDs for both business related information and other reasons while 35% of them do not have any reasons to use TDs.

Figure 47

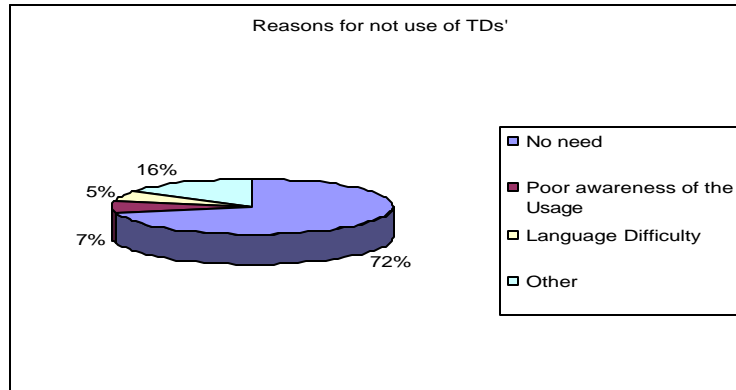


Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 48 below provides information on reasons for not use of telephone directories (TDs). According to the information in the pie chart given below, 72% of customers say that they do not need to have TDs. 7% of customers say that they are not aware of

the use of TDs for any purposes. 5% of them highlight that they have language difficulties to use TDs while 16% of customers stress other reasons for not use TDs.

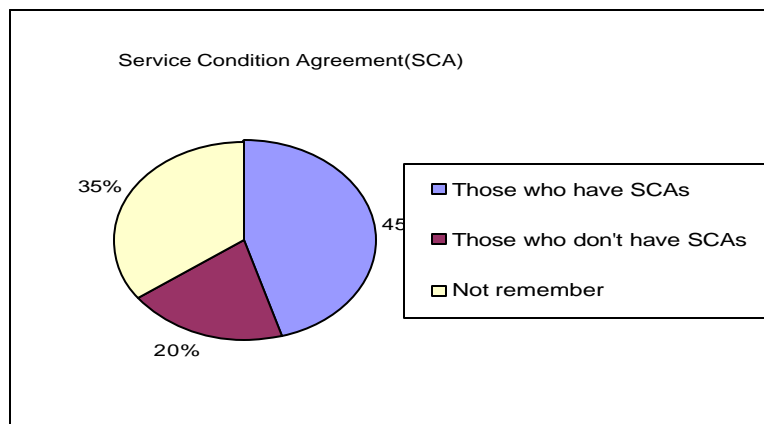
Figure 48



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 49 below provides information on service condition agreements (SCA) which are provided by fixed phone providing companies when customers buy their phone. According to the information in the pie chart given below, 45% of customers have SCAs while 35% of them do not remember of SCAs. Also 20% of customers do not have such SCAs.

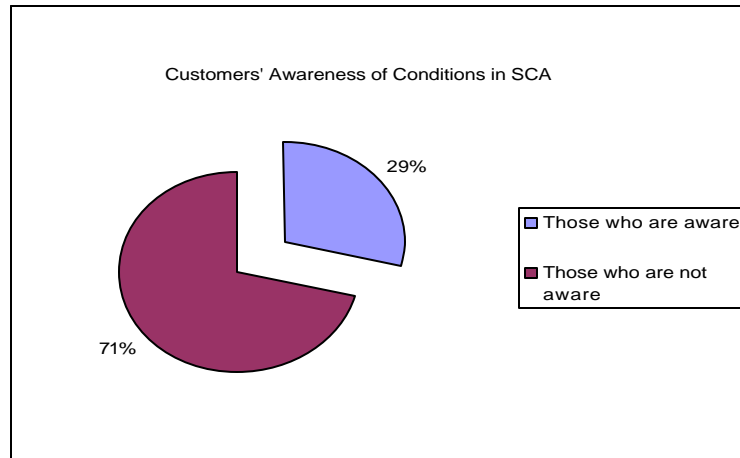
Figure 49



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 50 below provides information on customers' awareness of conditions of service condition agreements (SCA). According to the figure 71% of them do not aware of what informations are in SCAs. But 29% customers have indicated that they know the conditions of SCAs.

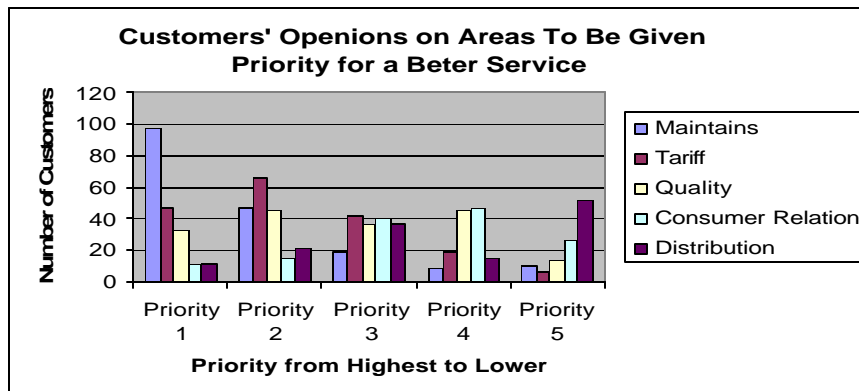
Figure 50



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 51 below provides information on customers' opinions on areas to be given priority to develop for a better service. The figure reveals that nearly 50% of customers (100 in number) have highlighted maintains in the first priority. Other categories being included in the first priority are tariff (22%), quality (12%), coverage (5%), and consumer relation (5%) respectively. In the second priority, 35% of customers have said tariff should be reduced in order to utilize a better service and around 22% of customers have given higher places for maintains and quality as well.

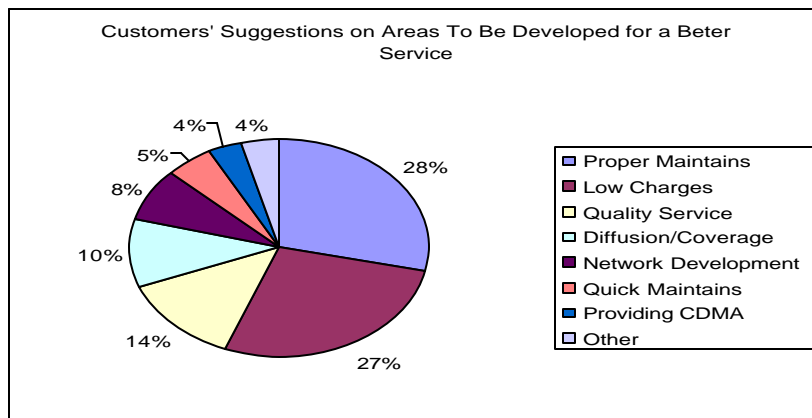
Figure 51



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 52 below indicates customers' suggestions on areas to be developed for a better service. According to the information in the figure, it is clear that 28% of customers are of the view that developing of maintain process has been an essential one for better service. Also, according to their views, low charges are needed to introduce to utilize the service better. 14% and 10% of customers have indicated respectively that the development of quality of service and coverage are also important.

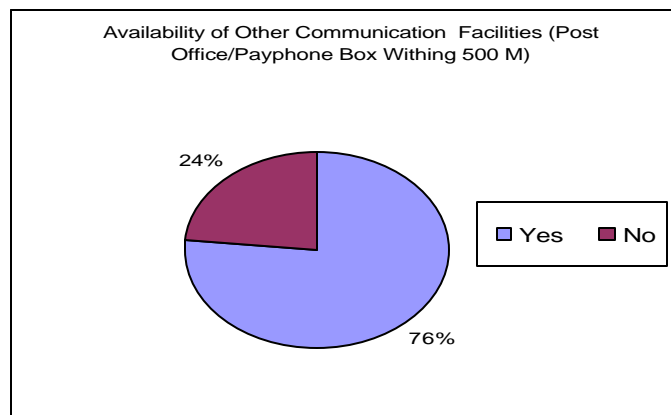
Figure 52



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 53 below provides information on the availability of other communication facilities within 500 Meters. According to the information in the pie chart given below, 76% of customers have either a post office or a pay phone box within 500 meters from their home. But 24% of customers do not have such facilities within the distance concerned.

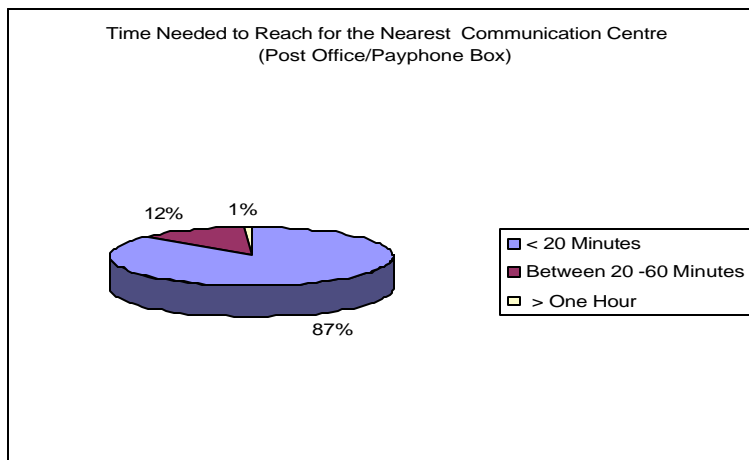
Figure 53



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 54 below provides information on the time needs to reach to the nearest communication centre. According to the information in the pie chart given below, 87% of customers spend less than 30 minutes while for 12% of them it lies between 20-60 minutes.

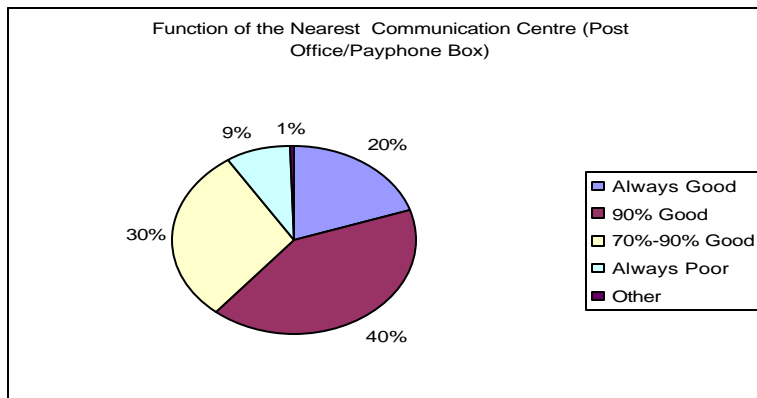
Figure 54



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 55 below provides information on the function of the nearest communication centre. According to the information in the pie chart given below, 40% of customers say that its condition is about 90% good while 20% of them say that it operates always well. However, 9% of customers indicate that its condition is always poor. This implies that if the conditions of payphone boxes are improved, there is another potential source of the demand for telecommunication services.

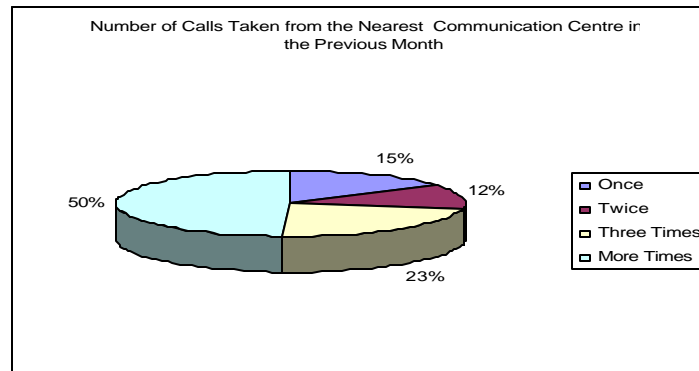
Figure 55



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 56 below provides information on the number of calls taken from the nearest communication centre in the last month. According to the information in the pie chart given below, 50% of customers have obtained calls more times from their nearest communication centre while 23% of customers have obtained calls three times.

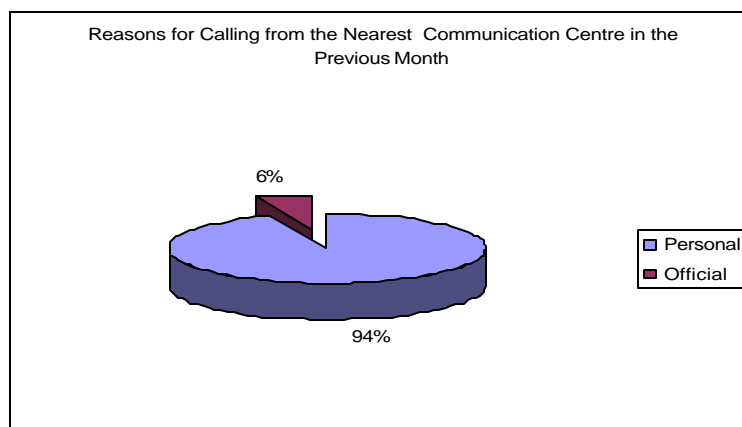
Figure 56



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 57 below provides information on reasons for calling from the nearest communication centre in the last month. According to the information in the pie chart given below, 94% of customers have obtained personal calls while 6% of customers have obtained calls for official purposes.

Figure 57

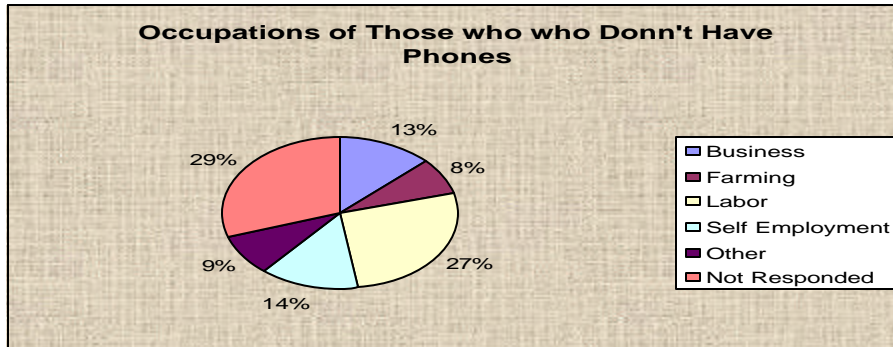


Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

4.3 Charts obtained for those who do not have fixed or mobile phones.

Figure 58 given below shows occupations of those who do not have phones. According to the pie chart given below, 27 %, 14 %, 13% and 8% of people are labors, self employers businessmen and farmers respectively. However, 27% of people did not have respond for this question.

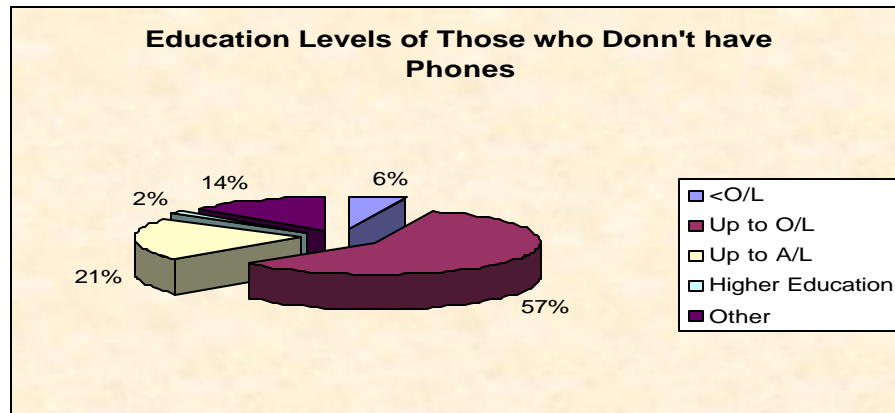
Figure 58



Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 59 given below shows education levels of those who do not have phones. According to the pie chart given below, 57% and 21% of people have educated up to O/L and A/L respectively.

Figure 59

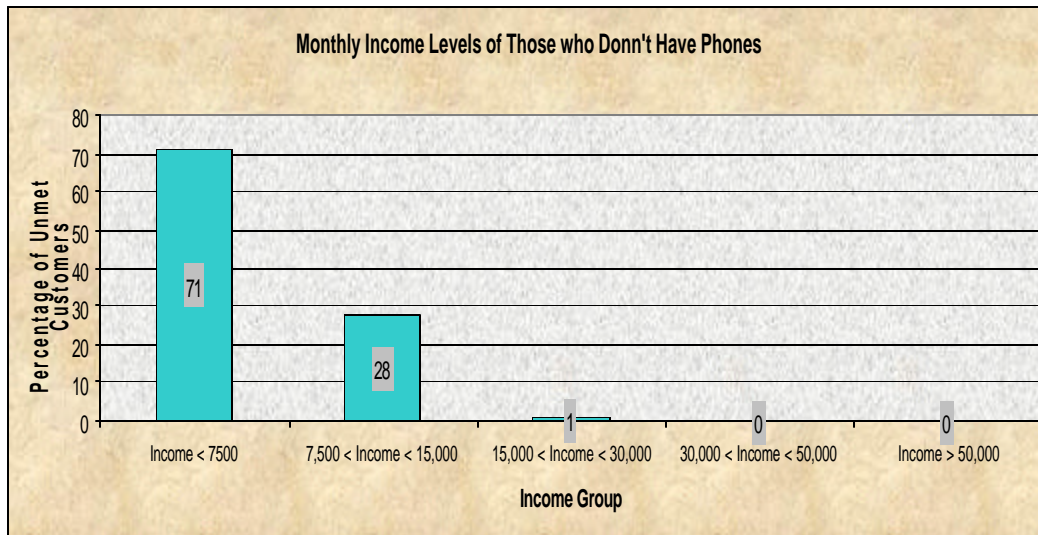


Source: Market Survey 2006 (for Matara District)-
Department of Economics, University of Ruhuna

Figure 60 shows monthly income levels of those who do not have phone. According to the bar chart given below, income of 71% of people is below 7500 LKR, while 28 percent of those who are in 7500-15000 income level. Therefore, more than 99% of

people who do not have mobile or fixed phones are less than monthly income of 15000 LKR.

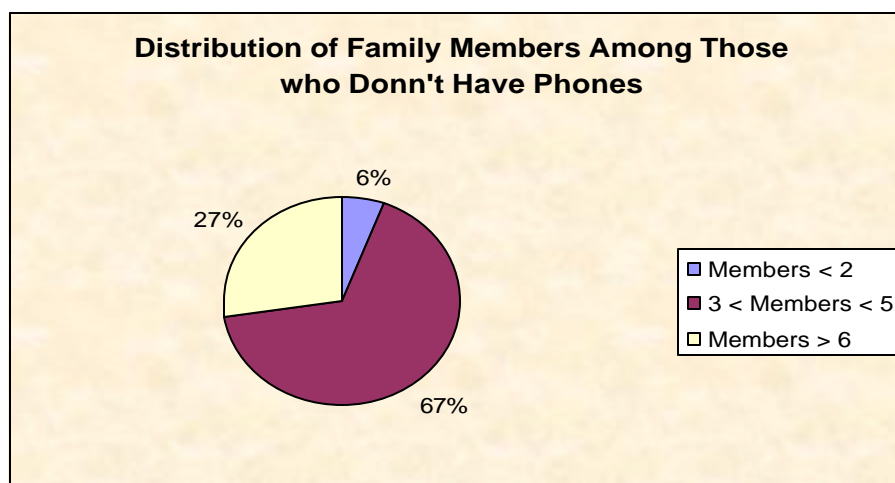
Figure 60



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 61 below shows that 67% of customers who do not have phone have 2-5 family members and 27% of those have more than 6 family members. But there are only 6% of customers who have less than 2 family members.

Figure 61

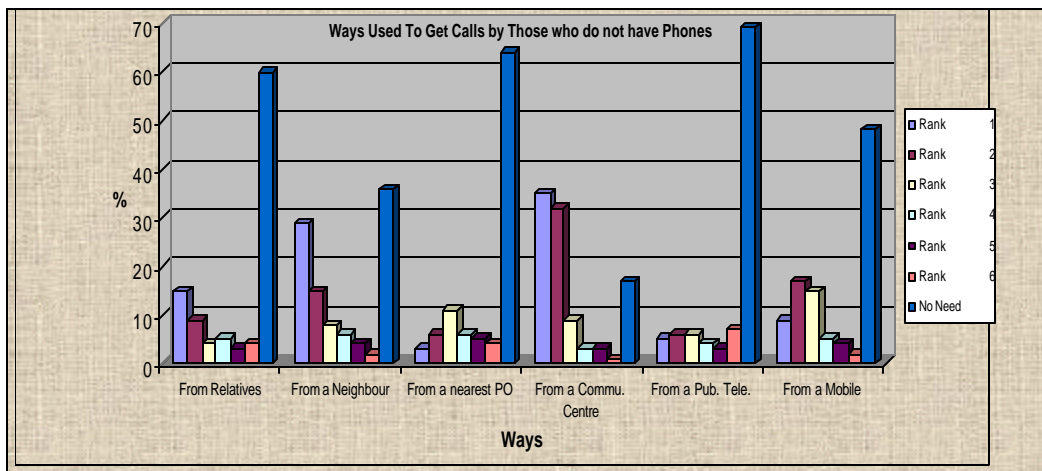


Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 62

Figure 63 shows that the ways used to get calls by those who do not have phone. According to the information in the bar chart given below, almost more than 60% of people who do not have phone obtain calls from post offices and public telephone boxes. Therefore, it is essential to develop service conditions of both post offices and public telephone boxes.

