Czech University of Life Sciences Prague

Facultyof Economics and Management

Department of Information Technologies

Bachelor Thesis

Mobile Internet and mobile communications

Sara Sarbazian Esfandabadi

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Department of Information Technologies

Faculty of Economics and Management

BACHELOR THESIS ASSIGNMENT

Sarbazian Esfandabadi Sara

Informatics

Thesis title

Mobile internet and communication

Objectives of thesis

The main objective of the project is to measure, model, and analyze mobile internet and communication between people all around the world. Major purposes are:

- To describe effects of this technology on people's life,
- To compare different models of internet mobile systems, and
- To evaluate future trends of this mean of communication in the world.

Methodology

The methodology of the thesis is based on study and analysis of specialized information resources. Theoretical, analytical and technical aspects of mobile communication and mobile internet, mobile systems and mobile technologies will be analyzed through secondary research. Own primary research will be made as comparison and analysis of mobile technologies.
Based on the synthesis of theoretical knowledge and the result of author's own research, the conclusion of the thesis will be formulated.

Schedule for processing

1. Preparation and study of specialized information resources, refinement of partial goals and selection of work process: 05/2012
2. Processing of collected information: 06 – 09/2012
3. Development of the case study, discussion and evaluation of results: 10 – 12/2012
4. Creation of final document: 01 – 02/2013
5. Submission of thesis and abstract: 03/2013

The proposed extent of the thesis

30 - 40 pages

Keywords

Information technology (IT), wireless and mobile (WM), wireless and internet, mobile internet , devices (MID), mobile communication and society.

Recommended information sources

1. Grayson, Mark, Shatzkamer, Kevin and Wieranga, Klaas. Building the Mobile Internet. Indianapolis : Cisco Press, 2011. p. 300. 978-1587142437.

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The Bachelor Thesis Supervisor

Ulman Miloš, Ing., Ph.D.

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doc. Ing. Zdeněk Havlíček, CSc.
Head of the Department

ČESKÁ ZEMĚDĚLSKÁ UNIVERZITA V PRAZE
Provozně ekonomická fakulta

prof. Ing. Jan Hron, DrSc., dr.h.c.
Dean

Declaration

I declare that I have worked on my bachelor thesis titled "Mobile Internet and Mobile communications" by myself and I have used only the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not break copyrights of any third person.

In Prague on _____

ACKNOWLEDGEMENT

For all the helps valuable notices and passion during fullfiling this assignment and writing my bachelor thesis i would like to thank the head consultant of my bachelor thesis Ing. Miloš Ulman, Ph.D. I also would like to thank all the teachers who have helped me to increase my knowlege during these three years of study.

Souhrn

Ve 21. století Internetová revoluce změnila životy lidí v mnoha různých aspektech. Mobilní Internet umožnil, aby lidé měli přístup k Internetu pomocí kapesního zařízení, které je známé jako mobilní telefon. Postupem času lidé začali být čím dál tím více závislí na mobilním Internetu jako hlavním nástroji usnadňující jejich každodenní život. Z tohoto důvodu se mobilní Internet stal důležitým předmětem pozorování v různých částech světa. Nicméně některé země, včetně Íránu, vytvořili lidem určitá omezení a předpisy v přístupu k tomuto prostředku komunikace.

Klíčová slova

Mobilní Internet, mobilní Internetová zařízení, mobilní komunikace a společnost, mobilní Internetové generace, telekomunikace, přístup lidí k mobilnímu Internetu, Internetové překážky, kvalita mobilního Internetu, schopnosti mobilního Internetu.

Summary

In 21 century the revolution of Internet has changed people's life in many different levels. Mobile Internet made it possible for the people to have access to the Internet through a pocket device known as cell phone. As the time goes on people have started to get more and more dependent on mobile Internet as a main toll for easing their daily life. Therefor the mobile Internet has become significantly important subject of study in different parts of the world. However some countries including Iran have created some regulations and restrictions in the path of people's access to this mean of communication.

Key Words

Mobile Internet, mobile Internet devices, mobile communication and society, mobile Internet generations, telecommunication, people's access to mobile Internet, Internet obstacles, quality of mobile Internet, skill of mobile Internet.

Table of Contents

1 Introduction

Nowadays mobile devices aren't just used for voice communication but they are starting to get used in many different aspects of our life and that was the main motivation to do some investigation about the progress of mobile devices in our today's life.

Basically a mobile terminal is a device that can receive and send data without the use of any wires. Different kinds of mobile terminals could be various devices such as cell phones, smartphones and even notebooks equipped with wireless modem technology. Nowadays people can not only send multimedia messages with their cell phones but mobile Internet plays a very significant role in our life today. We see people accessing Internet, checking their emails, browsing the web through their cell phones everywhere in today's life. This phenomenon didn't exist 15 years ago and now we see a huge wave of interest toward Internet mobile communication especially through social networking websites such as Facebook and Twitter.