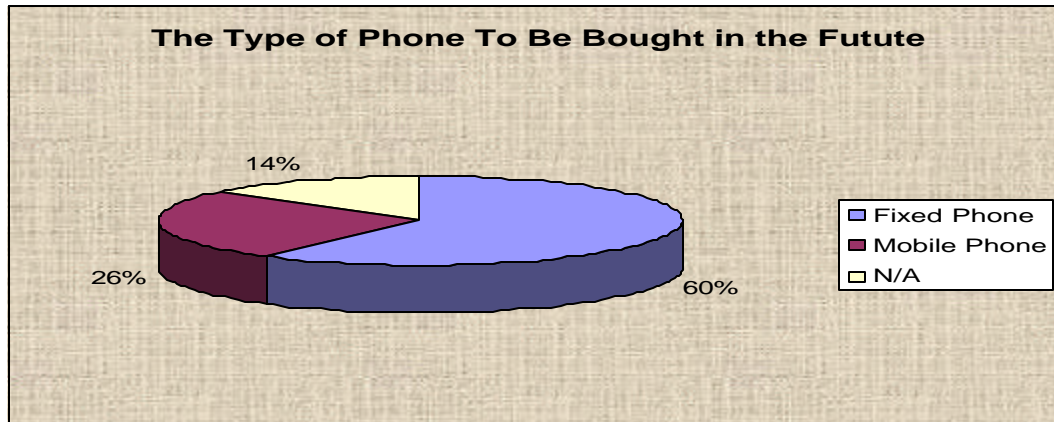
Figure 63



Source: Market Survey 2006 (for Matara District)- Department of Economics, University of Ruhuna

Figure 64 shows that the type of phone to be bought by customers in the future. According to the information in the pie chart given below, 60% and 26% people are expecting to access for fixed phone and mobile phone services respectively. But there are 14% of people do not have any idea regarding the matter raised.

Figure 64



Source: Market Survey 2006 (for Matara District)-Department of Economics, University of Ruhuna

5. Concluding Remarks

This research was conducted mainly in two steps. In the first step we made forecasts for mobile phone, fixed phone and mobile & fixed phone usage in Sri Lanka from 2006 to 2008 based on a simple exponential growth model. In the second stage we used a cross section sample in which we interviewed 600 customers regarding various issues related to nature and the types of market demand for mobile and fixed phone usages. We used three questioners; one for those who have mobile phone and the other was for those who have fixed phone. Final one was for those who do not have mobile and fixed phones. For the analysis, we used only bar charts and pie charts. Although we could use some econometric techniques (Logistic/Probit models), we did not do that because the primary idea of TRC was to get some impression about the type of market for telecommunication services in Matara district based on simple visualization techniques.

We are not going to highlight findings of this research here as it comes in the text in details and in the executive summary as well.

6.6



PROF. J.W. D. SOMASUNDARA

Professor J.W. Dayananda Somasundara obtained his first degree, B.A. Hons. Economics from the Vidyodaya University (presently University of Sri Jayewardenepura) in 1969. He read for his Master's degree in Economics, specializing Agricultural Economics at the University of New England in Australia. He obtained his M.Ec. in 1976. He was awarded a Ph.D. by the Open International University in 1998. Having considered his contributions to the field of Economics he was awarded a D.Sc. Degree by the University of Dublin.

His first academic appointment was at Vidyodaya University where he worked as a Lecturer, Senior Lecturer and Associate Professor since 1970 to 1996. He was promoted to the Professor post in 1996 and to the Senior Professor grade in 2002. Presently he holds the Chair and the Senior Professor of Economics post of the Department of Social Sciences, Sabaragamuwa University of Sri Lanka. In addition, he serves as a Visiting Professor of Economics at the Gombe State University in Nigeria since 2007. He also serves as a visiting professor and external examiner of several national and international universities.

He was appointed as the first Director of the Sabaragamuwa Affiliated University College in 1991 and he served in that capacity for four years and two months. When the Sabaragamuwa University College was elevated to a National University in 1995, he was appointed as the first Vice Chancellor of the Sabaragamuwa University of Sri Lanka in November, 1995, and he held that post until 2001. He served as the Director of External Degree Programmes and Extension Services Unit from 2001 to 2002 and again from 2006 to 2007. He also served as the first Director of the Sabaragamuwa University Centre for Indigenous Community Studies from 2006 to 2007. He was the Chairman and the Chief Organizer of the International Symposium held in 2006 at the Sabaragamuwa University of Sri Lanka. He has also worked as the Project Manager of the Ratnapura Community Information Project, 2002-2004 sponsored by ADB..

Prof. Somasundara has been awarded the Most Outstanding Citizen Award in the field of Education for the years 1996/1997 by the Lions Clubs International- District 306 A. He has been selected as one of the Leading Educators of the World for his outstanding

accomplishments in the field of Educational Development and University Teaching in the year 2005 by the International Biographical Centre, England. He has also been chosen for an honorary appointment to the Research Board of Advisors of the American Biographical Institute for the years 2006 and 2007. He has also been awarded the Sabaragamuwa Sarasavi Abhiramya Award at the Tenth Anniversary in recognition of his service rendered in establishment of the Sabaragamuwa University of Sri Lanka..

He was a pioneer member of the SAARC University Association formed in 1999. He was the Vice-President of the Sri Lanka Economic Association in 2006/07. He is a life member of Sri Lanka Economic Association, Sri Lanka Association for the Advancement of Science and American Studies Association of Sri Lanka. He is actively involved in volunteer organizations and community works, and held many executive posts in such organizations. He is currently the Vice President of the Ratnapura Buddhist Association and Senior Consultant to the Ratnapura Child Development and Education Foundation..

He had served as a Consultant/Economist for various international agencies and local agencies, such as United States Agency for International Development (USAID), Asian Development Bank (ADB), Japanese Toyota Foundation, Human Resource Development Council, Distance Education Modernization Project, Ratnapura Disaster Management Project, Ratnapura Child Development and Education Foundation etc. He has participated several international and local seminars and symposiums and presented research papers. He has also produced Research Volumes, Research Reports, Research Papers and Seminar Proceedings in addition to the several text books published in Economics. He has contributed several articles in Sinhala and English to Journals, Magazines and News Papers.



MR. N.N.K.P. WITHANAGE

Mr. Niroshan N.K.P. Withanage graduated from the University of Colombo in 2000, having completed a B.Sc. Special Degree in Statistics. He has obtained a M. Sc. Degree in Applied Statistics from the University of Limburgs in 2004 and another M. Sc. Degree in Biostatistics from the University of Hasselt in Belgium in 2005.

He started his academic career in 2000, having joined the Department of Statistics and Computer Science of the University of Colombo as an Instructor. In 2001 he joined the Department of Social Sciences, Sabaragamuwa University of Sri Lanka as a Lecturer in Statistics. He is working in that post up to date. He is also working as a visiting lecturer in Statistics in other Faculties.

He has presented papers at International and local symposiums and seminars. He has served as a Coordinator of the University Symposiums organized by the Sabaragamuwa University of Sri Lanka. He has also worked as a consultant to the Distance Education Modernization Project funded by the Asian Development Bank and TEAMS Consultants. He has contributed articles to the Journals and Research Volumes published by the Sabaragamuwa University.

His research interests are in the fields of Social Statistics, Social Sciences and Information & Technology.

Telecommunications Regulatory Commission of Sri Lanka

Research Studies in the Field of Telecommunications – 2006

**Problems and Prospects of Telecommunications
Services in the Ratnapura District**

Final Report

Prepared By

J.W.D.Somasundara
N.N.K.P.Withanage

December, 2006

Department of Social Sciences
Sabaragamuwa University of Sri Lanka
Belihuloya – Sri Lanka

Preface

This study was undertaken by a Research Team of the Department of Social Sciences of the Sabaragamuwa University of Sri Lanka. It was sponsored by Telecommunications Regulatory Commission of Sri Lanka (TRCSL).

The information and data for the study were collected from three categories; those who had Fixed Phones, Mobile Phones and who did not have either fixed or mobile phones.

We are grateful to the officers of the TRCSL, Mr. Mohan Jayesekara, Mr. Jagath Rathnayake, Mr. Nishantha Palihawadana and Ms. Champa Waragoda for their assistance and comments on the Draft Report.

Data collection was done by the first year, second year and third year students of the Department of the Social Sciences of the Sabaragamuwa University of Sri Lanka. We appreciate their dedication shown in the survey.

We are also thankful to all those who volunteered to provide information and data and for extending their co-operation.

We wish to extend our thank to Suntel (Pvt) Ltd, Lanka Bell (Pvt) Ltd and Sri Lanka Telecom branches at Ratnapura, Avissawella and Hambantota providing the secondary data and information regarding telecommunication services in the Ratnapura District

Prof. J.W.D. Somasundara

N.N.K.P Withanage

List of Abbreviations

CDMA	-	Code Division Multiple Access
CLI	-	Caller Line Identification
DS	-	Divisional Secretariats
ELU	-	Extended Line Units
GOSL	-	Government of Sri Lanka
ICT	-	Information and Communication Technology
ISP	-	Internet Service Provider
MEU	-	Main Exchange Unit
NTT	-	Nippon Telegraph and Telephone Corporation
RSU	-	Radio Server Unit
SLTL	-	Sri Lanka Telecom Ltd
WLL	-	Wireless Local Loop

Executive Summary

The objective of this research study is to identify the problems and prospects of telecommunications services and the unmet demand of telecommunication services in the Ratnapura District. In addition, the study examines the prevailing quality of the telecommunication services in the Ratnapura District.

Systematic sampling technique was applied to get information and all Divisional Secretariat Divisions in the Ratnapura District were covered. A number of families in each DS division were selected proportionally to the total number of families in each DS division. The sample consists of 663 individuals and it includes, three categories, i.e. fixed phone subscribers (408), mobile phone subscribers (119) and phone-less people (136).

Around 52% of the fixed phone subscribers (A 95 per cent Confidence Interval for this estimator is [0.471,0.567]) are not satisfied of the service provided due to the factors of low signals, no immediate attention to repair their phones when they go out of order, frequent disconnections, congestion etc. Low signals, frequent disconnections and congestion were mainly mentioned by the respondents who had wireless land phones and other wireless telephones with CDMA technology.

Many fixed phone subscribers suggest the establishment of maintenance units at least for main cities in the Ratnapura District. The present maintenance units are not enough as compared to the work and the number of phones covered by these units; the staff, equipment and vehicles are not sufficient to handle repairs immediately. Also, one team cannot attend to all the repairs per day. It is suggested to employ sufficient number of workers with equipment for handling breakdowns and maintenance works.

In addition, an appropriate technology should be used to overcome the telephones problems due to bad weather (rain and lightning).

Also many respondents have suggested increasing the coverage area of wireless fixed phones. They mentioned that present coverage is not sufficient for some areas, hence, the number of towers on operation has to be increased to avoid the problems of low signals, frequent disconnections and congestion phones.

The main reasons for frequent faults related to wireless land phones are; battery failures, antenna alignments, RBS and interconnection congestion, customer premises equipment failures etc.

For mobile phones, people prefer to use prepaid card connections to postpaid connections.

More than 86% of the mobile phone users are satisfied with the voice quality. According to the mobile phone holders' point of view, the coverage area should be increased and secondly quality of the service and the consumer relations be improved.

More than 80% of the phone-less people intend to buy a telephone. This indicates that still there is a higher demand which is not yet captured by the telecommunication service providers in the Ratnapura District. Among them many respondents prefer to buy a fixed phone and they consider the reliability and the reasonable cost of the service before buying it.

Around one third of the phone-less people had indicated that they did not have the facility for making a call. The main reason is that there is no nearby public telephone/payphone or a communication centre. They have reported that many public payphones/telephones in the rural areas of the Ratnapura District are not functioning properly.

This report suggests fixing public payphones/telephones at least one for each village, facilitating anybody to get a telephone call within a short period. They suggest that public phones could be installed in the Grama Niladhari Office or Village Temple for safety and convenience.

In the survey it is observed that 20% of the people who are presently not having a phone do not wish to have a phone. This reveals that still a considerable percentage of people cannot afford to buy a phone service. They do not intend to get a phone in the near future. However, they need to get phone calls occasionally. Fixing public pay phones at village centres can fulfill their needs.

According to the information collected by personal interviews, service providers face problems such as long delay in getting statutory approvals for site selections and also for tower constructions. Unrealistic conditions by authorities and inadequacy of infrastructure facilities cause these delays.¹

It seems that some local authorities make unrealistic and unreasonable objections for rejecting or delaying the required approval for the construction of new towers in some low signal areas. They take long time to give permission though there are no major problems in approving construction of towers in the area.¹

To overcome these problems, the government must form a top level committee to look into these problems and take prompt action to expedite the approval procedure since this is very important for the expansion of telecommunication services in the rural areas.

Insufficient infrastructure facilities (electricity, road access, etc) are one of the major problems for the expansion of telecommunication services in the rural areas. Hence, government must provide required infrastructure facilities in addition to the institutional support to construct towers.

¹ Telecommunications Regulatory Commission & Operators

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1. Introduction

1.1 Overview of Telecommunications Industry in Sri Lanka

Telephone usage has minimized the space between individuals in exchange of information. Telecommunications service has become one of the fastest growing industries in the economy supported by rapid innovations, strong reforms and healthy competition. Rapid developments in the telecommunications industry is now a global phenomenon. In Sri Lanka, the telecommunication services have not spread over the rural sector as in many countries. In Sri Lanka still 45 percent of the telephones are located in the Colombo metropolitan area. Other 55 percent is spreading in other areas of the Island.

The supply of mobile phones is increasing at an annual rate of 50 percent, but that of fixed phones is increasing only at an annual rate of 10 per cent. As far as the demand is concerned, still people prefer fixed phones to mobile phones.

The reforms introduced since 1991 have made telecommunications one of the most liberal, competitive and fast growing infrastructure services in the country. Vigorous competition was seen among 3 fixed access telephone operators, 4 mobile operators, 32 external gateway operators, 29 data communication and Internet service providers, 4 paging operators, 2 payphone operators and 2 trunk radio operators. During the year, the sector continued to derive benefits from the opening of the external gateway operations in 2003. As a result, international connectivity improved remarkably and charges were reduced significantly, benefiting both domestic and corporate consumers.

Sri Lanka Telecom Ltd (SLTL), (before 1996 Sri Lanka Telecom Corporation) is the incumbent telecommunications fixed services provider with largest customer base in Sri Lanka. The SLTL's monopoly over fixed-line telephone services ended in 1996 with the issue of licenses to two Wireless Local Loop (WLL) operators, namely *Suntel (Pvt) Ltd*, and *Lanka Bell (Pvt) Ltd*. In August 1997, under the privatisation programme of the Government of Sri Lanka (GOSL), 35% of the shares of SLTL were acquired by the Nippon Telegraph

and Telephone Corporation (NTT) of Japan. This was an important step towards developing the infrastructure that would provide the country a solid platform for economic and social growth. After joining NTT, the SLTL was able to reduce the number of applicants in the waiting list to get fixed phones by a significant amount.¹

Frequencies have been issued on March 2005 to three fixed access telephone operators to deploy fixed wireless access services using CDMA technology and there are 472,000 CDMA connections as at June 2006.¹ The introduction of CDMA technology supported the growth in fixed access network. CDMA technology has narrowed the urban- rural disparity where as access to telephone services is concerned.

There are four operators providing Mobile Telephone Services in Sri Lanka, namely Celltel Lanka (Pvt.) Ltd., Dialog Telekom Ltd., Mobitel (Pvt.) Ltd. and Hutch Telecommunications (Pvt) Ltd. The mobile telephone technology caused an island wide boost in the rapid exchange of information and a tremendous growth in telephone ownership in Sri Lanka as has been reported from each District. The use of mobile phones has grown steadily in recent years due to the reasons of; improvement in cellular telephone technology, aggressive competition, affordable initial cost, quick supply, expansion of coverage etc. Mobile telephone penetration (the share of mobile phones in the total number of telephones) in the telecommunications sector further increased to 73 per cent in 2005 from 71 per cent in 2004.² The mobile operators have provided more than 4.28 million¹ connections as at end June 2006.

Since 1991, Sri Lanka has licensed more than 32 Internet Service Providers (ISPs) to supply internet and related services to the public and business sectors. These services include website hosting and development, software development, network integration etc. ISPs are connected to the internet backbone through either their own satellite links or international gateways of facility-based operators. The liberal ISP policy and significant reduction in leased line charges are expected to promote fast proliferation of internet usage within the country and give a boost to applications such as E-commerce, Web-Hosting and Virtual Private Networks (VPN). Subscribers to Internet and e-mail services increased by 23 per cent

¹ Source: Telecommunications Regulatory Commission of Sri Lanka

² Source: Central Bank Annual Report

in 2005¹. Sri Lanka has more than 125,800 internet subscribers as at June 2006². However the number of internet users may be more than three or four times higher of this, since, internet services in public and private organizations like schools, universities, educational institutes, communication centres, private and public offices, catering to thousands in a day.

Sri Lanka has the potential to develop Information and Communication Technology (ICT) related services further increasing the literacy rate in Sri Lanka to a very high level. There is potential to further develop information technology based services for overseas and domestic clients such as telemarketing, call centres, data processing and internet based products.

Table 1.1 shows how the literacy rate, fixed telephone density, mobile phone density variation among the SAARC countries and selected East Asian countries.

Table 1.1: Variation of the literacy rate, main telephone density and mobile phone density among the SAARC countries and selected East Asian countries. Reference year is 2005

Indicator	SAARC Countries						
	Sri Lanka	India	Pakistan	Bangladesh	Nepal	Bhutan	Maldives
Literacy Rate, %	92.1	61.0	48.7	41.1	48.6	47.0	97.2
Main Telephones per 100 persons	6.0	4.51	3.43	0.75	1.65	n.a.	n.a.
Mobile phones per 100 persons	16.21	8.16	8.30	6.35	0.92	n.a.	n.a.
Indicator	Selected East Asian Countries						
	Singapore	Korea	Malaysia	Thailand	Philippines	Indonesia	
Literacy Rate, %	92.5	97.9	88.7	92.6	92.6	87.9	
Main Telephones per 100 persons	43.50	49.17	16.79	10.95	4.16	5.73	
Mobile phones per 100 persons	103.41	79.39	75.17	42.98	39.50	21.06	

Sources: –International Telecommunications Union and United Nation Programme Development Report 2005

¹ Central Bank annual report, 2005

² Source: Telecommunications Regulatory Commission of Sri Lanka

1.2 Objectives of the Project

The research study reported in this document assesses the problems and prospects of telecommunications services in the Ratnapura District and identifies the factors affecting the demand for telecommunications services in the Ratnapura District. In addition, the study reveals the prevailing quality of the telecommunications services in the Ratnapura District.

1.3 Background of the Ratnapura District

Ratnapura is one of the two administrative districts of the Sabaragamuwa Province which covers 67% of the total area of the Province, with an area of 3,275 km². Ratnapura is the capital of the District as well as of the Province.

The entire Ratnapura District falls into the tropical wet zone of the country and having rich bio-diversity within its limits. The District depends on the southwest monsoon (April to May) and inter- monsoon (October to December) for its water resources.

The Administrative authority of the District is the District Secretariat of Ratnapura, which is headed by the District Secretary. For administrative purposes Ratnapura District has been divided into 17 Divisional Secretaries' Divisions (DS) and 575 Grama Niladari Divisions (GN). The DS divisions of Ayagama, Godakawela and Elapatha are very rural compared to the other DS Divisions. A considerable number of Samurdhi beneficiary families live in those DS divisions compared to all other DS divisions in the Ratnapura Districts (Table 1.2).

Ratnapura District consists of 8 electorates according to the previous electoral system, namely, Balangoda, Eheliyagoda, Kalawana, Kolonna, Nivithigala, Pelmadulla, Rakwana and Ratnapura. Ratnapura District has one Municipal Council, one Urban Council and 14 Pradeshiya Sabhas. Ratnapura is the only Municipal Council and the Balangoda is the only Urban Council. Pradeshiya Sabhas are Ayagama, Atakalampanna, Balangoda, Eheliyagoda,

Embilipitiya, Imbulpe, Kalawana, Kahawatta, Kollonna, Kuruwita, Nivithigala, Pelmadulla, Ratnapura and Weligepola

Ratnapura District Map



Figure 1: Ratnapura District map

Table 1.2 Number of GN Divisions, Villages, Families and Samurdhi receiving families in each D.S Division.

Divisional Secretaries' Division	Number of GN Divisions	Number of Villages	No. of Families	Samurdhi Families (as a % of total families)
Ayagama	21	67	6,413	4,687 (73%)
Balangoda	53	259	21,969	13,597 (62%)
Eheliyagoda	44	96	16,430	9,166 (63%)
Elapatha	20	68	9,725	6,122 (63%)
Embilipitiya	40	107	31,794	17,173 (54%)
Godakewela	44	62	21,949	15,846 (72%)
Imbulpe	50	252	15,547	7,989 (51%)
Kahawatta	21	54	10,089	5,775 (57%)
Kalawana	33	125	11,988	4,430 (37%)
Kiriella	17	33	8,377	4,884 (58%)
Kollonna	29	123	12,753	7,464 (59%)
Kuruwita	39	85	21,534	11,212 (52%)
Nivithigala	24	82	17,398	7,965 (46%)
Opanayake	20	119	6,896	3,828 (56%)
Pelmadulla	37	111	23,119	11,542 (50%)
Ratnapura	53	160	28,911	12,340 (43%)
Weligepola	30	138	8,408	4,043 (48%)
Total	575	1941	273,300	148,063 (54%)

Source: District Secretariat, Ratnapura – District Profile

According to 2001 census, the total population in the Ratnapura District was 1,008,164 and the estimated population in 2005 is 1,060,000. The Embilipitiya Division represents the highest population. However, according to the population density, Pelmadulla (585), Kuruwita (495), Eheliyagoda (454) and Kahawatta (415) Divisions show a higher population density compared to other divisions in the Ratnapura District (Table 1.3).

Table 1.3: Population, Area (sq. km) and population density (persons per square km) in each division in the Ratnapura District.

Serial No.	Divisional Secretaries' Division	Population	Area Sq.Kms.	Population Density per sq. km.
01	Ayagama	28,222	150.30	188
02	Balangoda	77,593	272.10	285
03	Eheliyagoda	63,298	139.50	454
04	Elapatha	35,576	93.11	382
05	Embilipitiya	118,307	382.64	309
06	Godakawela	69,263	171.25	404
07	Imbulpe	55,324	231.40	239
08	Kahawatta	42,300	101.99	415
09	Kalawana	48,181	385.85	125
10	Kiriella	30,272	86.60	350
11	Kolonna	43,238	187.26	231
12	Kuruwita	85,497	172.80	495
13	Nivithigala	58,018	157.20	369
14	Opanayake	25,232	84.63	298
15	Pelmadulla	84,485	144.50	585
16	Ratnapura	114,324	318.50	359
17	Weligepola	28,828	195.77	147
	Total	1,007,958	3,275.40	308

Source: District Secretariat, Ratnapura – District Profile 2001

1.4 Telecommunications Services in the Ratnapura District

According to the 2001 census data, there were 273,447 housing units, 689 collective living quarters and 1,262 institutes in the Ratnapura District. There is an expansion of telecommunications services in the District. However, the telecommunication needs in the Rathnapura District are not yet fulfilled completely.

Table 1.4: Number of connections (CDMA and Non-CDMA), number of waiters and Coin Boxes in the Ratnapura District as at June 2006

	Amount
CDMA Phones	18,887
Fixed wire line telephones	18134
WLL	680
Number of Coin Boxes:	14
Number in the waiting list for telecommunication services	8143

Sources: Telecommunications Regulatory Commission of Sri Lanka, Suntel Ltd, Sri Lanka Telecom and Lanka Bell (Pvt) Lt

Table 1.5: Distribution of the land phones in the Sabaragamuwa Province (Ratnapura and Kegalle Districts), 2001 - 2005

Description	Year				
	2001	2002	2003	2004	2005(a)
No. of fixed lines	36,113	30,139	40,987	42,171	62,231
Public Pay Phones	304	204	282	245	287

(a) Including CDMA telephones

Source: Telecommunication Regulatory Commission of Sri Lanka

Table 1.6:

2. Methodology

This research was carried out in the Ratnapura District covering all the D.S. Divisions. The survey was done in February, 2006. The sample size of 600 respondents was selected at random consisting of fixed phone holders, mobile phone holders and people who do not have phones. For the fixed phones, the survey focused on householders or other senior household members who had some experience of using telephones. The number of interviewees in each D.S. Division was selected proportionally to the number of families in the Division. Table 2.1 shows the distribution of the sample in the Ratnapura District. The systematic sampling technique has been used in this survey. The starting point of the sample was selected randomly and thereafter every 10th house was visited.

Table 2.1: Selection of the sample size proportionate to the number of families in each DS Division in the Ratnapura District. Last column shows the number of questionnaires received from each DS Division.

Divisional Secretariat	Division	No. of Families in the Division	Sample size in each Division	
			Required	Received
1	Ayagama	6,413	14	16
2	Balangoda	21,969	48	53
3	Ehaliyagoda	16,430	36	40
4	Elapatha	9,725	21	23
5	Embilipitiya	31,794	70	75
6	Godakawela	21,949	48	50
7	Imbulpe	15,547	34	36
8	Kahawatha	10,089	22	25
9	Kalawana	11,988	26	30
10	Kiriella	8,377	19	24
11	Kolonna	12,753	28	34
12	Kuruwita	21,534	47	51
13	Nivithigala	17,398	38	43
14	Opanayake	6,896	15	20
15	Pelmadulla	23,119	51	54
16	Ratnapura	28,911	64	66
17	Weligepola	8,408	19	23
	Total	273,300	600	663

2.1 Questionnaires

Three questionnaires were designed to assess the problems and prospects of telecommunications services in the Ratnapura District. Questionnaire 1 focuses on people who have fixed phones, questionnaire 2 on mobile phone holders and questionnaire 3 on people who do not have either fixed or mobile phone. Given below is an analysis of the composition of those questionnaires and the format of questionnaires are attached to the appendix.

Questionnaire 1: Fixed Phones

Question 1	-	Name of the respondents
Question 2 to 4	-	Details of location
Question 5	-	Employment
Question 6	-	Educational Level
Question 7	-	Number of members in the family
Question 8	-	Service providers in the corresponding area
Question 9	-	Number of telephones in your family
Question 10	-	Telephone number (Optional)
Question 12 to 14	-	Satisfaction of the service provided and reasons for dissatisfaction
Question 16 to 17	-	Problems related to voice
Question 18	-	Problems related to breakdowns
Question 19 to 21	-	Problems related to charges
Question 22	-	Problems related to telephone directory
Question 23 to 24	-	Agreement of the service
Question 25 to 26	-	Sections and suggestions for quality improving of the service
Question 27	-	How did you fulfill your telecommunication needs before buying a telephone?
Question 28	-	Questions related to outdoor telephones around the Respondents' residence

Questionnaire 2: Mobile Phones

Almost all questions are the same as there in questionnaire 1. However, questions related to mobile phones are included here.

Questionnaire 2: Prospective Clients (Phone less people)

Questions 1 to 9 are exactly the same as there in questionnaire 1.

- Question 10 - How do you fulfill your telecommunications needs?
- Question 11 to 15 - Types of the telephone you hope to buy and the reasons
- Question 16 - Reasons for applying for the telephone
- Question 17 - Factors that you consider when you are going to buy a telephone

Question 18 is exactly the same as question 28 in questionnaire 1

The formats of these questionnaires were finalized only after detailed discussion of the drafts with the executors of the research team.

Table 2.2 shows the composition of the sample according to the received questionnaires of fixed phone holders, mobile phone holders and the households who do not have phones. However, we received 678 questionnaires (422: Fixed phone holders, 120: Mobile phone holders and 136: Phone-less people), there were many incidents of missing information in 15 questionnaires. Therefore, those questionnaires were excluded in the analysis and finally 663 questionnaires were selected for the analysis.

Table 2.2: Composition of the sample

Category	Number of Questionnaires Received
Fixed phone holders (Questionnaire 1)	408
Mobile phone holders (Questionnaire 2)	119
People who do not have phones (Questionnaire 3)	136
Total	663

2.2 Collection of Data

Data collectors were selected from the first year, second year and third year students of the Department of Social Sciences of the Sabaragamuwa University of Sri Lanka. Before going to the field, they were given an orientation on the method of data gathering as well as the reporting system. No major problems were envisaged in regard to obtaining the information. It was, however, found to be more difficult to obtain reliable information regarding certain aspects related to income and expenditure such as family income, last month telephone bill, affordable expenditure on phones, telephone number etc.

2.3 Data Entry and Analysis

The trained students of the Sabaragamuwa University have done the data entry and tabulation. Statistical package SPSS was used to analyse the data.

2.4 Problems Encountered

The sample in this study was limited to 663, which is only 0.24% of the total number of families in the District. The budget approved for the study was not adequate to do a comprehensive detailed study. Most of the weaknesses and inadequacies of certain data were mainly due to the limited budget, which restricted covering a large sample.

Data collectors were paid only a nominal fee for their services. Budget restricted to marginally incur on typesetting, traveling and stationery. With all these limitations and constraints the survey attempted to submit a fair picture of the status of the telecommunications services in the Ratnapura District.

3. Data Tabulation and Analysis

3.1 Introduction

In this report the analysis is mainly sub-divided into three parts such as; fixed phone subscribers, mobile phone subscribers and the people who do not have either fixed or mobile phones. From fixed phone subscribers and mobile phone subscribers, information gathered about the satisfaction of the services provided, reasons for dissatisfaction, awareness of the facilities provided, problems about the services provided, billing problems, affordability on monthly telephone bill etc. Mainly from the phoneless people gathered information about the unmet demand.

3.2 Fixed Phone Subscribers

3.2.1 Satisfaction with the Telephone Service Provided

Nearly 48% of fixed phone subscribers in the Ratnapura District are satisfied with the telephone service provided. Around 1.5% of fixed phone subscribers are not satisfied with their telephone service at all. The rest are moderately satisfied with the services provided.

User Satisfaction with the Telephone Services Provided

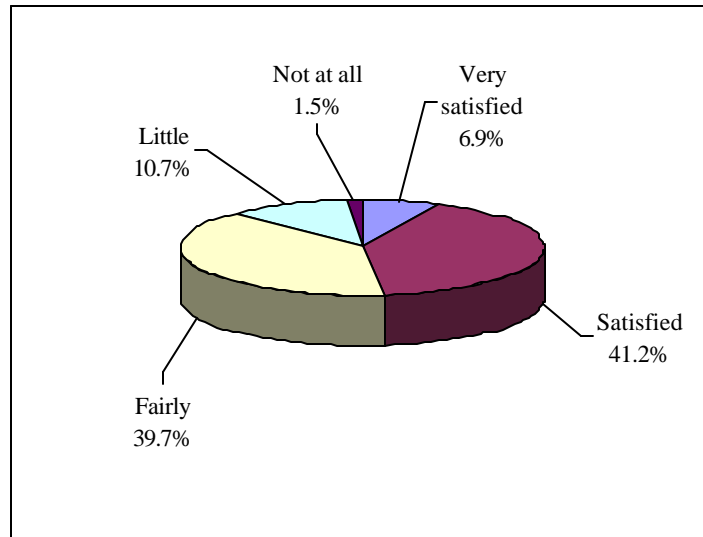


Figure 3.2.1: User Satisfaction with the telephone services provided for fixed phone holders in the Ratnapura District

3.2.2 Reasons for Dissatisfaction with the Fixed Phone Services Provided

The main reasons for the dissatisfaction of the services provided for fixed phones subscribers are obtained considering the group of people who are moderately satisfied (little or fairly) or not satisfied at all. This group consists of 52% of the fixed phone subscribers. For selecting the main reasons for dissatisfaction, informants were required to prioritize the reasons and the first preference has taken into analysis. Of the respondents, 37.2% are dissatisfied because of low signal strength. This mainly applies to the wireless land phones such as Lanka bell, Suntel and other wireless telephones with CDMA technology. Of the total number of respondents, 27.9% mentioned no immediate attention to repairs when the telephone is out of order. Respondents said that the main reason for their telephones frequently going out of order has something to do with the telephone lines (cables). Getting calls during the peak hours is a problem for 16.3% of the total number of respondents. Also, 16.3% of the respondents are dissatisfied with the service provided due to the frequent breakdowns. Around 2% of the total number of respondents are dissatisfied due to other reasons.

Reasons for User Dissatisfaction

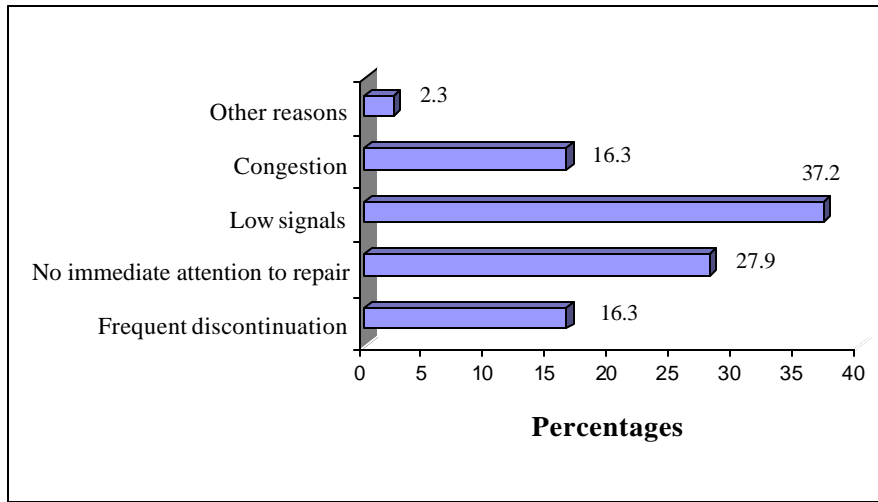


Figure 3.2.2: Reasons for User Dissatisfaction with the telephone services provided in the Ratnapura District

3.2.3 Affordability on Monthly Telephone Bills of Fixed Phone Subscribers

Table 3.2.1 illustrates the summary statistics of customers' affordability on monthly telephone bills for fixed phones. On average, the affordability on monthly telephone bills for fixed phones is around Rs. 1016. The median amount of Rs. 850 indicates that more than half of the fixed phone subscribers can afford a minimum of Rs. 850 or more as their monthly bill. A 95% confidence interval of the true mean value for the affordability on monthly telephone bills for fixed phones is around Rs. [953, 1077]. This implies that the probability is 95% that this random interval includes the true population mean value for the affordability on monthly telephone bills for fixed phone subscribers.

According to Figure 3.2.3, around 56% of the responded fixed phone subscribers have mentioned that they can afford between Rs. 501 & 1000 for their monthly telephone bill, while around 15% can afford more than Rs. 1500 per month.

Affordability on Monthly Telephone Bill of Fixed Phones

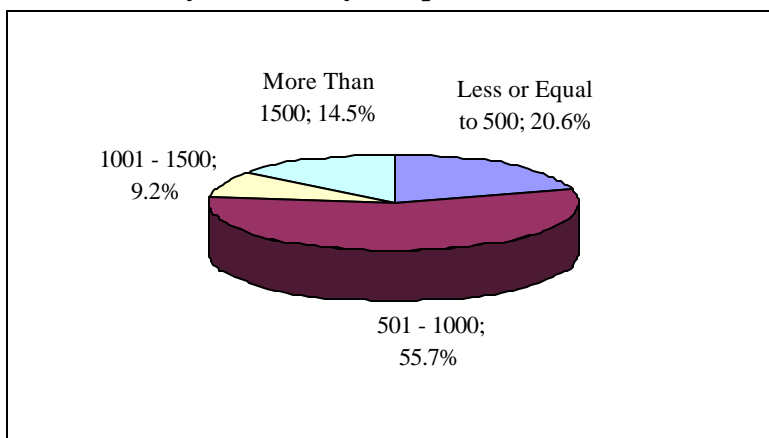


Figure 3.2.3: Affordable Expenditure on Monthly Telephone Bill of Fixed Phones

Table 3.2.1: Summary statistics of customers' affordability on monthly telephone bills of fixed phones

N	Mean	Median	Maximum	Minimum	Standard Deviation
393	1015.65	850	5000	200	628.12

There is a positive relationship between the customer's affordability on monthly telephone bill for the fixed phones as shown in Figure 3.2.4. The correlation between customer's affordability on monthly telephone bill and the actual monthly bill is 0.667 (P value < 0.000). Practically, this positive relationship is expected. The fitted regression line between these two variables is,

$$AE = 257 + 0.636 * AMB$$

Where AE and AMB are the Affordable Expenditure (Rs.) and Average Monthly Bill (Rs.)

The regression coefficient, 0.636, indicates that on average, fixed phone holders can afford around 64 cents for the increment of one rupee of the monthly telephone bill.

**Scattered Plot of the Affordable Expenditure Vs
Average Monthly Telephone Bill**

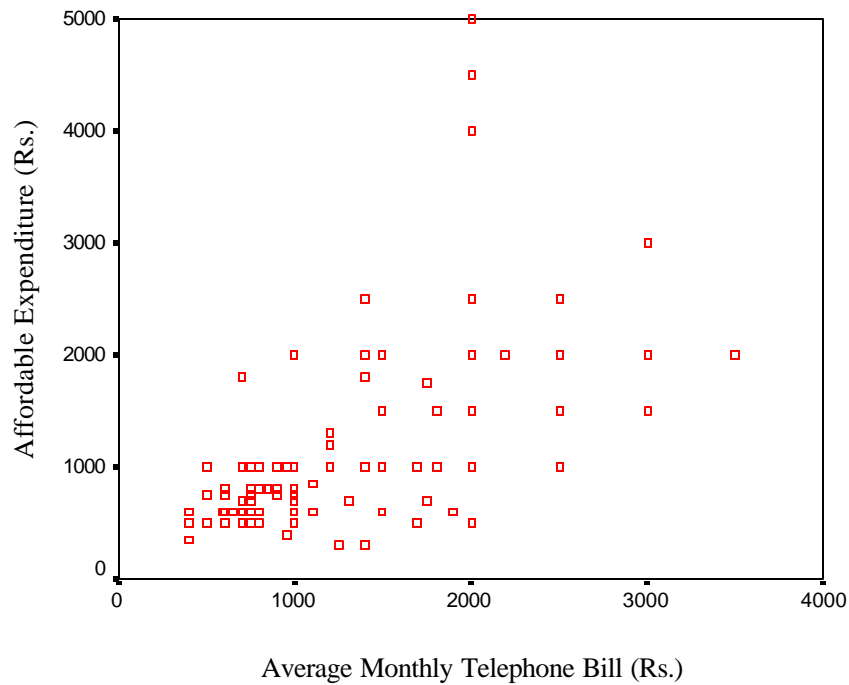


Figure 3.2.4: Scattered Plot of the Affordable Expenditure Vs Average Monthly Telephone Bill of Fixed Phone Subscribers

3.2.4 Telephone Directory

Fixed phone subscribers have been asked whether they had received a telephone directory. Of the total number of respondents, 89% had answered this question. According to the responded fixed phone subscribers, 65.3% of the respondents have a telephone directory and the rest do not have one. When asked for the reasons, the respondents mentioned that they did not have time to go to the prescribed places to collect it during the period; some had forgotten to collect it while some of them hardly use a telephone directory. Yet, some others told they could manage with the directories of the previous years.

Of the fixed phone subscribers who have telephone directories, 75% use a telephone directory and the rest do not use it. Nine (9) respondents had not answered this question. Hence, the survey concludes after excluding this missing data.

In the questionnaire, fixed phone subscribers were asked whether they had knowledge of the uses of a telephone directory. Of the fixed phone subscribers, around 68% had knowledge of the uses of the telephone directory, around 15% had not, and the rest (17%) had not answered this question.

3.2.5 Service Agreement

Service agreement form is the one, which includes everything about the services provided by the telecommunications operator. This is the agreement between the telecommunications operator and the consumer. Hence, this agreement is an important document where as the consumers are concerned.

According to the sample, around 51% of the fixed phone subscribers had been provided with a service agreement by the telecommunications operator, around 27% had not been provided and the rest could not remember whether they had been provided with a copy of the service agreement by the telecommunications operator. These percentages were obtained after excluding the missing cases. In the data set, 14% of the fixed phone subscribers, (57 respondents) had not answered this question. They are uncertain about the availability of the document.

Of the fixed phone subscribers, who have been provided a service agreement copy by the telecommunication agency, around 93% are aware of the terms and conditions in the service agreement, while the rest are not.