In other words, a mobile communication is the type of communication that is independent from the location of communication. The degree of possible mobility depends on a few factors such as: network coverage, wireless access range and accessibility of the access point.

The main reason that a huge interest is seen in Internet mobile communications nowadays is the fact that today's technology allows high speed mobile Internet access though the mobile devices. We see 3G networks, 4G networks emerging in the market and all of these possibilities together open up a platform through which the users can communicate, read, listen, watch and work as they really like to, wherever they want, by means of mobile services designed to their interests and even their location.

2 Objective and methodology

2.1 Objectives

The aim of this thesis is going to cover the history of mobile communication during the time and also different types of mobile terminals which are nowadays used by the people such as phones, smartphones, laptops equipped with wireless modem technology and the aspects of its evolution and its impacts on every individual's life throughout the history.
The other issue which must be discussed in this thesis would be the advantages compared to disadvantages of this mean of communication in people's daily life compared to other means of communication.
Different standard generations of Internet mobile communication plays a very significant and important role in the whole process of evolution of this mean of communication, therefore the goal would be to also go through this issue as well and discuss every details of it and the revolution that it has caused in today's modern life.
People's use of mobile Internet based on quality of mobile Internet, obstacles and skills of using Internet has also been assessed in the form of practical part.

2.2 Methodology

This project is formed based on the author's own research and study of secondary data sources and also with the review of books and websites specifically related to Internet mobile communication domain.
Practical part of this thesis will be based on developing a linear regression model and statistical hypotheses tests. Data will be gathered through a questionnaire survey among mobile Internet users in Iran.
Based on the synthesis of theoretical knowledge and the result of author's own work, the conclusion will be formulated.

3. Literature review

3.1 What is mobile Internet?

Along with rapid growth of Internet usage and its technology, the technology of the mobile devices was also growing. Therefore it was quite inevitable to expect the combination of these two features of technology in one device enabling the users to access the web browser through a mobile device with a network connection.

The term of mobile Internet is the process of accessing the web through a mobile device such as smartphone and feature phone. There has been a huge and rapid development in the growth of Internet mobile. Mobile Web access has been accelerating with the rise since 2007 of larger multi touch smartphones, and of multi touch tablet computers since 2010. Both platforms provide better Internet access, screens, and mobile browsers or application-based user Web experiences than previous generations of mobile devices have done.

Smartphone have become so popular and have caused a huge wave of innovation and evolution of the mobile Internet technology. It has been estimated that soon the mobile devices are going to surpass the computers among the Internet users. The history of the mobile web can be traced back to over ten years ago, but development has skyrocketed in the past few years. (1)

3.1.1 The role of smartphones in mobile Internet

Smartphones are advanced mobile devices with special equipments and usages such as personal computers. A smartphone is actually a device that combines a cell phone with a PDA. Smartphones are being used as computers by more people. They are generally cheaper than computers and more accessible because of their portability.

One of the most important characteristics of the smartphones is the possibility of installing advanced processing programs and connecting to them but in other cell phones, the soft wares are already installed in the device by the producer which can only be upgraded by the producer or the operators. (2)

3.1.2 The role of PDAS in mobile Internet

PDA (personal digital assistant) is a handheld mobile device that has touchscreen technology and its main function is to organize personal tasks. It can include a memory card in order to store the data and it has ability to be synchronized through connection to a computer. The PDA was mainly meant to be for data centric applications; however the new generation of PDAs has the ability to connect to mobile services and Wi-Fi for voice call and Internet access. By the use of cell phone service provider, a user can subscribe to a service plan through a PDA device. (3)

3.2 Operating systems for mobile devices

Mobile operating system is a kind of operating system which is specific for portable cell phones and controls these devices. In fact it's very similar to but simpler than Microsoft windows or Linux or Mac OS operating systems on PC's. Many of them have equipped with different multimedia functions and different input possibilities. The most common version of these operating systems can be seen nowadays in smartphones, Digital assistants, PDAs and tablets. (4)

3.2.1 Android

Android is currently the most common mobile operating system which was designed by Google Company for smartphones and tablets. Android was designed based on Linux operating system.
The term Android itself means small humanlike robot controlled by a computer. Android was at first a small computer company founded by Andy Robin and 3 of his colleagues. Their initial activity was in the field of software and programs for the cell phones in which they had gained lots of credit.
In 2005 Google bought this company and elected Andy Robin as the one in charge with all the Android projects. The teams started their activities in designing a mobile operating system based on Linux platform and in 2007 Google announced a big revolution in the mobile industry. In this year association called OPEN HANDSET ALLIANCE was form by Google made of 30 different companies in the field of mobile and smartphone software and this issue soon drew the attention of some big mobile device producers such as Samsung, LG and HTC. In 2008, the first Android smartphone called T-mobile was made by HTC.
According to strategy Analytics, in 2012 more than 3.5 Android smartphones shipped for every iPhone. Android has shown quite a lot of growth. One of the great things about Android developer tools is they are free. This is one of the reasons why operating system is so popular on smartphones and tablets.
Some of android applications are pretty well known and popular such as Angry Birds, Car Locator application. (5)

3.2.2 IOS

IOS is the exclusive Apple company operating system which was presented in 2007 with iPhone by Apple Company. Steve Jobs made the boundaries clear from the beginning to prevent any problem regarding copy right issue, bought the IOS sign from CISCO.