3.2.6 Billing Problems

In the questionnaire, there were questions related to the billing process. The main objective of including these questions into the questionnaire is to explore the consumers' perception on the billing process. The questionnaires carried questions

such as; the accuracy of the charges and the expenditure in the telephone bill; whether they had ever made any complaint about the errors in the telephone bill; if any, and if so, whether they are satisfied about the process of problem solving related to telephone bills.

3.2.6.1 Accuracy of the Charges in the Telephone Bill

Of the responded fixed phone holders, around 76% believe that, in general, the charges in the telephone bill are correct while the rest believe it is not. These percentages, as usual, were obtained after excluding the missing cases. In the sample, around 16% of the respondents have not answered for this question.

3.2.6.2. Complaints on the Billing Issues

During the previous year, around 61% of the responding fixed phone subscribers who believe that the billing process had some shortcomings, and that they had made at least one complaint during the past year about their problems related to the bills. The rest had not made any complaint during the past year.

Around 72% of the fixed phone subscribers were not satisfied with the process of solving billing problems. For this analysis, respondents who had problems related to billing process and who had made complaints regarding billing problems were taken into account.

3.2.7 Functioning of the Telephones

Of the respondents of fixed phone subscribers, around 80% had indicated that their fixed phones are functioning regularly while the rest had mentioned the contrary. More than 85% of the fixed phone subscribers had indicated that they had not experienced any problem in getting a call. They say that they can get a call easily.

Fixed phone subscribers were asked how often their telephones had been out of order daily, weekly, fortnightly, monthly, once in three months, once in six months or once in a year. Of the respondents, 63% had experienced failures at least once a year, while 37% had never experienced breakdowns.

Figure 3.2.5 shows the percentage values of how often their telephones have been out of order. Fixed phone subscribers who had experienced failures were taken into account. Of the respondents, around 7% had experienced problems with telephone daily, 9.4%, weekly, 8.2%, fortnight, 22.3%, monthly and 21.9%, once a year.

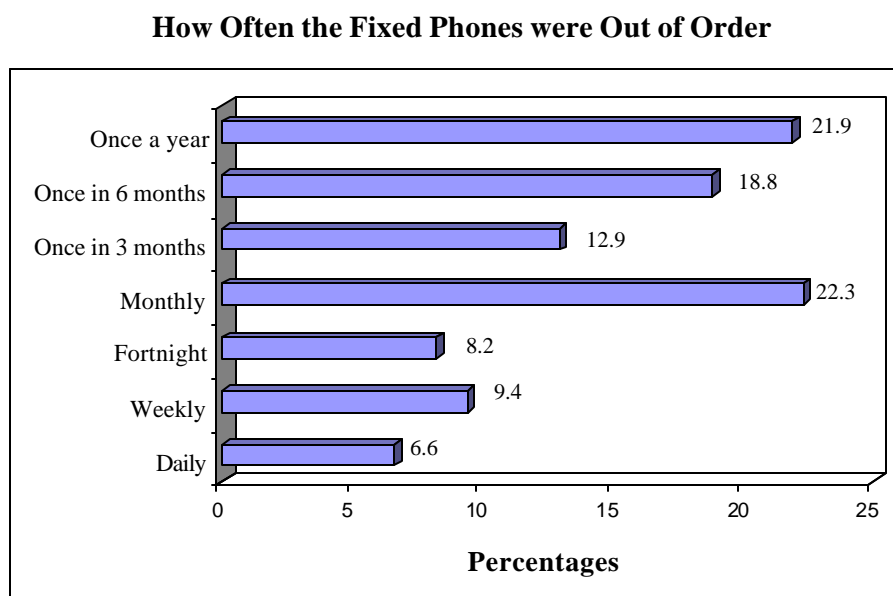


Figure 3.2.5: Frequency of the out-of-order fixed phones

The main reasons for their telephones going out of order according to the first preferences of the respondents are problems in the cables, water leakage into the underground cables and some other problems related to wireless fixed phones.

According to the views of telecommunications officials in the exchange units in the Ratnapura District, bad weather (rain and lightning) is the key reason for the fixed phones to go out of order. The district experiences more faults during rainy seasons

namely; southwest monsoon (April to May) and inter-monsoon (October to December) seasons.

3.2.8 Areas to be Improved upon to get a Better Service

According to the responded questionnaires, 52% of fixed phone subscribers have said that the “Maintenance Branch” needs improvements while 21% want that “tariff” be reduced so that they could get a better service. Of the respondents, 14% agree with the necessity to improve the areas of “Quality” and the rest agree to with the necessity to improve the area of “Consumer relation” for a better telephone service (Figure 3.2.6).

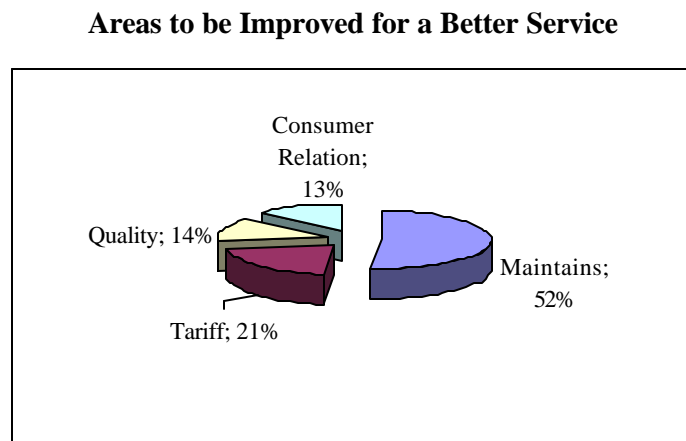


Figure 3.2.6: Areas to be improved for a better service for fixed phones in the Ratnapura District

3.2.9 Suggestions for Upgrading the Telecommunication Services

Respondents were asked to prioritize their suggestions for upgrading telecommunication services. Of the fixed phone respondents, 48.3% suggested that an efficient maintenance service be introduced, 24.2%, to establish a maintenance unit at each main town in the Ratnapura District, while 26.7% have suggested increasing the coverage areas by improving signals. This was suggested mainly by wireless fixed phone subscribers especially those in rural areas of the Ratnapura District. Some of

those who have wireless fixed phones do not have sufficient signal strength in their residential areas. The prospects for having cable phones are not available in near future.

Suggestions to Upgrade the Telecommunication Services

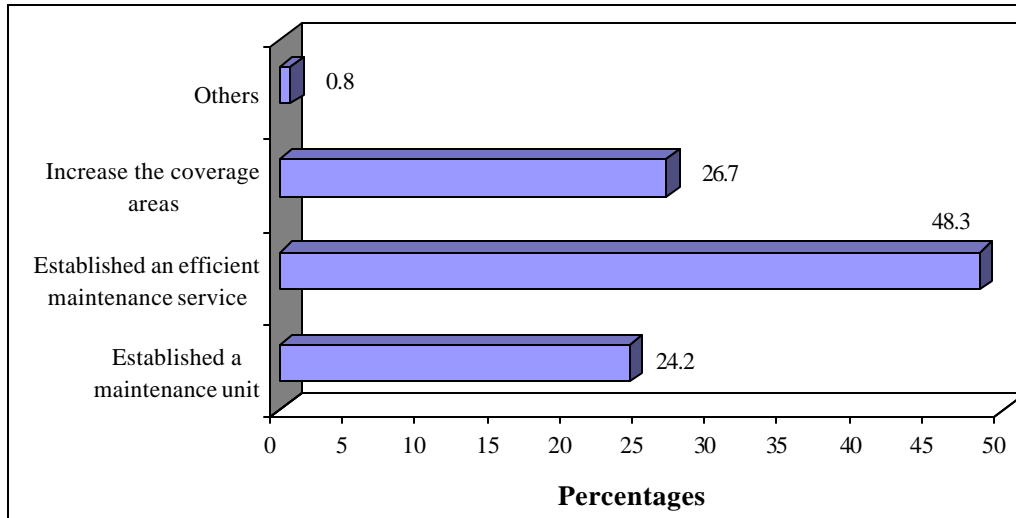


Figure 3.2.7: Suggestions for upgrading the telecommunication services

3.2.10 Awareness of the Facilities Provided by Fixed Phones.

In the Table 3.2.2, a series of facilities provided by fixed phones are listed. Respondents were asked to mark whether they were aware of such facilities or they had used them. The percentages of the third column of the Table 3.2.2 have been calculated using the opinion of the respondents who were aware of that particular facility.

According to the information provided by the respondents, a considerable number of subscribers are not aware of the facilities provided by fixed phones. In the course of interviews with the respondents, the priority was given to householders and, in case of their absence, to senior household members who had experience of using telephones.

A considerable No. of respondents were under the impression that their telephones could be used for calling only to local numbers and the majority do not try the IDD

facilities provided by the operator. Around 38% of the respondents are not aware that they can get international calls from their fixed phones.

Of the respondents, around 71% of the fixed phone subscribers are aware of the CLI facility.

Though the internet and email are two connected words, only around 42% of the fixed phone subscribers in the sample are aware that they can get connected with the internet through their telephone. And around 30% of the fixed phone subscribers are aware that they had access to internet. This indicates the lack of subscriber's knowledge in internet and email facilities that are provided with their phone unit. Very few houses of the sample had connected themselves with the Internet and e-mail facilities.

Less than 10% of the respondents are aware of the hunting facility, blocking of IDD with secret code and abbreviated dialing.

Table 3.2.2: Facilities made available by the Provider and the user-awareness

	Facility	Known (%)	Whether Used (%)
1.	International Calls (IDD)	62	39.7
2.	Conference Calls	27	31
3.	CLI	71	50.6
4.	Internet	42	13.4
5.	Email	30.4	30.3
6.	SMS	36.3	77.5
7.	Telegrams	10.8	50
8.	Knowing the Time	75	57.1
9.	Alarm	63.1	41.4
10.	Absentee Service	10	36.4
11.	Call forwarding	11.7	30.3
12.	Hotline	14.4	90.2
13.	Hunting facility	6.3	71.4
14.	Blocking of IDD with secret code	2.7	33.3
15.	Abbreviated Dialing	6.4	42.3

3.3 Mobile Phone Users (Subscriber / Pre-paid Cards).

3.3.1 Introduction

In this section the problems and prospects of the mobile phone subscribers and pre-paid card holders will be examined. The Researcher mainly gathered information regarding the reasons for dissatisfaction and problems related to services.

The sample consists of 119 mobile phone subscribers and pre-paid card holders.

3.3.2 Profile of the Mobile Phone Subscribers / Pre-paid Connections in the Sample

3.3.2.1 Educational Level

More than 28% of the mobile phone subscribers in the sample have had received education upto G.C.E. Advanced Level (A/L); around 18% have passed G.C.E (O/L) Examination; around 19% have studied upto Ordinary Level (O/L); around 15% have passed G.C.E Advanced Level (A/L) Examination and around 10% have tertiary education, vocational education or post graduate degree (Figure 3.3.1)

Educational Level of the Mobile Phone Users in the Sample

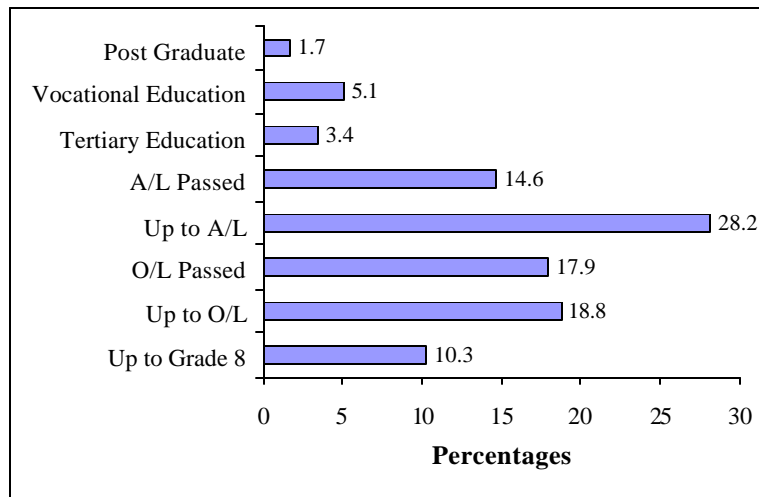


Figure 3.3.1: Educational Level of the Mobile Phone Holders in the Sample

3.3.2.2 Age

Of the mobile phone holders in the sample, around 59% are in the age group of 25 – 44; around 28% are in 45-59; around 8% are in the range of 20-24 (Figure 3.3.2). None of the mobile phone holders are below 19 years of age. This may be due to the selection of householders or senior members of the family in the sample.

Age Distribution of the Mobile Phone Holders in the Sample

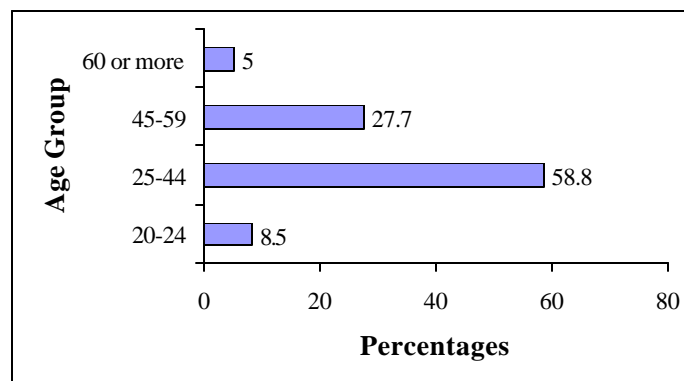


Figure 3.3.2: Age Distribution of the Mobile Phone Holders in the Sample

3.3.2.3 Gender

In the sample, around 78% of the mobile phone holders are male and the rest are female.

Mobile Phone Holders Based on Gender

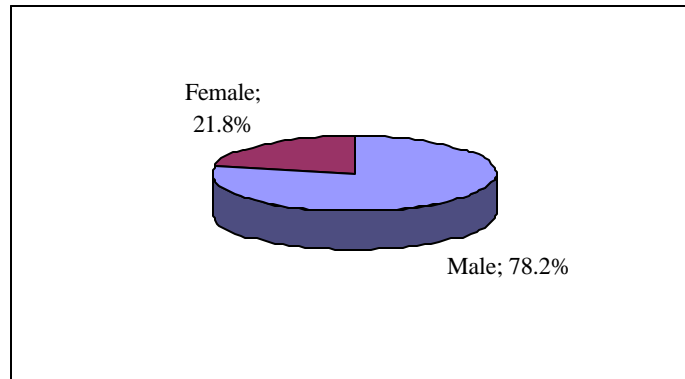


Figure 3.3.3: Mobile phone holders in the sample based on gender

3.3.3 Type of the Connection

According to the mobile phone respondents, around 80% of mobile phone holders use pre-paid card connections while the rest prefer monthly billing. (Figure 3.3.4). This implies that many mobile phone holders prefer pre-paid card connections.

Type of the Connection of Mobile Phones

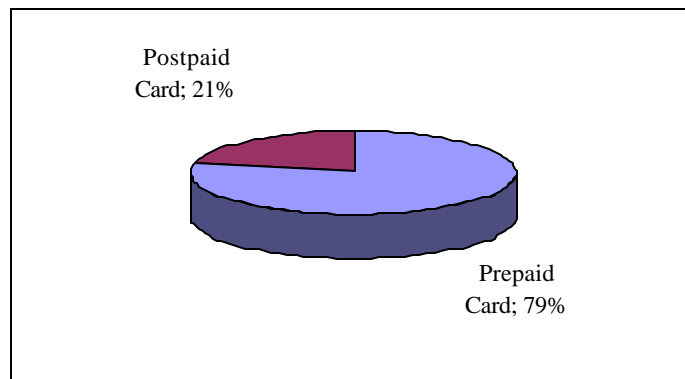


Figure 3.3.4: Type of the connection of mobile phones in the sample

3.3.4 Satisfaction with the Service Provided for Mobile Phones

Around 27% of the respondents of mobile phone subscribers and pre-paid connections are satisfied (very satisfactory + satisfactory) with the service provided; 61% are satisfied moderately and around 8% are not satisfied at all with the services provided (Figure 3.3.5).

Satisfaction with the Services Provided for Mobile Phones

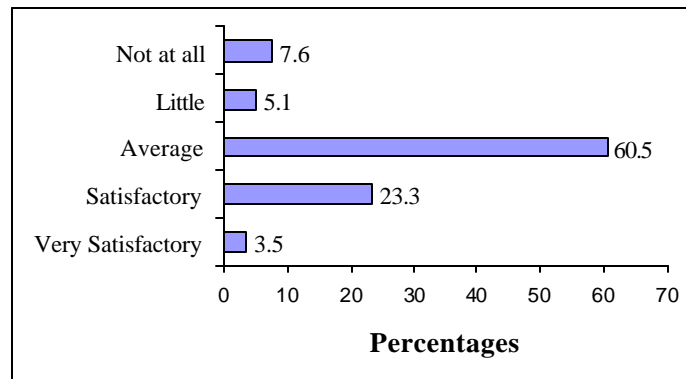


Figure 3.3.5: Satisfaction of the services provided for mobile phones

3.3.5 Reasons for Dissatisfaction

The main reasons for dissatisfaction of the services provided for their mobile phones were identified considering the mobile phone holders who are moderately satisfied (average or little) or not satisfied at all with it. This group consists of around 73% of mobile phone subscribers and pre-paid card connections in the sample. Respondents were asked to prioritize the reasons for dissatisfaction. According to the first priority, around 62% of the respondents have indicated that low signal strength is the foremost reason for their dissatisfaction; around 24% of the respondents have indicated the foremost reason as the difficulty of getting a call during peak hours (congestion) while the rest have attributed it to frequent disconnections. (Figure 3.3.3).

Reasons for Dissatisfaction – Mobile Phones

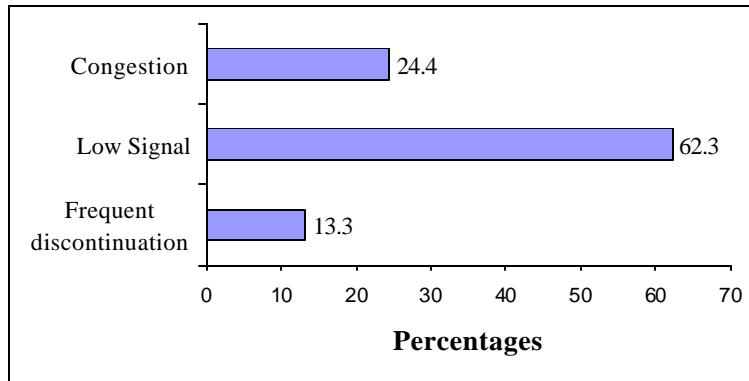


Figure 3.3.6: Reasons for dissatisfaction of the services provided for mobile phones.

3.3.6 Problems Related to Mobile Phones

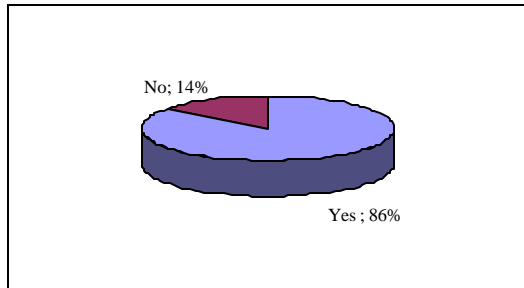
3.3.6.1 Difficulties in Reaching Desired Numbers

Mobile phone subscribers and those who have pre-paid connections were asked whether they could get a call easily. Around 71% of the respondents have indicated that they can get a call easily and the rest, the contrary. The main cause of this problem can be attributed to low signal strength.

3.3.6.2 Voice Quality of the Mobile Phones and Pre-paid Connections

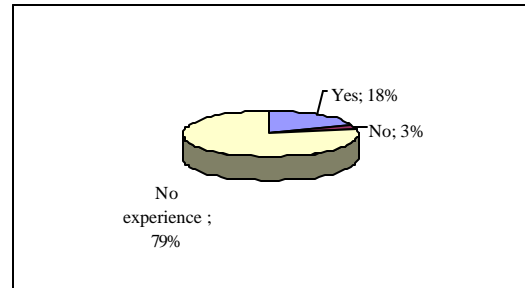
Of the respondents, 83% have indicated that they can get clear voice quality for local calls on their mobile phone while the rest said the contrary. The same question was asked regarding the international calls as well. However, around 77% of the respondents in the sample have had no experience in dialing or calling international numbers from their mobiles (Figure 3.3.7 a). Of the rest, around 80% of the respondents have mentioned that they could get clear voice quality for international calls while the rest did not (Figure 3.3.7 b).

**Voice Quality on Mobile Phone:
Local Calls**



(a)

**Voice Quality on Mobile Phone:
International Calls**



(b)

Figure 3.3.7: Voice quality on mobile phones (a) local calls, (b) international calls

Note: Figure 3.3.7 (b), “no experience” indicates that respondents in the mobile sample have not had an any international call to get an idea about the voice quality.

3.3.6.3 Problems of Echoing, Crackling, Uneven Voice Level, Blank and Hissing

Respondents were asked whether they had experienced problems such as echoing, crackling, uneven voice level, blank and hissing frequently while making local calls. Around 50% of the respondents have not answered this question (Table 3.3. 1). Many mobile phone users have frequently experienced problems such as phone suddenly going blank while talking and hearing their own voice in the phone (echoing); around 27% of them have frequently experienced the problem of breaking of voice while talking; and 21%, background disturbances within the phone and uneven voice levels.

The same questions were asked regarding the international calls. However, many respondents (around 80%) had not taken international calls from their mobile phones. Due to the large number of missing observations, this analysis was not taken into account.

Table 3.3.1: Problems (echoing, crackling, uneven voice level, blank and hissing) frequently while making local calls

Problem	Percentages (%)		
	Yes	No	Missing data
1. Echoing: hearing your own voice in the phone	31.1	25.2	43.7
2. Crackling: Breaking of voice while talking	26.9	24.4	48.7
3. Uneven voice levels: The voice level goes up or down	21.0	25.2	53.8
4. Blank: Phone suddenly going dead while talking	31.9	16.0	52.1
5. Hissing: Background disturbances in the phone	21.0	26.9	52.1

3.3.7 Areas to be Improved upon to get a Better Services

All mobile phone subscribers and pre-paid connections unanimously insist that the coverage areas be increased for a better service. In addition, the service quality and the consumer relations were identified as the areas to be considered for improvements.

3.4 Phone -less People

3.4.1 Introduction

In this section, the information obtained is mainly based on the people who do not have either a fixed or a mobile phone. The sample consists of 136 individuals.

Questionnaire 3 was used in this regard. The answers given to the questions by the respondents in this sample reflect the unmet demand for telecommunication services in the Ratnapura District.

We mainly examine the information on demand for phones, availability of the nearest payphone/telephone booth, affordable monthly telephone bill etc.

In addition to the information obtained by questionnaire 3, some secondary data were obtained from the Department of Census and Statistics Reports.

3.4.2 Profile of the Phone-less People

3.4.2.1 Monthly Income

In the sample, around 53% of the respondents' monthly income is less than Rs. 7,500 and more than 41% of the respondents belong to the income group of Rs. 7,500 to 15,000. The rest belongs to the income group between Rs.15,000 and Rs. 30,000.

Monthly Income of the Respondents in the Sample

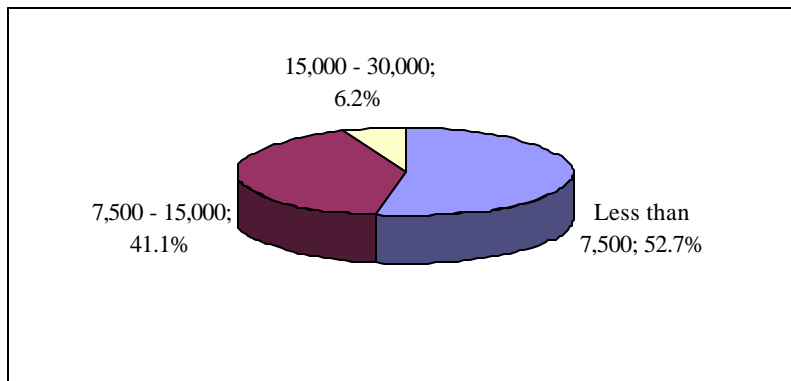


Figure 3.4.1: Monthly income of the phone-less respondents in the sample

3.4.2.2 Level of Education

Around 30% of the phone-less people have studied upto G.C.E. Ordinary Level (O/L) and 24% of them have studied upto grade 8. Around 11% have passed G.C.E. O/L and around 16% studied of up to A/L. Other 8% have had higher education (Figure 3.4.2).

Educational Level of the respondents in the Sample

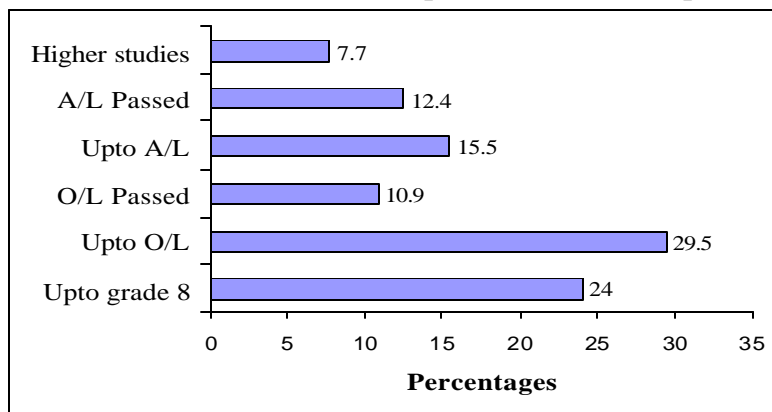


Figure 3.4.2: Educational level of the phone-less people in the sample

3.4.3 Affordable Level of Monthly Telephone Bills

Around 40% of the respondents are willing to pay between Rs. 301 to 600 as monthly telephone bills. Of the respondents, around 14% prefer to pay between Rs. 601 to 900

and around 18% can afford to pay more than Rs. 900 as monthly telephone bills (Figure 3.4.3).

Table 3.4.1 shows the information of customers' desired maximum expenditure on monthly telephone bills. Though there were 136 respondents in the sample, only 74 respondents have responded for this question. On average, people who do not possess a telephone at present are willing to pay around Rs. 574. Median amount of Rs. 500 indicates that more than half of the respondents are willing to pay a minimum of Rs.500 or more as their monthly bills (Table 3.4.1).

Customers' Desired Maximum Expenditure on Monthly Telephone Bills

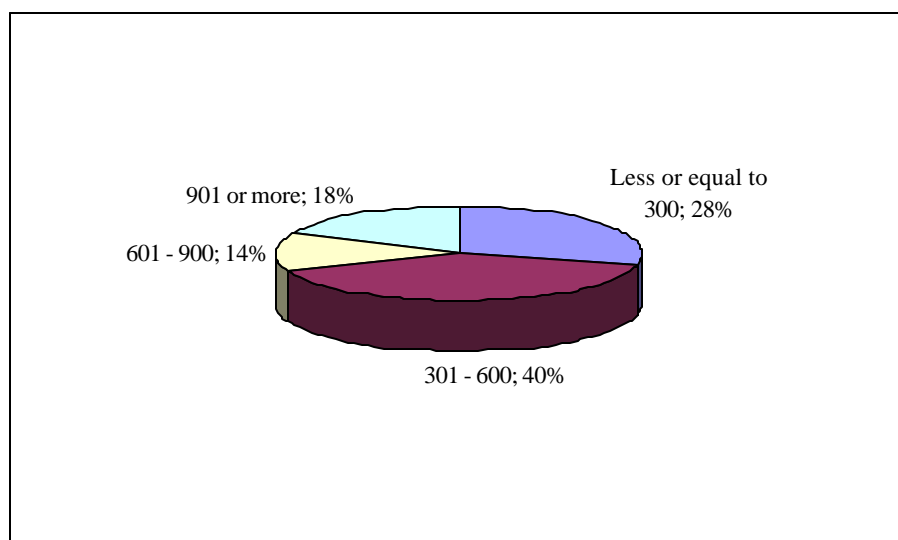


Figure 3.4.3: Customers' desired maximum expenditure on monthly telephone bill based on phone-less people

Table 3.4.1: Summary statistics of customers' desired maximum expenditure on monthly telephone bills.

N	Mean	Median	Maximum	Minimum	Standard Deviation
74	574	500	2000	100	41.4

3.4.4 Intention of Buying a Telephone

Of the respondents who do not have either fixed or mobile phones, around 81% intend to buy a phone (Table 3.4.2). Among them, 81% of the respondents intend to buy a fixed phone while the rest intend to buy a mobile phone (Figure 3.4.4); of those intending to buy a fixed phones, around 24% have already applied for a fixed line.

Table 3.4.2: Intention of buying a phone. Fourth column represents the percentages excluding the missing values

Intention to buy a telephone		Frequency	Percentage	Valid Percentage
Valid	Yes	98	72.1	81.0
	No	23	16.9	19.0
	Total	121	89.0	100.0
Missing	Values	15	11.0	
Total		136	100	100.0

Type of the Phone, Intended to Buy

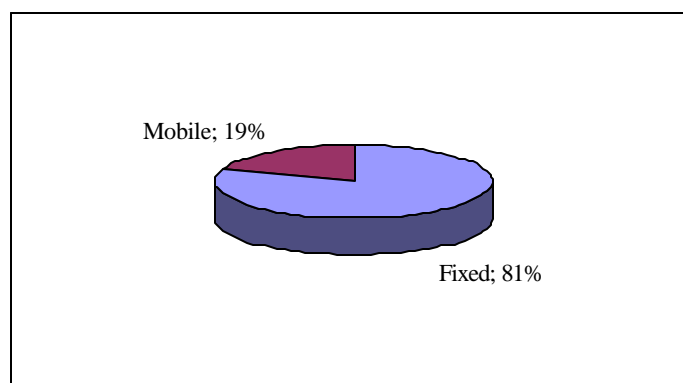


Figure 3.4.4: Type of the phone that respondents, who do not have either fixed or mobile phone, intend to buy

3.4.5 Reasons for Applying for a Phone

Of the respondents who intend to buy a phone, the main reasons for applying for a fixed or a mobile phone are; being convenient at the workplace, the reduction of traveling, ability to contact children or spouse while at work or traveling, accessibility to contact numbers during emergency or on necessity etc. Among those factors, around 39% of the respondents have mentioned that the foremost reason for applying for a phone is the occupational requirements. And around 32% of them have mentioned that the foremost reason for applying for a phone is that it reduces undesirable traveling.

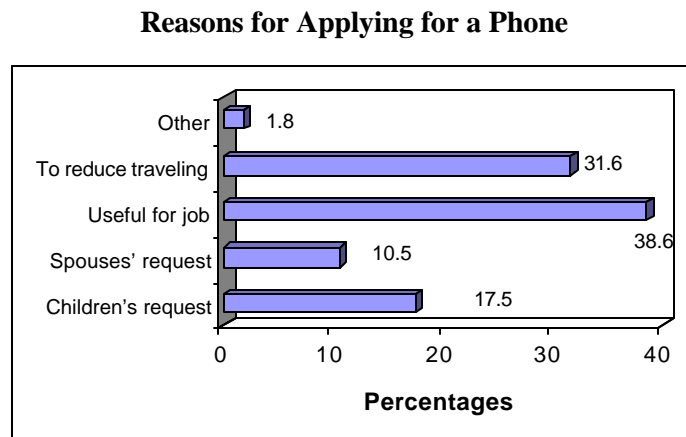


Figure 3.4.5: Reasons for applying a phone; According to the respondents first priority

3.4.6 Reasons for Selecting a Fixed Phone Service

. According to the information provided by respondents, the major reasons for selecting a fixed subscribers and pre-paid connections service are the reliability and the reasonable cost (less cost). Among these factors, the foremost reason, as given by around 48% of the respondents, subscribers and pre-paid connections is, reliability and 42% of the respondents, less cost compared to other services (Figure 3.4.6).

Reasons for Selecting an SLT Service

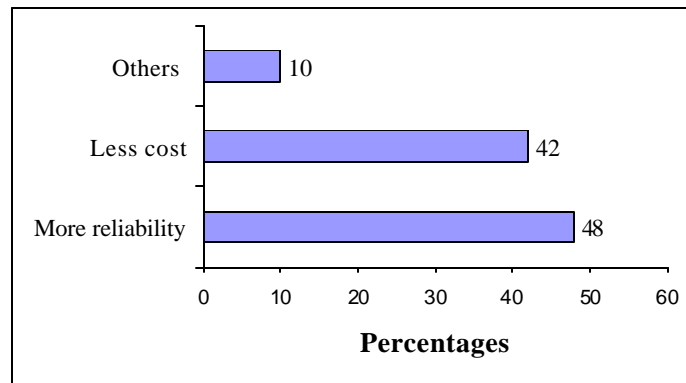


Figure 3.4.6: Reasons for selecting a fixed service reported by respondents who do not have either fixed or mobile phone, percentages related to the first priority.

3.4.7 Facilities of Making a Call

Around 33% of those without either a fixed or a mobile phone mentioned that they do not have a facility of making a call; especially the respondents who come from rural areas in the Ratnapura District mentioned that they do not have access to telephones/payphones or a communication centre at close proximity. These areas have not been included in the network coverage provided by mobile or wireless phones.

3.4.8 The Closest Public Telephone/Payphone to the Respondents

Around 31% of the respondents have indicated that there was a telephone/payphone within the distance of 500 meters. Figure 3.4.7 shows the distribution of the distances to the nearest telephone/payphone as reported by the respondents who do not possess either fixed or mobile phones. When asked for the distance to the nearest telephone or payphone, many respondents were not able to mention the distance at least to some extent of accuracy. Therefore, there were around 34% of missing observations in the sample. However, those individuals were quite sure that there was no telephone or payphone within 500m.

Around 55% of the respondents, who do not possess a payphone or a telephone nearby within 500m, have mentioned that they needed a telephone/payphone nearby.

Distribution of the Distances to the Nearest Telephone / Payphone

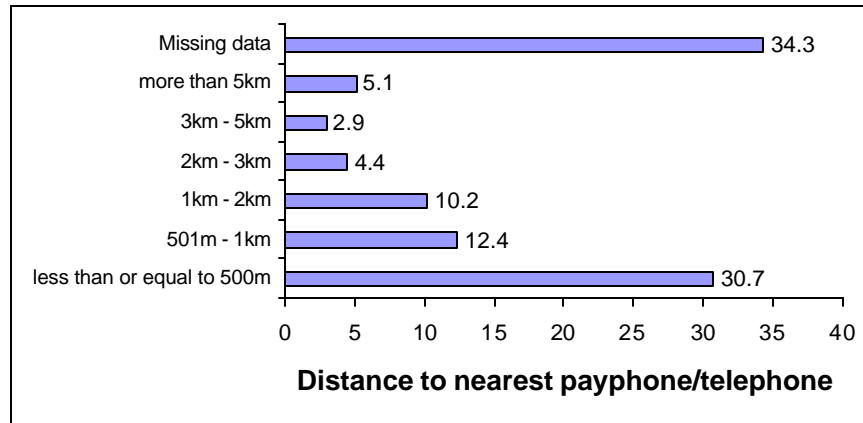


Figure 3.4.7: Distribution of the distances to the nearest telephone/payphone as reported by the respondents who do not have either fixed or mobile phones

3.4.9 Time and the Cost Incurred for Reaching the nearest Telephone, Payphone or Communication Centre.

Of the respondents, around 42% have answered the question about the duration of time taken to visit the nearest telephone/payphone. The rest have not answered this question; the reason might have been that they do not have a telephone or a payphone nearby. Of the answered respondents, more than 76% indicated that they spend less than thirty minutes to go to the nearest telephone/payphone or communication centre. This is a fairly good situation since they spend less than 30 minutes to reach a telephone. The main reason for this is that many telecommunications centres (communication shops) are located in every small town in the District. There are about 3000 townships in the District having more than five business places. Of the respondents, around 18% have indicated that they spend between 30 to 60 minutes to go to the nearest telephone/payphone or communication centre. The rest (around 5%) spend more than one hour to do so.

As far as the cost is concerned, around 50% of the respondents have mentioned that no cost is involved to go to the nearest phone; perhaps, they can walk or ride to the

nearest place where a phone is available. This implies that, to a half of the respondents, the nearby telephone/payphone or communication centre is not far away. Around 30% of the respondents have mentioned that they spend less than Rs. 10 to go to the nearest telephone/payphone or communication centre, around 10% of the respondents have indicated that they spend less than Rs. 20 but more than Rs. 10 to go to the nearest telephone/payphone or communication centre; and the rest spend more than Rs. 20 to do so.

3.4.10 Availability of Telephones/Payphones

Respondents who are in the city limit said that a payphone or a public phone is available at 90% of the instances when a phone is required. For those who are outside the city, a pay phone or public phone is not available at close proximity. Even the available pay phone or public phone box is filled with coins and non-operational most of the time when required. However, they mentioned that they could use cards system but the initial cost is high. Mainly they use nearby payphone in an emergency situation and no one keeps cards at home. They said that most of the emergencies they go to the nearest home or the communication centre where a telephone is available. However, the cost for this is higher compared to the payphone cost.

3.4.11 Number of Telephone Calls Taken during a Month

According to the sample, on average, respondents who did not possess a phone had made two calls during the previous week, and nine during the previous month. The median of the number of calls made is two during the previous week and six in the previous month (Table 3.4.3).

More than 95% of these calls had been for personal purposes.

Table 3.4.3: Statistics about the number of calls made previous week and previous month by the respondents who do not have either a fixed or a mobile phone.

	N	Mean	Median	Maximum	Minimum	Standard Deviation
Last week	110*	2.4	2	12	0	2.28
Last Month	110*	9	6	40	0	8.17

*Only 110 responded had answered for this question out of 136

3.5 Information Collected by Personal Interviews

3.5.1 Problems Related to Telecommunications Service Providers

The study reveals that the coverage areas should be increased to supply better mobile services and some fixed phones. The main solution for this is the construction of new towers in the low signal areas. It was informed that, to construct a tower, the service provider has to get the approval from the Ministry of Defense, Environmental Authorities, Telecommunications Regulatory Commissions of Sri Lanka, Local Authority and the Divisional Secretariat of the area. Getting the approval from the Ministry of Defense, Environmental Authority and TRCSL is not problematic if there is no major threat to security, safety and environment in the area. However, it seems that some local authorities make unrealistic and unreasonable objections for rejecting or delaying the required approval. They take a long time to give permission though there are no major problems in approving the construction of towers in the area.

To overcome these problems, the government must form a top level committee to look into these problems and take proper action to expedite the approval procedure since this is very important for the expansion of telecommunication services in the rural areas.

Development of infrastructure facilities are one of the key factors for the expansion of telecommunication services in the country. Sometimes the service providers cannot make towers in some areas because of inadequate infrastructure facilities such as electricity, access roads etc. Hence, the government must provide required infrastructure facilities in addition to institutional support to fix towers.

4 Discussion and Conclusion

This research study focused on 663 families though there are around 273,300 families in the Ratnapura District and it represents around 0.25% of the total number of families in the District. However, our sample covered all D.S. Divisions and the selection of the families from each D.S. Division was proportionate to the total number of families in each D.S. Division. Ratnapura District is a vast area with forests and mountains; hence, systematic sampling technique was applied instead of simple random sampling technique. The starting points of each D.S. Divisions were selected randomly and all efforts were made to represent the true population.

The problems and prospects of telecommunications services in the Ratnapura District are discussed overall, as fixed phones and mobile phones.

A question was asked about the telecommunication service providers in the area. However, many people were not aware of the service providers in a particular area. The signal strength of the same network varies from area to area. Hence, analysis of this kind of question by using the information provided by the respondents is difficult and incomplete.

According to the information provided by fixed phone subscribers, the main reason for their dissatisfaction is that the telecommunications authorities do not pay immediate attention to breakdowns and defaults. As a remedy for this, respondents wish to have well equipped maintenance units in each town. Fixed phone subscribers and pre-paid connections with wireless connection experience low signal strength and congestion. Mobile phone subscribers wish to have wider coverage areas and improved consumer relations assuring a better service. Many mobile phone subscribers prefer to use prepaid card connections to postpaid connections.

Problems related to IDD calls were analyzed, but many mobile and fixed phone holders in the sample had not utilized the IDD calls facility. In the sample only a few respondents have answered questions related to IDD calls. Hence, it is recommended

to take a larger sample to identify the problems related to voice quality and other prevailing factors related to IDD calls.

More than 80% of the prospective clients, in their responses, intend to buy a telephone. This indicates that there is a big demand, which is not yet captured by the telecommunication service providers in the Ratnapura District. Among those respondents, a considerable number of applicants intends to buy a fixed phone rather than a mobile phone. The main reason for this is that the survey mainly focused on householders who are willing to have a phone at home.

Around 33% of the respondents who do not possess a phone have mentioned that they do not have the facility of making a call at close proximity for a reasonable price. It is a clear indication there is no nearby public telephone, payphone or a communication centre. This is the main problem in rural areas. They have said that they had to travel long distances to the nearest public phone or the communication centre. Therefore, many people go to the nearest neighbouring house where a telephone is available, but they have to pay a minimum fee of Rs. 20.00 even though they make a short distance call with a short duration. The main request of those people is to fix a public telephone/payphone box at central place in each village; at the Grama Niladhari Office, temple, or community centre. According to the information provided by SLT offices at Ratnapura, Eheliyagoda and Embilipitiya, there are around 40 coin boxes in Ratnapura District. In addition to SLT coin boxes; there are some other public payphone services like Tritel. However, those are limited to places where phones are available. This facility is hardly available at rural areas. Therefore, the present supply of pay phones is not enough to fulfill the telecommunication needs of the common people of the Ratnapura District. It is reported that there are 1941 villages in Ratnapura District covering 575 GN divisions. There are about 3000 mini towns or townships in the District. Therefore, this research suggests installing at least two public payphones/telephones for each village. This would not be profitable in the short run. Until the public get used to use these phones the monthly collection of these phones would be not sufficient. Therefore, an incentive should be given to the Providers.

The frequent failures of the public phones are a major problem reported by the respondents. Many people in the rural areas claim that most of the time they are disappointed when they go to a public phone for getting a call. A regular maintenance system for public phones should be implemented.

For forecasting telecommunications demand, further studies have to be made in respect to other variables which influence the demand. The tremendous changes in the telecommunications market have caused new difficulties for the telecommunications forecasting professionals. Forecasters have always modeled the impact of economic and demographic variables on their products and services but largely ignored the influence of technology and policy decisions. Yet, these decisions generate substantial shifts in demand.

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2. David S, Nigel S, Christopher G, Rekha J, Ophelia M and Kevin M, “The Economic Impact of Telecommunications on Rural Livelihoods and Poverty Reduction: A study of Rural Communities in India (Gujarat), Mozambique and Tanzania,” Report of DFID KaR Project 8347
3. Central Bank Annual Report – Sri Lanka, 2005
4. Telecommunications Regulatory Commissions of Sri Lanka, Annual Report, 2005

Questionnaire - 01
Survey on Telecommunications Services – Fixed Phones
Ratnapura District

Enumerator:.....

No:.....

Date :.....

01. Name:.....

02. Address:.....

03. G.N. Division:.....

04. D.S. Division:.....

05. Occupation (Householder):.....

06. Educational Level (Tick [v] the appropriate cage)

1. Upto Grade 8

2. Upto O/L

3. Passed O/L

4. Upto A/L

5. Passed A/L

6. Tertiary Education

7. Vocational Education

8. Post Graduate

9. Other

07. Monthly Income (Tick [v] the appropriate cage)

1. Less Than 7,500

2. 7,500 – 15,000

3. 15,000 – 30,000

4. 30,000 – 50,000

5. More than 50,000

08. Number of Family Members :

--	--

09. What are the institutions which supply telecommunication services in your area (Tick [v] the appropriate cages)

SLT	<input type="checkbox"/>	Mobitel	<input type="checkbox"/>
Suntel	<input type="checkbox"/>	Hutch	<input type="checkbox"/>
Lanka Bell	<input type="checkbox"/>	Celltel	<input type="checkbox"/>
Dialog	<input type="checkbox"/>	No idea	<input type="checkbox"/>

10. Number of telephones in your household

Fixed	<input type="checkbox"/>
Mobile	<input type="checkbox"/>

11. Your telephone number

Residence:.....

Official:.....

12. Are you satisfied with your telephone service (Tick [v] the appropriate cage)

5. Very satisfactory	<input type="checkbox"/>
4. Satisfactory	<input type="checkbox"/>
3. Fair	<input type="checkbox"/>
4. Little	<input type="checkbox"/>
5. Not at all	<input type="checkbox"/>

13. If you are not satisfied reasons for it? (Rank according to the priority)

1. Frequent discontinuations	<input type="checkbox"/>
2. No immediate attention to repair	<input type="checkbox"/>
3. Low signals	<input type="checkbox"/>
4. Congestion	<input type="checkbox"/>
5. Other (Specify).....	

14. Can you make and get calls easily? (Tick [v] the appropriate cage)

1. Yes
2. No

15. Facilities in your telephone (Tick [v] the appropriate cages)

Facility	Known	Used
1. Local calls		
2. International calls		
3. Conference calls		
4. CLI		
5. Internet		
6. Email		
7. SMS		
8. Telegrams		
9. Knowing the time		
10. Alarm		
11. Absentee services		
12. Call forwarding		
13. Hotline		
14. Hunting facility		
15. Blocking of IDD with secret code		
16. Abbreviated dialing		
17. Other (Specify).....		

16. Can you get clear voice quality on phone? (Put appropriate numbers in the cages)

- (a) Local 1. Yes 2. No
- (b) IDD 2. Yes 2. No

17. Which of the following do you experience frequently while using the phone? (Put appropriate number in the cages)

1. Yes
2. No

	IDD	Local		IDD	Local
Echoing: You hear your own voice in the phone			Hissing: Background disturbance in the phone		
Crackling: Breaking of voice while talking			Other (Specify)		
Uneven voice levels: the voice level goes up or down			None		
Blank: Phone suddenly goes blank while talking			Can't say		

18.

18.1 Has your phone broken down? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

18.2 If 'yes', how many times? (Tick [v] the appropriate cage)

- 1. Daily
- 2. Weekly
- 3. Fortnightly
- 4. Monthly
- 5. Once in 3 months
- 6. Once in 6 months
- Once in year

18.3 If "Yes" reasons for breaking downs?

.....
.....
.....

18.4 If "Yes" how long did it take for it to be rectified from the date of complaining?
(Tick [v] the appropriate cage)

- 1. Within 1 day
- 2. Within 2 days
- 3. Within 3 days or more

18.5 Are you satisfied with the repairs? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

18.6 In general, are you satisfied or dissatisfied with the complaint registration process, once your phone breaks down? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

18.7 In general, are you satisfied or dissatisfied with the effectiveness of repair services for speedy restoration of phone in case your phone experiences a fault? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

19 What is your average monthly telephone bill?

20 What is the maximum amount you can afford for telephone bill?

21

21.1 Do you think that your bill is correct? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

21.2 The clarity of bill in explaining your expenditure on phone? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

21.3 Have you complained on billing disputes within the last year? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

21.4 Are you satisfied with the way your complaint was handled and resolved? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

22

22.1 Do you have a directory? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

22.2 If “Yes”, do you use it? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

22.3 If “Yes”, for what purposes you use it?

- 1. To know private phone number / address
- 2. To know business phone number / address
- 3. Other (Specify)

22.4 If you do not use the directory, reasons for it? (Rank according to the priority)

- 1. No necessity
- 2. No idea of how to use it
- 3. It can not be used because of English
- 4. Other (Specify).....

23 Did you receive a copy of the service agreement form the operator? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No
- 3. Can't remember

24 If “Yes” do you remember the terms and conditions in the agreement form?

- 1. Yes
- 2. No

25 Any specific areas of dissatisfaction you would like to mention which you would like the operators to look into and improve upon? (Rank according to the priority)

- 1. Maintains
- 2. Tariff
- 3. Quality
- 4. Customer Relations

26 What are the suggestions you make to improve the telecommunications services?

.....

27 How did you fulfill your telecommunications needs before buying a phone?

- 1. Relatives' house
- 2. Neighbours
- 3. Nearest post office
- 4. Communication centre
- 5. Public telephone
- 6. Mobile phone
- Other (Specify).....

28

28.1 Is there a Post office/ Pay phone/Public phone or Communication centre nearby?

- 1. Yes
- 2. No

28.2 If "Yes", then at what distance (meters)

- 1. 500 – 1,000 m
- 2. 1,000 – 2,000 m
- 3. More than 2,000 m

28.3 If there is a phone nearby then how much time is taken to go and come back?

- 1. Less than 30 minutes
- 2. In between 30 to 60 minutes
- 3. More than one hour

28.4 If there is a phone nearby then how much money you spend to go there and come back?

1. No cost
2. Less than Rs. 10
3. Less than Rs. 20
4. More than Rs. 20

28.5 If there is a phone nearby, then what is the availability of it?

1. Always available
2. Available 90% of the times
3. Available 70% - 90% of the times
4. Faulty most of the time

28.6 How many times you have made a telephone call during last?

1. week
2. month

28.7 For what purpose?

1. Personal
2. Official

Questionnaire - 2
Survey on Telecommunications Services – Mobile Phones
Ratnapura District

Enumerator:.....

No:.....

Date :.....

19. Name:.....

20. Address:.....

21. G.N. Division:.....

22. D.S. Division:.....

23. Occupation (Householder):.....

24. Sex

Male

Female

25. Age

1. Less than 18 yrs
2. In between 18 -25
3. In between 25 -60
4. More than 60

26. Educational Level (Tick [v] the appropriate cage)

1. Upto Grade 8
2. Upto O/L
3. Passed O/L
4. Upto A/L
5. Passed A/L
6. Tertiary Education
7. Vocational Education
8. Post Graduate
9. Other

27. Monthly Income (Tick [v] the appropriate cage)

- 1. Less Than 7,500
- 2. 7,500 – 15,000
- 3. 15,000 – 30,000
- 4. 30,000 – 50,000
- 5. More than 50,000

28. Number of Family Members :

29. What are the institutions which supply telecommunication services in your area ?
(Tick [v] the appropriate cages)

SLT	<input type="checkbox"/>	Mobitel	<input type="checkbox"/>
Suntel	<input type="checkbox"/>	Hutch	<input type="checkbox"/>
Lanka Bell	<input type="checkbox"/>	Celltel	<input type="checkbox"/>
Dialog	<input type="checkbox"/>	No idea	<input type="checkbox"/>

30. Number of telephones in your household?

Fixed	<input type="text"/>
Mobile	<input type="text"/>

31. Your mobile telephone number:

32. Your telecommunication service is? (Tick [v] the appropriate cage)

- 1. Prepaid card
- 2. Postpaid Card

33.

14.1 What is your average monthly telephone bill?

14.2 If your telecommunication service is prepaid card connection then on average,
how much you spend for it?

34.

15.1 Are you satisfied with your telephone service (Tick [v] the appropriate cage)

- 5. Very satisfactory
- 4. Satisfactory
- 3. Fair
- 4. Little
- 5. Not at all

15.2 If you are not satisfied reasons for it?

.....
.....

15.3 Can you make and get calls easily? (Tick [v] the appropriate cage)

- 1. Yes
- 2. No

15.4 Do you experience regular congestion when you make a call?

- 1. Yes
- 2. No

15.5 If “Yes”, to what phones?

35. Facilities in your telephone (Tick [v] the appropriate cages)

Facility	Known	Used
1. Local calls		
2. International calls		
3. Conference calls		
4. CLI		
5. Internet		
6. Email		
7. SMS		
8. Telegrams		
9. Knowing the time		
10. Alarm		

11. Absentee services		
12. Call forwarding		
13. Hotline		
14. Hunting facility		
15. Blocking of IDD with secret code		
16. Abbreviated dialing		
17. Other (Specify).....		

36. Can you get clear voice quality on phone? (Put appropriate numbers in the cages)

- (a) Local 1. Yes 2. No
- (b) IDD 2. Yes 2. No

37. Which of the following do you experience frequently while using the phone? (Put appropriate number in the cages)

1. Yes
2. No

	IDD	Local		IDD	Local
Echoing: You hear your own voice in the phone			Hissing: Background disturbance in the phone		
Crackling: Breaking of voice while talking			Other (Specify)		
Uneven voice levels: the voice level goes up or down			None		
Blank: Phone suddenly goes blank while talking			Can't say		

38. What is the maximum amount you can afford for telephone bill?

39.

1. Do you think that your bill is correct? (Tick [v] the appropriate cage)

1. Yes
2. No

2. The clarity of bill in explaining your expenditure on phone? (Tick [v] the appropriate cage)

1. Yes
2. No

3. The clarity of prepaid cards in explaining your expenditure on phone? (Tick [v] the appropriate cage)

1. Yes

2. No

4. Have you complained on billing disputes within the last one year? (Tick [v] the appropriate cage)

1. Yes

2. No

5. Are you satisfied with the way your complaint was handled and resolved? (Tick [v] the appropriate cage)

1. Yes

2. No

40. Any specific areas of dissatisfaction you would like to mention which you would like the operators to look into and improve upon? (Rank according to the priority)

1. Maintains

2. Tariff

3. Quality

4. Customer Relations

41. What are the suggestions you make to improve the telecommunications services?

.....
.....

42. Did you receive a service agreement form by the telecommunication institute?

1. Yes

2. No

43. How did you fulfill your telecommunications needs before buying a phone?

1. Relatives' house

2. Neighbours

- 3. Nearest post office
- 4. Communication centre
- 5. Public telephone
- 6. Mobile phone
- Other (Specify).....

44.

1. Is there a Post office/ Pay phone/Public phone or Communication centre nearby?

- 1. Yes
- 2. No

2. If “Yes”, then at what distance (meters)

- 1. 500 – 1,000 m
- 2. 1,000 – 2,000 m
- 3. More than 2,000 m

3. If there is a phone nearby then how much time is taken to go and come back?

- 1. Less than 30 minutes
- 2. In between 30 to 60 minutes
- 3. More than one hour

4. If there is a phone nearby then how much money you spend to go there and come back?

- 1. No cost
- 2. Less than Rs. 10
- 3. Less than Rs. 20
- 4. More than Rs. 20

5. If there is a phone nearby, then what is the availability of it?

- 1. Always available
- 2. Available 90% of the times
- 3. Available 70% - 90% of the times

4. Faulty most of the time

6. How many times you have made a telephone call during last?

1. week

2. month

7. For what purpose?

1. Personal

2. Official

Questionnaire - 3
Survey on Telecommunications Services – Phone-Less People
Ratnapura District

Enumerator:.....

No:.....

Date :.....

01. Name:.....

02. Address:.....

03. G.N. Division:.....

04. D.S. Division:.....

05. Occupation (Householder):.....

06. Age

1. Less than 18 yrs

2. In between 18 -25

3. In between 25 -60

4. More than 60

07. Educational Level (Tick [v] the appropriate cage)

8. Upto Grade 8

9. Upto O/L

10. Passed O/L

11. Upto A/L

12. Passed A/L

13. Tertiary Education

14. Vocational Education

15. Post Graduate

16. Other

08. Monthly Income (Tick [v] the appropriate cage)

17. Less Than 7,500

18. 7,500 – 15,000

- 19. 15,000 – 30,000
- 20. 30,000 – 50,000
- 21. More than 50,000

09. Number of Family Members :

10. What are the institutions which supply telecommunication services in your area
(Tick [v] the appropriate cages)

SLT	<input type="checkbox"/>	Mobitel	<input type="checkbox"/>
Suntel	<input type="checkbox"/>	Hutch	<input type="checkbox"/>
Lanka Bell	<input type="checkbox"/>	Celltel	<input type="checkbox"/>
Dialog	<input type="checkbox"/>	No idea	<input type="checkbox"/>

11. How do you fulfill your telecommunications needs?

1. Relatives' house	<input type="checkbox"/>
2. Neighbours	<input type="checkbox"/>
3. Nearest post office	<input type="checkbox"/>
4. Communication centre	<input type="checkbox"/>
5. Public telephone	<input type="checkbox"/>
6. Mobile phone	<input type="checkbox"/>
Other (Specify).....	

12. Do you expect to buy a phone?

- 1. Yes
- 2. No

13. What type of phone you expect to buy?

Fixed	<input type="checkbox"/>
Mobile	<input type="checkbox"/>

14. Did you apply for a telephone?

- 1. Yes
- 2. No

15. When did you apply for a telephone?

16. What is your selected service?.....

17. What are the reasons for selecting that particular service? (Rank according to the priority)

- | | |
|--------------------------------|----------------------|
| 1. Less Cost | <input type="text"/> |
| 2. Easy to obtain | <input type="text"/> |
| 3. More reliable | <input type="text"/> |
| 4. No access to other services | <input type="text"/> |
| 5. Coverage | <input type="text"/> |
| Other (Specify)..... | <input type="text"/> |

18. Why did you decide to apply for a phone? (Rank according to the priority)

1. Children's request	<input type="text"/>
2. Spouse's request	<input type="text"/>
3. Useful for the job	<input type="text"/>
4. To reduce the cost and time	<input type="text"/>
Other (Specify).....	<input type="text"/>

19. What are the factors you consider when you are applying a phone? Rank according to the priority)

- | | |
|----------------------------|----------------------|
| 1. Income | <input type="text"/> |
| 2. Job need | <input type="text"/> |
| 3. Easy to rent the house | <input type="text"/> |
| 4. Rental / Package | <input type="text"/> |
| 5. Installation charges | <input type="text"/> |
| 6. Recommended by some one | <input type="text"/> |
| 7. Business promotions | <input type="text"/> |
| 8. Coverage | <input type="text"/> |
| Other (Specify)..... | <input type="text"/> |

20.

22. Is there a Post office/ Pay phone/Public phone or Communication centre nearby?

1. Yes
2. No

23. If “Yes”, then at what distance (meters)

- 1. 500 – 1,000 m
- 2. 1,000 – 2,000 m
- 3. More than 2,000 m

24. If there is a phone nearby then how much time is taken to go and come back?

- 1. Less than 30 minutes
- 2. In between 30 to 60 minutes
- 3. More than one hour

25. If there is a phone nearby then how much money you spend to go there and come back?

- 1. No cost
- 2. Less than Rs. 10
- 3. Less than Rs. 20
- 4. More than Rs. 20

26. If there is a phone nearby, then what is the availability of it?

- 1. Always available
- 2. Available 90% of the times
- 3. Available 70% - 90% of the times
- 4. Faulty most of the time

27. How many times you have made a telephone call during last?

- 1. week
- 2. month

28. For what purpose?

- 1. Personal
- 2. Official

29. Do you have the facility of getting a call?

- 1. Yes
- 2. No

6.7

Study Undertaken For the Telecommunications
Regulatory Commission of Sri Lanka (TRCSL).
Final Version
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Policy Brief on: **Local Loop Unbundling in Sri Lanka: Issues and Challenges***

December 2006

Institute of Policy Studies
99, St.Michael's Road
Colombo 3
Sri Lanka
Website: <http://www.ips.lk>

Contact Person

Dilani Hirimuthugodage
Research Assistant
Industry, Public Enterprise Reform and Regulatory Policy Research Unit
Tel No: +94-112-431368
Fax No: +94-112-431395
Email: dilani@ips.lk

* This Policy Brief was written by Dilani Hirimuthugodage. The views expressed in this Brief are those of the author and do not necessarily represent those of the Institute of Policy Studies.

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Appendix

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The author gratefully acknowledges all those in the telecom industry who gave their views on the problems and prospects of local loop unbundling in Sri Lanka. Further, the overall guidance and supervision provided by Malathy Knight-John, who heads the Industry, Public Enterprise Reform and Regulatory Policy Research Unit and the assistance provided by Amrit Rajapakse, Apsara Thurairatnam and Jeevani Kapugama are also gratefully acknowledged and appreciated.

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Executive Summary

1. The telecom industry in Sri Lanka contributed 2.4 percent in the year 2000, 3.5 percent in 2003 and 4.5 percent in the year 2004. (*CBSL, 2003, pg.9*) and is one of the most dynamic and fast growing sectors of the economy (*Annual Report of the Central Bank of Sri Lanka (CBSL, 2005, pg.43)*) The industry consists of seven Public Switched Telephone Networks (PSTN): three fixed access operators (Sri Lanka Telecom, Suntel, and Lanka Bell) and four mobile operators (Dialog, Celltel, Mobitel, and Hutchison). In addition to these operators there are a number of External Gateway Operators (EGOs), data communication and Internet Service Providers (ISPs), paging, payphone and trunk radio operators.
2. Over the past three decades, the global telecom industry has seen rapid policy, institutional, and technological changes. Competition – by way of liberalization and privatization has replaced the traditional “model”- of public sector monopoly service provision in most countries around the world.
3. The concept of local loop unbundling (LLU) is a particular step in the process of increasing competition in the industry. Empirical evidence from developed countries indicates that the onset of competition has produced positive impacts in terms of access, affordability, consumer choice and investment (*Development in local loop unbundling, OECD, 2003, pg 6*). The key objective of LLU is to increase the competition in market for broadband network access services so as to provide high quality, high speed, cost effective data services to end-users. (www.sonusnet.com/contents/Local Loop whitepaper .pdf)
4. A brief review of the international experience indicates that regulatory and technical factors account for the varied results in the implementation of LLU. Countries such as Australia, and Japan have been successful in implementing LLU, whereas UK, and USA have experienced various difficulties in its implementation. India and New Zealand on the other hand have carefully researched the costs and benefits of LLU in terms of end-user benefits and have opted for other solutions, such as WiFi and WiMax to improve broadband services. Indonesia has also opted for Wireless Technology in order to provide better broadband facilities, a technology seen as an economically feasible solution for developing countries (*Frieden.R, Unbundling the local loop: A cost benefit analysis for developing nations*) such as Sri Lanka, where telecom infrastructure facilities are still underdeveloped.

5. As revealed in the face to face interviews carried out amongst key stakeholders in the telecom policy space, the principal constraint with respect to LLU is the inadequacy of local loops to be unbundled. Given this “uniform” perception in the industry, the implementation of LLU in itself appears to be rather futile. As such, existing policy and regulatory priorities need to be geared towards identifying other options to achieve end-user benefits.

6. Particular options identified in this Policy Brief are:
 - Securing more investments in wireless technology
 - a. Facilitating Wi –Max and Wi – Fi solutions
 - b. Expanding CDMA facilities
 - Building more loops

7. In addition to the options listed above, the following policy and institutional measures are recommended to develop the industry in a sustainable manner.
 - Implementing the Interconnection Rules of 2003 and ensuring that a workable interconnection system is in place
 - Allocating spectrum in a transparent manner. Ideally replacing “regulatory allocations” with market based solutions (i.e. auctions)
 - Facilitating cost effective solutions to the international backbone(access to SEA-ME-WE III or IV)
 - Reducing internet access charges
 - Unbundling the local backbone

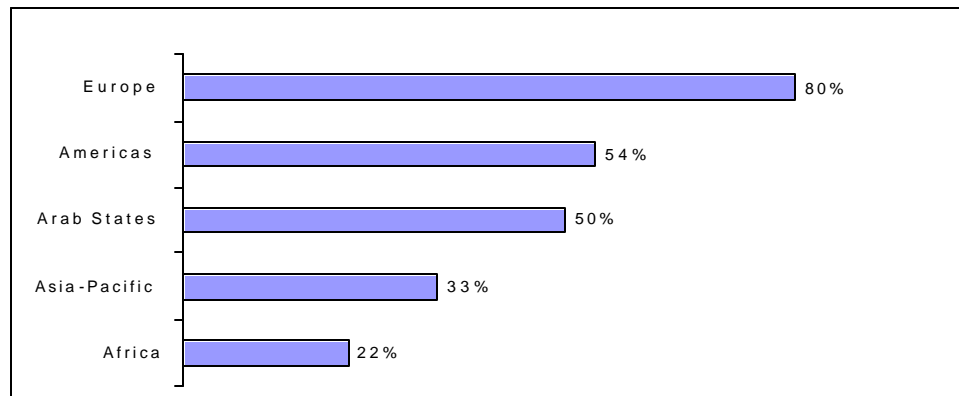
1. Background

1.1 Rapid technological developments in the telecom industry create new opportunities for competition. The unbundling of the local loop –“access to the last mile”- has been and is being explored as a means of stimulating competition in broadband services by policy makers and regulators in both developed and developing countries.

1.2 As illustrated in Figure 1 however, the record to date indicates a higher take up of local loop unbundling (LLU) in developed countries. Figure 1 indicates how countries, on a regional basis, view the importance of implementing LLU. As shown in this Figure, LLU appears to be more of a policy priority in developed countries.

1.2.1 A plausible technical explanation for this variance would be the fact that developing countries have insufficient (wire line) local loops, while developed countries at the other end of the spectrum have excess capacity.

Figure 1
Implementing LLU: A Regional Perspective, 2004



Source: ITU World Telecommunication Regulatory Database, (www.itu.int/dms_pub/itu-d/opb/reg), 2004.

1.3 The objective of this Policy Brief is to address the following questions given Sri Lanka’s current industry, regulatory and policy context.

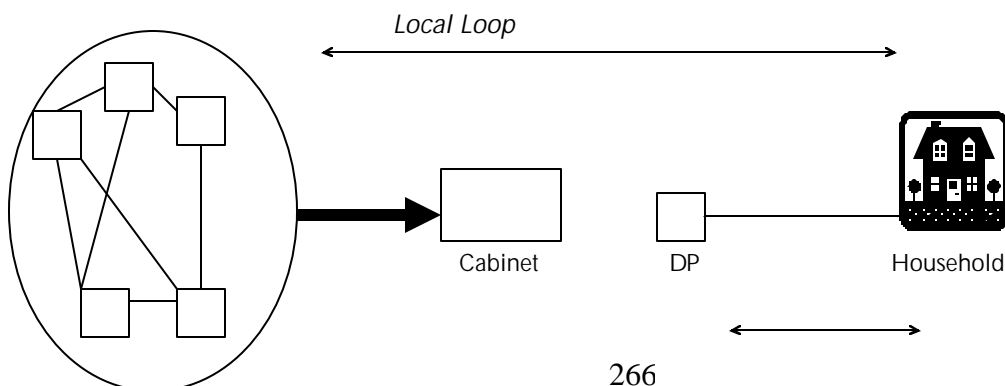
1.3.1 Is LLU a first best solution for enhancing broadband access in Sri Lanka? If yes, what are the policy, regulatory and technical measures required to unbundle the last mile?

1.3.2 Is LLU not a first, second or even a third best – solution? If so, what policy, regulatory and technical measures need to be prioritized and implemented to stimulate competition and increase access in and for the market for broadband services?

2. Definition and Methods of LLU

- 2.1 The local loop is the twisted pair of copper circuits in the local access network, connecting the terminal equipment in the user's premises with the network operator's infrastructure. LLU is defined as the "process in which the incumbent carriers lease, wholly or in part, the local segment of their telecommunications network to competitors" (*Development in local loop unbundling, OECD, 2003, pg 4*).
- 2.2 As illustrated in Figure 2, the local loop connects end-users to the Public Switch Telephone Network (PSTN). In Sri Lanka, the pair of copper wires runs through the Cabinet (which cross connects all loops) and the Distribution Provision (DP) and on to households. LLU can be implemented at the Cabinet point or in the case of sub-loop unbundling at the point of DP. Sub-loop unbundling is a method where the incumbent leases a part of the copper pair.
- 2.3 The benefits of competition from LLU may spill over into productivity improvements such as lower prices, and service innovation. In Japan for instance, interconnection charges fell by 22.5 percent between 1997 and 2002, following the successful implementation of LLU. (*I. Nobuo, The Unbundling of Network Elements, Japan's experience, pg.09*). In UK, since the introduction of LLU, the prices of broadband digital subscriber line connections fell from £25-30 to £14.75 between 1995 and 2002, and broadband penetration was increased to 6.1percent by the end of 2002 (*Key trends in fixed and mobile telephony and internet, Oftel, November, 2002*). However the UK still faces practical difficulties "British telecom supposes to give its rivals access to its exchanges, but still has failed to deliver on promised improvements." (*Sunday Times of UK, Oct, 11, 2006*).

Figure 2
The Local Loop



Sub-loop (Part of a local loop)

PSTN (Exchange Area)

2.4 There are three technical modalities for the implementation of LLU:

- Full unbundling
- Line sharing or shared access
- Bit stream access

	Full Unbundling	Line Sharing	Bit Stream
Definition	Copper pairs connecting subscribers to the main distribution frame are leased from the incumbent by a competitor.	The incumbent maintains and controls the copper pairs and provides telephony service to subscribers while leasing out a part of the copper pairs.	The incumbent maintains control over the subscriber's line but allocates spectrum to an access seeker.
Incumbent's role	Incumbent retains ownership of the unbundled loops and is responsible for maintaining it. So the incumbent has no relationship with end- user.	Incumbent provides data services to end- user.	Incumbent provides Asymmetric Digital Subscriber Line (ADSL) technology and modems. (therefore the incumbent retains control and management over the network).
Competitor's role	Take total control of the copper pairs and is able to provide subscribers with all data and voice services.	Competitor provides broadband services to the end- user, using the same copper pairs as the incumbent.	Can only obtain access to the network system at points designated by the incumbent. No management control over the line and not allowed to add other equipment.
Examples of countries and pricing methods (Pricing methods differ from country to country)	In USA, Australia and the UK, competitors have to pay for fully unbundled lines and also for the collocation equipments therefore, initial capital of competitors will be high. Thus prices are higher compared to the line sharing and bit stream methods	In Australia, UK and Japan competitors share the facilities of the incumbent (technology, collocation equipments) Therefore collocation cost is relatively low and initial capital will be low.	In Australia, UK and France, the incumbent incurs the costs of collocation equipment.
Advantages	<ul style="list-style-type: none"> • Competitors can enhance the copper pairs by adding ADSL technology. • The level of competition will be higher than the Line Sharing and Bit Stream methods. 	<ul style="list-style-type: none"> • Consumers can obtain broadband services from the most competitive provider without installing a second line. 	<ul style="list-style-type: none"> • The initial capital of the competitors will be low, because the incumbent provides ADSL technology and modems.
Disadvantages	<ul style="list-style-type: none"> • Competitors have to bear all the collocation equipment and collocation costs. • Initial capital will be high compared to the other two options. • Initial capital requirements may act as a barrier to entry. 	<ul style="list-style-type: none"> • Technical interface problems. • Slows down the speed for digital access, due to frequency unbundling. For example, when high speed data runs along adjoining telephone lines the signal on one wire can bring noise to the next wire; interfering signals results in slower data rates. 	<ul style="list-style-type: none"> • Can only supply the services which the incumbent designates; competitors are not permitted to add any technology or equipment. • For competitors a low level of competition can be expected due to the fact that they can only obtain access to the system that the incumbent chooses to implement. • This method can lead to line interference in specific situations depending on the Digital

	Full Unbundling	Line Sharing	Bit Stream
			Subscriber Line (DSL) technology used. For example, when there is simultaneous use of DSL technology by more than one operator, there may be difficulties in operating at the same time.

Appendix 1 of this report explains these three methods using graphical illustrations.

3. Implementation of LLU in Developed and Developing Countries: Lessons for Sri Lanka

The countries selected for comparison in this study represent a cross section of those where LLU has been successful in terms of end-user benefits (Australia and Japan); those that have implemented LLU and still face regulatory challenges in enhancing its end user benefits(USA and UK); and countries that have opted for alternate solutions (India, Indonesia and New Zealand).

Country and the Objectives of LLU	Status of LLU	Reasons for the Current Status	Lessons for Sri Lanka
Australia			
<ul style="list-style-type: none"> Objective was to provide high speed, efficient service in broadband internet and telephony services. 	LLU introduced in 1999.LLU successful in terms of providing high speed data capacity and enhancing competition in broadband services.	<ul style="list-style-type: none"> Competitor's initial capital requirements were low due to line sharing. Reduced barriers to entry. Competitors able to provide broadband services exclusively to subscribers. 	<ul style="list-style-type: none"> Reduce entry barriers for new entrants / competitors.
Japan			
<ul style="list-style-type: none"> Objective was to increase competition in broadband services and in the telecom industry as a whole. 	LLU was implemented in 1997. End-user benefits occurred in terms of price and quality.	<ul style="list-style-type: none"> Unbundling the backbone. Slashing interconnect rates which the incumbent charged from competitors for accessing its network. Providing access collocation to 	<ul style="list-style-type: none"> Extending the backbone around the island and Unbundle it.(Refer annex 2) Getting a workable interconnection regime in place. Competitive prices for collocation.

Country and the Objectives of LLU	Status of LLU	Reasons for the Current Status	Lessons for Sri Lanka
		competitors at a very reasonable and competitive price.	
United Kingdom			
<ul style="list-style-type: none"> Objective was to increase efficiency telephony services in general and in terms of speed, cost and price. 	Implemented LLU in 1995, but still faces difficulties in the implementation process.	<ul style="list-style-type: none"> Incumbent required that the competitors should operate their own equipment. Collocation cost was very high, given that in most cases, the incumbent had the first mover advantage this was a barrier for new entrants New entrants raised issues in regard to the commitment and the length of time taken by the incumbent to provide the services mandated by the regulator. 	<ul style="list-style-type: none"> Recognition that co-operation between incumbent and competitors result in a "win win" situation for all. Regulatory measures need to be put in place to facilitate a competitive environment which balances the needs of end-users with the need for investments in the sector.
USA			
<ul style="list-style-type: none"> Objective was to increase competition in local communications for high speed data services. 	Implemented in 1996. Faced difficulties in its implementation. USA has to face pricing issues like difficulties in setting geographically de-averaged prices for local loops and other unbundled network elements.	<ul style="list-style-type: none"> The 1996 Telecommunication Act established provisions for competitors to supply broadband services via unbundled elements and to establish their own infrastructure. Incentives were given to competitors for collocation. 	<ul style="list-style-type: none"> Providing incentives to competitors .Eg: fiscal incentives such as tax for broadband equipment for competitors.
India			
<ul style="list-style-type: none"> Objective was to increase the number of broadband subscribers. 	<p>Conducted studies on LLU in 2004, but did not implement due to several issues such as:</p> <ul style="list-style-type: none"> Regulator recommended LLU, the Government recognized it is not essential to increase the competition in the broadband facilities. According to the Governments' Broadband Policy in 2004, 	<ul style="list-style-type: none"> Technologies such as cables and wireless were seen as alternatives to LLU. Regulator recommended policies which include fiscal incentives such as tax concessions for broadband equipment for competitors. 	<ul style="list-style-type: none"> Cost benefit analysis on wireless technologies. Technology neutral unbundling, where all fixed and mobile operators share the last mile.

Country and the Objectives of LLU	Status of LLU	Reasons for the Current Status	Lessons for Sri Lanka
	<p>(www.dotindia.com/ntp/broadbandpolicy2004) LLU is not a 'bottleneck facility' for broadband services; access providers shall be free to enter into mutually agreed commercial arrangements with the incumbents.</p> <ul style="list-style-type: none"> • Giving recommendations to Broadband Policy 2004, regulator suggest that, Local Loop owners should be given an opportunity to decide the areas where they would make their own investments for providing broadband services and to decide on the type of unbundling depending on their commercial objectives (www.trai.gov.in/recommendations_content.asp), but the two main incumbents carry very limited fixed lines. • Considering all these facts regulator recommended some other facts to increase broadband facilities. 		
Indonesia			
<ul style="list-style-type: none"> • Objective was to provide efficient broadband services. 	Used wireless technology such as WiFi to address broadband facilities in 1996.	<ul style="list-style-type: none"> • Lower cost of Wifi compared to wired last mile. • Inadequate supply of backbone network in Indonesia encouraged wireless technology. 	In the current scenario, with a low coverage of the backbone network, it is essential to, evaluate the feasibility of wireless technologies like, WiFi and WiMax.(Refer to SLT map in appendix).
New Zealand			
<ul style="list-style-type: none"> • Objective was to improve broadband facilities. 	Carried out studies in 2001, and introduced cost benefit model for LLU. However, most of the operators were not satisfied with the New Zealand Commerce Commission's cost benefit analysis and decisions.	<ul style="list-style-type: none"> • LLU was not seen as a solution for broadband access due to the problem of predicting the costs and benefits of unbundling network elements. • It would provide negative costs on investments, property 	<ul style="list-style-type: none"> • Cost benefit analysis of LLU done in collaboration with PSTN operators. • Promotions for new technologies and incentives for new investments in the telecom industry.

Country and the Objectives of LLU	Status of LLU	Reasons for the Current Status	Lessons for Sri Lanka
		<p>rights and technological developments.</p> <ul style="list-style-type: none"> • The major operators in the telecom sector and the business sector have identified some other options to increase broadband; <ol style="list-style-type: none"> i. Continued promotions of new technology. ii. Protection of property rights. iii. Supportive environment for investment. 	

3.1 It is clear that unbundling the local loop is not a solution for all countries, and that the success of LLU depends on a country's infrastructure, geographical situation etc. For a country such as Sri Lanka, with under-developed telecommunication infrastructure facilities (optical fiber under the main incumbent covers only a very few areas, as seen in the fiber map contained in the appendix of this report) it is recommended that alternate options or solutions be explored to enhance the speed and quality of broadband services.

4. LLU in the Sri Lankan Context

4.1 Table 4.1 gives a brief description of the key reforms and regulatory events in Sri Lanka's telecom sector from 1980 to date.

Table 4.1

Key Regulatory Events in the Industry 1980 -2006

1980	Bifurcation of post and telecom service provision
1989	1st private operator enters market (Celltel- mobile operator)
1991	Legislation to set up regulatory agency ;Corporatization of incumbent
1994	National Telecom Policy issued by GOSL (covered USOs, cost-based tariffs, QOS etc.)
1996	Licensing of WLL operators (Suntel & Lanka Bell); Amendment to 1991 legislation (5-member Commission- however, conflict of interest with Secretary to Ministry as <i>ex-officio</i> Chairman of TRC); TRC (fixed telephony) interconnection directive not taken on board by operators (Alternate Dispute Resolution measures initiated by TRC does not have positive impact)
1997	Incumbent (SLT) partially privatized (NTT: 35%, GOSL: 61.5%, Employees 3.5%); GOSL retains international exclusivity until August 2002; Sri Lanka makes WTO commitments
1998	New (fixed telephony) interconnection determination issued by TRC; Incumbent appeals against determination in courts – failed to stay it; 1st stage of tariff rebalancing commences (5 stage rebalancing exercise)
1999	TRC issues and implements interconnection determination (involving fixed: mobile)
2002	Incumbent acquires balance 60% shares of Mobitel; SLT shares traded on the CSE in a significant manner, prior to this it was very little. (And subsequent re-mix of shares as: NTT 35.2%, Public 11.8%, Employees 3.5%; GOSL 49.5%)
2003	Exclusivity on international telephony ends; Interconnection Rules put in place; First assignment by auction of 1800 GSM frequencies; Final tariff rebalancing implemented; EGO licences issued.
2005	CDMA licences issued; Court case against 7 PSTN operators and ICTA w.r.t. alleged exclusivity clauses in regional telecom network licenses; Consumer lobby takes TRC and SLT to court over 5th (final) tariff re-balancing exercise; CPP taken up and dropped (yet again)
2006	Sri Lanka's 1st commercial 3G mobile licence issued; SLT foreign currency debt outlook revised from stable to negative by Fitch Ratings; TRC issues calls for 5th mobile operator

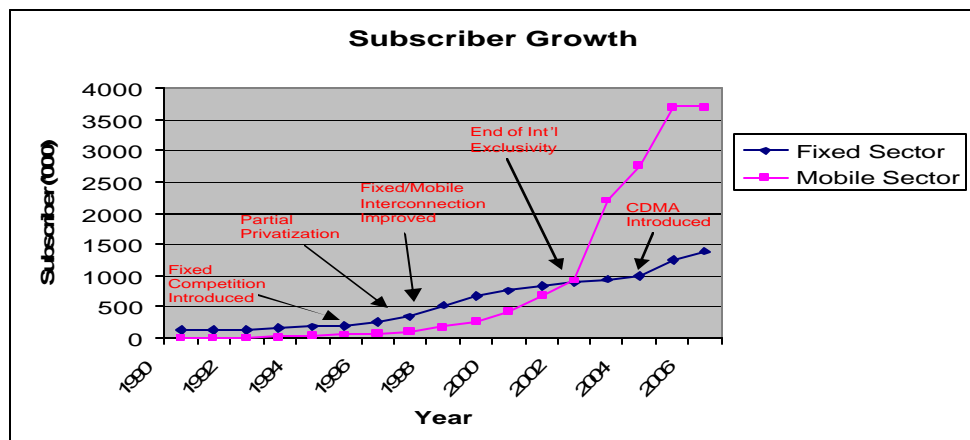
Source: Knight-John,M. (2004) and LBO various articles (<http://www.lbo.lk>)

4.2 Figure 4.1 indicates the growth in fixed sector subscriber line and mobile sector subscriber line. Fixed sector subscriber supply gained momentum with the introduction of two fixed line

operators in 1996. After the year 1998, new interconnection rules were determined and this facilitated both mobile and fixed sector growth. Cease Fire Agreement (CFA) and the introduction of Code Division Multiple Access (CDMA) technology, caused to increase fixed subscriber line respectively in 2002 and 2005.

4.3 In the case of mobile sector year 2003 is very significant where, exclusivity in international telephony was ended and it resulted in a nearly 130 percent increase in the mobile subscribers in 2004. CFA also helped to increase the mobile subscriber line due to the increase in North and North-Eastern subscribers, but it is important to note that even though there is an increase in the subscriber density, a higher percentage (nearly 60 percent) of this is in the Western Province.

Figure 4.1

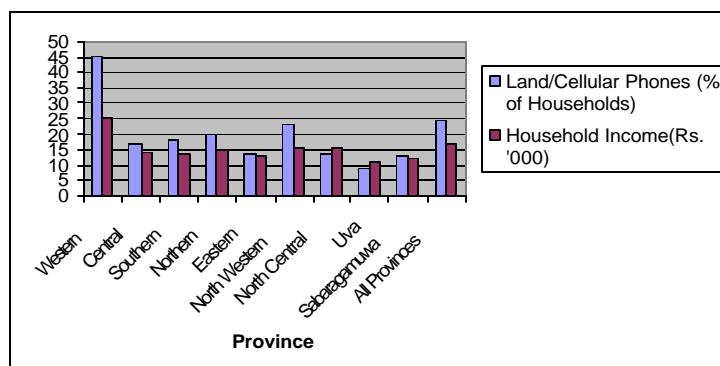


Source: TRC

4.4 Figure 4.2 depicts the relationship between household income and access. It suggests that income levels and access to telephones are higher in the Western Province.

Figure 4.2

Household Income and Access in the Nine Provinces

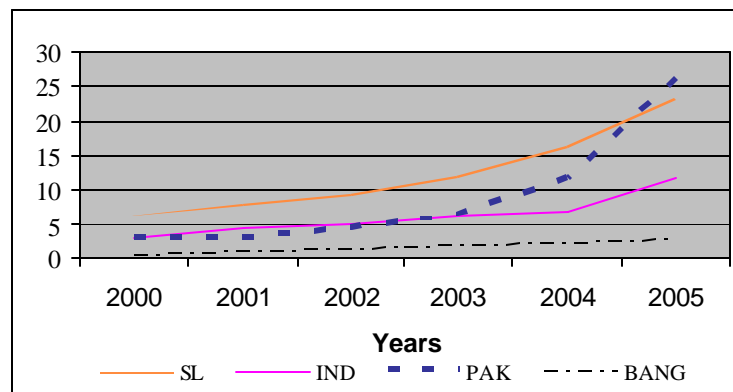


Source: Consumer finance Survey, 2003/2004

4.5 As illustrated above, the supply of telecom services is concentrated mainly in areas where infrastructure and income levels are better compared to other areas. According to the 1996/1997 Consumer Finances Survey the percentage of households with telephone and cellular phones all-island was 4.5 percent, in 2003/2004 it was 24.5 percent. Over these eight years there was an eighty percent increase in the number of households which carry the telephone.

In terms of teledensity Sri Lanka was in second, below Maldives (which carries 99 percent teledensity), but the Figure below shows drastic changes in other countries except Nepal and Bhutan during last five years. Eg: in Pakistan two years ago their teledensity was 2 percent, but in the year 2005 it increased to 22 percent. This growth came in the mobile sector in parallel with infrastructure developments. In the case of Bangladesh, teledensity was 1.56 in the year 2003 and it was nearly double in the year 2005 as it increased to 2.9 percent with the improvements of infrastructure facilities in the telecommunication services. The improvements of teledensity in South Asian countries are depicted in Figure 4.3.

Figure 4.3
Teledensity in Selected Countries



Source: ITU data, Department of telecommunication in Pakistan, <http://www.trai.gov.in>, and TRC.

4.6 Is there a need for LLU in Sri Lanka?

Most countries implement LLU with an objective to improve end-user benefits. However, the findings of face to face interviews carried out amongst key stakeholders in the telecom policy space, suggests that there are insufficient local loops to unbundle* in Sri Lanka. The limited numbers of local loops available are exclusively controlled and maintained by the SLT. But, as explained earlier the household connections or the copper wire which runs through the distribution provision to the household is owned by the user, once he has paid for the connection. So, that part of the loop can be recognized as unbundled, but to provide the local loop to competitors is not feasible due to the insufficiency of loops. Therefore at the moment, LLU is not a first, second or even third best solution for Sri Lanka to enhance broadband facilities.

Given a situation where there are insufficient local loops to unbundle, the question is: what methods can Sri Lanka adopt to enhance broadband facilities to facilitate end-user benefits?

- Techniques of Wireless Local Loops (WLL)

WLL is a system that connects subscribers to the PSTN using radio signals as a substitute for copper for all or part of the connection between the subscriber and the switch. WLLs are often cited as an economically feasible solution to serve the dearth of communications infrastructure in developing countries. (*Frieden.R, unbundling the local loop: A cost benefit analysis for developing nations*). Wireless technologies comprise satellite, wireless cable, mobile and fixed cellular and personal communications systems etc. Suntel and Lanka Bell got licences to provide fixed wireless local loops in 1996 and they both do last mile via wireless technologies. Suntel does wireless broad band and Lanka Bell has recently signed an agreement with Reliance Communication's Flag Telecom in India for an undersea submarine cable link connecting the two countries.

a)Expand CDMA facilities

The introduction of CDMA is another good option, which Sri Lanka has already introduced in the year 2005. This facility enables customers to use wireless telephone facilities. It is only one and a half years since Sri Lanka implemented CDMA, but up to June 2006, there were 47,200 users. And also, for a country like Sri Lanka it will be a good option to increase teledensity in remote areas.

* All the current PSTN operators (3 fixed line and 4 mobile) emphasized this in the interviews which were carried out by the author. According to them at the moment, all the three methods of unbundling are not feasible for Sri Lanka due to the lack of local loops.

b) Wi-Max technology

LLU comes in the context of broadband facilities to the end-user. Among the other options available, World wide Interoperability for Microwave Access (WiMax) is considered to be a more cost effective broadband technology than traditional wire line based technologies such as ADSL and Dial up lines. This technology is widely used to provide broadband data connectivity to remote areas at a very low cost. India, Thailand, and the Philippines are some countries which performed well in this. Initiating a good start Sri Lanka Telecom has signed up an agreement with Aperto Networks to test a wireless broadband solution, and Sri Lanka telecom will provide radio access and core network elements for WiMax.

- **Building more loops**

If the telecom regulatory authority extends incentives such as tax, to provide more loops unbundling will be possible.

To reiterate, LLU is a solution for a particular situation where there are excess unutilized loops.

5. Policy Recommendations

It is clear that LLU is neither feasible nor a priority at present given insufficient local loops in the country. As explained earlier the household connections or the copper wire which runs through the distribution provision to the household is owned by the user, once he has paid for the connection. So, that part of the loop can be recognized as unbundled. But to provide the whole local loop to competitors is not feasible due to the insufficiency of loops. Therefore, policy regulatory authority needs to be accessed to the following means if the industry is to grow in a sustainable manner:-

- **Unbundling the backbone**

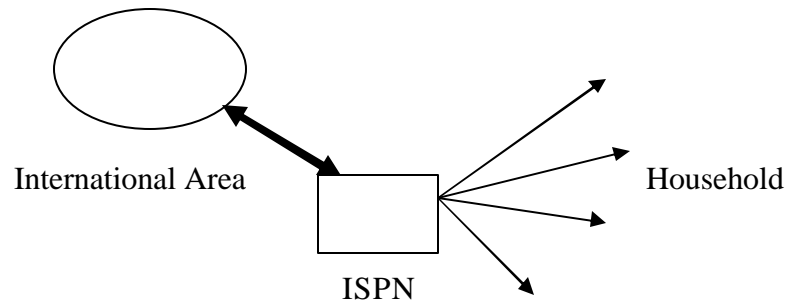
Unbundling the backbone will enable and encourage operators to provide a quality broadband service and with competition customers have a choice to select the best deal according to their requirements. Backbone can be divided in to two; Local backbone and the International backbone.

- a. The international backbone is where the International Service Provider Network (ISPN) connects with the international cloud.

- b. This can be accessed through, SEA ME WE iii or iv etc.

Figure 5

International Backbone



- c. The local backbone provides a path for the exchange of information between different Local Area Networks (LANs) or sub networks. This can be accessed through using micro waves or fiber. Annex 2 depicts the fiber optic network under the main incumbent of Sri Lanka. If the other operators get an opportunity to access these backbones it will be competitive and competitors get the opportunity to build new rings which will cover the entire area.

- **Provide facilities to access SEA-ME-WE**

South East Asia- Middle East- and Western Europe (SEA-ME-WE) connects through these under-sea cable links, which helps to channel overseas data traffic. At the moment, SLT has under-sea cables and Lanka Bell is taking initial steps to engage this facility. It will be supportive if the regulator gets the incumbent to provide access to international SEA-ME-WE. Therefore competitors willing to access landing stations can have access to cables at a reasonable price. If the access prices stated above are extraordinarily high no service provider will be able to operate it. Therefore it is only the regulator who can make that price competitive with other factors. If this competitiveness is created, broadband facilities will improve.

- **Reduce internet access charges**

Sri Lanka is recognized as a country which has high internet access charges, when compared to other developed and developing countries (www.apdip.net/project). It should be noted that the increased broadband facilities in the country should be affordable to the end-user, or else the

whole process would be rendered futile. It suggests that high access charges are one of the barriers to internet usage.

When compared with Pakistan, which has gone through rapid developments in broadband facilities it shows how the number of internet subscribers increased with the reduction in internet tariff charges.

Table 5.1
Pakistan Internet Charges

Year	No: of subscribers (000)	Internet access tariff % of per capita income
2000	505	1.52
2001	830	1.39
2002	1000	1.19
2003	1600	0.94
2004	2029	0.65
2005	2137	0.40

Source: <http://www.dof.or.kr/pdf/FPW-session6>.

In the case of Indonesia internet access tariffs as a percentage of per capita income is 0.77 and in India it was 0.869 in the year 2005 (<http://www.dof.or.kr/pdf/FPW-session6>). In Sri Lanka it was nearly 0.91 in 2005 which was a reduction of 40 percent from 2002 (2002 it was 1.28). (Used TRC data to calculate the above). The high internet access prices results in slow growth of internet access in Sri Lanka. When compared with other South Asian countries Sri Lanka is lagging behind in terms of internet penetration (internet users as a percentage of population). The table below shows a comparison between India, Pakistan, and Sri Lanka.

Table 5.2
Internet Penetration in Selected Countries

	Internet Penetration	
	2000	2005
India	0.46	3.6
Pakistan	0.1	4.6
Sri Lanka	0.5	1.4

Source: www.internetworldstats.com,naisproject.org

One of the most important factors which drives Pakistan to increase the number of internet users was the reduction of internet access tariffs. So, it is evident that internet access charges have a direct impact on the internet users, therefore to facilitate end-user benefits internet charges need to be reduced.

- **Wimax and Wifi for Sri Lanka**

Countries which are on par with Sri Lanka have explored and implemented this technology to provide broadband facilities. As mentioned before, India is currently providing broadband services using Wifi technologies. Indonesia, Thailand and Philippines are some of the other developing countries which perform well in broadband services using these technologies. Wifi which needs 2.4 -2.483 GHz and WiMax which needs a bandwidth of 2.5-2.6 GHz is a possible solution for Sri Lanka.

At present, Sri Lanka is in the process of exploring the facilities for WiMax. Operators are expecting to obtain Wifi and WiMax licences. If the regulators are willing to conduct spectrum auction for the frequencies of WiMax and Wifi at competitive prices, operators will bear other costs and will provide high quality broadband services to customers. Wifi will be one of the best last mile network access solutions for developing countries such as Sri Lanka. Wifi is recognized as a cheaper and easier technology to be deployed compared to wired infrastructure (*Frieden.R, Unbundling the local loop: A cost benefit analysis for developing nations*). It will be a positive solution if the regulators extend licences and other necessary facilities to wireless broad band technologies.

- **Spectrum Allocation**

With the objective of allowing a level playing field for all the operators, regulators are practicing spectrum allocation. However, there are several loopholes in this method. In most cases spectrum allocation depends on the number of subscribers each operator carry. The

primary issue is that there is no clear definition of a subscriber. Various operators define and calibrate their subscribers in different ways. There are some other terms which do not have unique definitions such as call units, pre-paid customers, which indirectly affect the calculation of subscribers under each operator. Spectrum allocation is regarded as an economically inefficient method to allocate scarce resources. Therefore spectrum auction, where governments sell frequency bands to potential users using an auctioning process will be more efficient than spectrum allocation. Sri Lanka has followed spectrum auction in 2003 for 1800GSM frequencies.

- **Rules regarding interconnection**

At present one of the issues faced by smaller mobile and fixed line operators is the difficulty of accessing the network of bigger operators. As a corrective measure to this, The 2003 Interconnection Rules should be implemented in full with immediate effect.

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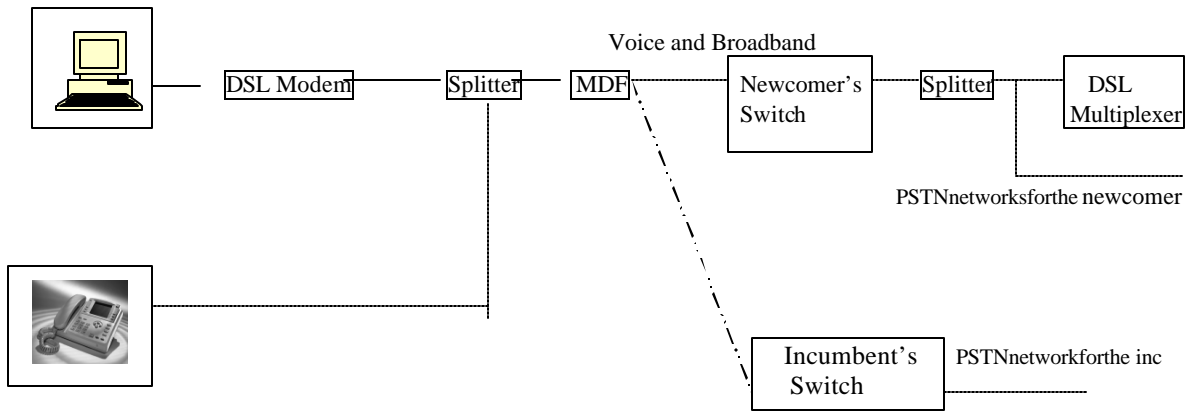
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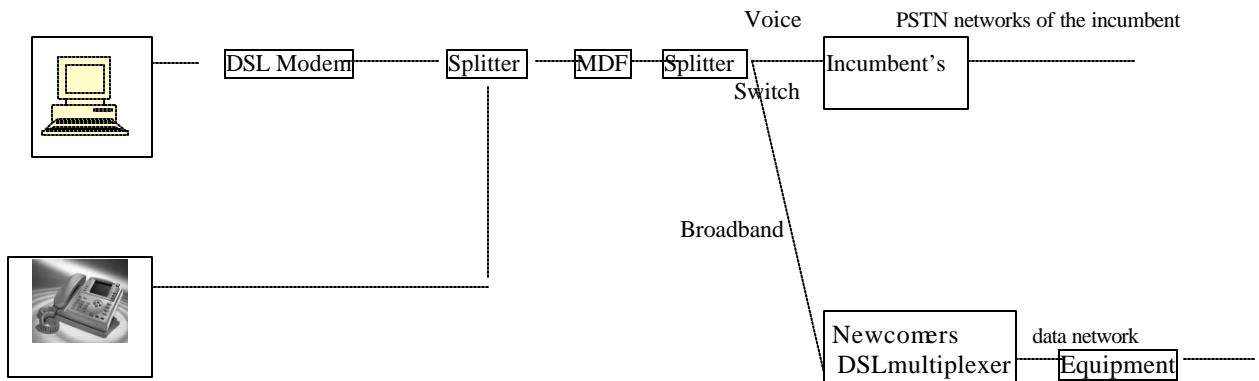
Appendix: 1

Diagram of full unbundling



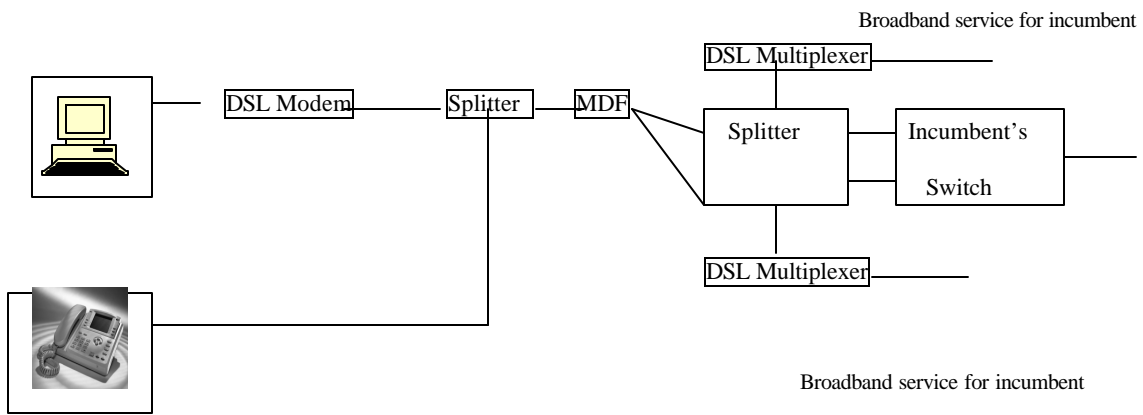
Source: OECD (2003), Development in Local Loop Unbundling.

Diagram of Line Sharing



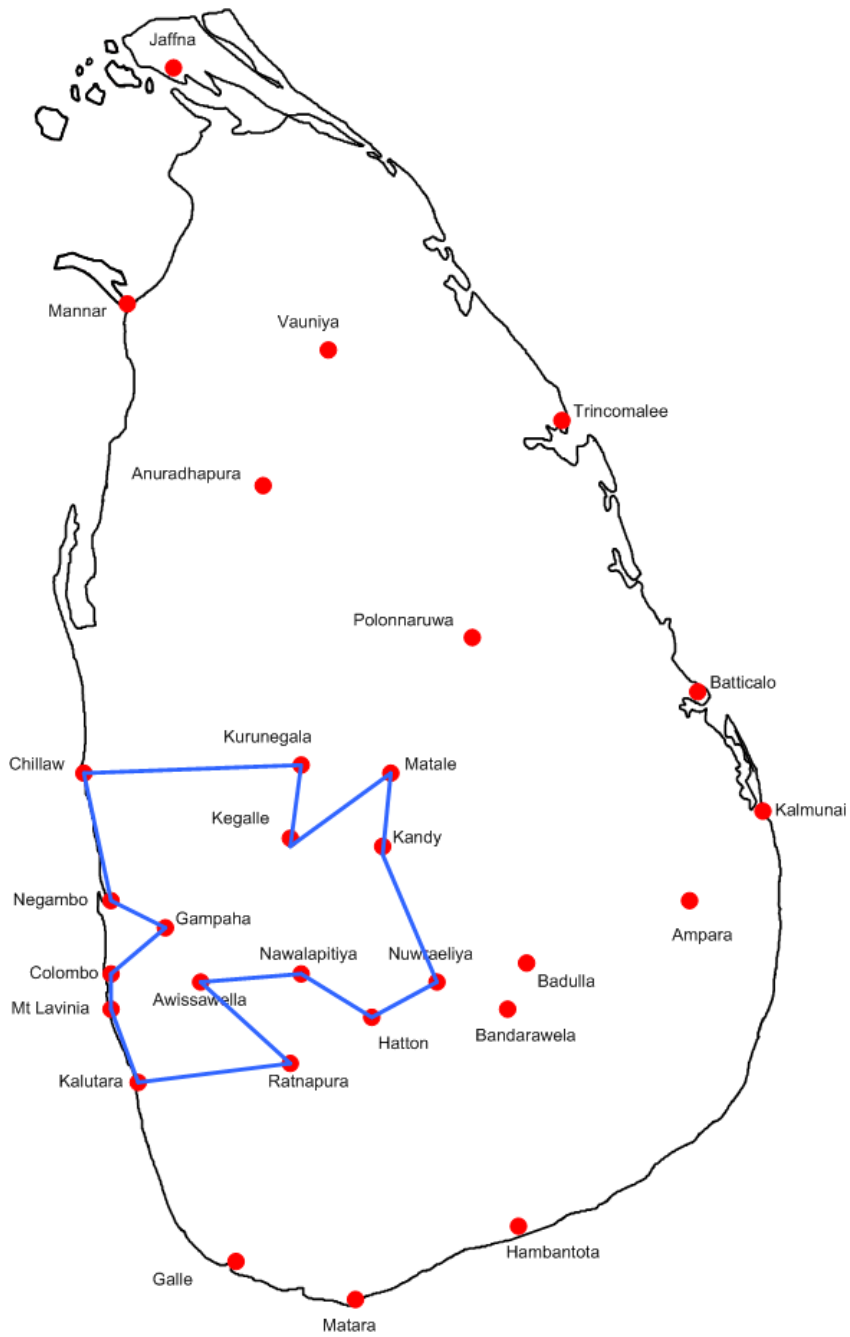
Source: OECD (2003), Development in Local Loop Unbundling.

Diagram of Bit stream (or wholesale) access



Source: OECD (2003, Development in Local Loop Unbundling).

Appendix 2 : Fiber Optic Network under SLT



Source: SLT.

For further clarifications please contact:

Policy & International Relation Division
Telecommunications Regulatory Commission of Sri Lanka

Email: [pir @trc.gov.lk](mailto:pir@trc.gov.lk)

011-2676206

011-2682564