IOS was designed based on the multi-touch user experience and is in details and depth very similar to Mac OS.
The Apple Company began the App store in 2008. App store has already had more than 725700 applications until February 2012.
The number of downloads have already exceeded 25 billion which shows that the number of IOS users are rapidly growing. Apple has also always assumed its products among the best if not the best products and this issue has increased the expectations of the users and possible customers for Apple products.
One of the main characteristics of IOS is its uniqueness. Other than the fact that IOS is exclusive only to Apple, Its applications are also only written for IOS and ARM. IOS is also the operating system used for Apple's iPod Touch and iPod tablet computer. It was the first handheld OS to offer routines that manage gesture inputs, such as using your fingers to "squeeze" an on-screen graphic into a smaller size. It also includes apps for stock quotes, maps, and weather reports. IOS is an open platform, which means that programs, called iPhone apps, can be created by third-party programmers.
The latest version of IOS is called IOS6 which has more than 200 updated features and functions. (6)

3.2.3 Windows phone

Windows phone operating system is Microsoft's cell phone operating system. The user interface of windows phone is called METRO which is different than the Windows mobile user interface. The latest version of windows phone is called windows phone 8 which is based on windows 8 platform and is predicted to be a serious competitor for the IOS and Android and has features such as multitasking, rooms, data sense, NFC and wallet etc.
One of the main features of this operating system is Zune for windows phone program which makes a great and different experience for the users in terms of sharing, downloading and transferring their personal multimedia files and applications between their mobile device and their PC's.

The number of windows phone users are much less than Android and IOS users currently. (7)

3.2.4 Symbian Operating System

Symbian is mobile operating system and computing platform designed for smartphones. Symbian is owned by some large cell phone companies such as Samsung, Sony Ericsson, Ericsson, Siemens and Nokia. Symbian OS was originally based on EPOC operating system and was mostly used for PDAs developed by Psion. Symbian OS began with version 6.0 following EPOC version 5.0.The last version of Symbian OS is 9.0.
Symbian programs are mainly written with programming languages such as java, WML script, Java script and a few other programming languages but the main used programming language in this operating system is C++. And it's one of the main reasons of its preciseness and its great speed.
Symbian has already introduced 2 user interfaces: Series 60 and UIQ. Series 60 model is for numerical keyboard high-end cell phones and smartphones that run on the Symbian operating system. UIQ (User Interface Quartz) is a software platform based on Symbian operating system and is able to customized pen-based touch screen mobiles. Symbian OS is designed to support a wide range of voice and data services in 2G, 2.5G, and 3G cellular systems, as well as multimedia and data synchronization. (8)

3.2.5 BlackBerry Operating System

The BlackBerry operating system was designed by research in motion (RIM) Company. RIM released its first BlackBerry smartphone in 2002. It supports multitasking, like other operating systems; it includes e-mail and Web browsing support, music management, video recording, calendar tools, and more. (9)

This operating system was mainly popular because of its electronic mail and with an easy-to-use QWERTY keyboard. The BlackBerry became the “gold standard” in smartphones for business professionals and executives in the US and Europe. The BlackBerry has the second largest market share of smartphones in the US.
Although this operating system is not as popular as Android and IOS but it has its own users. RIM has been blamed recently for being slow to introduce color screens and touch interfaces to its devices although this has been addressed with the release of its most current devices. (10)

3.3 Standards and evolutions of the mobile Internet networks

3.3.1 First generation

First-generation mobile systems used analogue transmission for speech services.
In 1979, the first cellular system in the world became operational by Nippon Telephone and Telegraph (NTT) in Tokyo, Japan. Two years later, the cellular epoch reached Europe. The two most popular analogue systems were Nordic Mobile Telephones (NMT) and Total Access Communication Systems (TACS). Other than NMT and TACS, some other analog systems were also introduced in 1980s across the Europe. All of these systems offered handover and roaming capabilities but the cellular networks were unable to interoperate between countries. This was one of the inevitable disadvantages of first generation mobile networks.
The handsets in this technology were quite expensive (more than $1000).
(11)

3.3.2 Second generation or 2G

The first “modern” network technology on digital 2G (second generation) cellular technology was launched in 1991 in Finland on the GSM standard. In 2G networks the voice was transferred digitally rather than analogue. One of the most important standard systems used in 2G networks was GSM. The 2 G networks could transfer a limited amount of multimedia data. Even a simple Nokia 1101 cell phone could access the web in its black & white screen but it was made possible for very limited amount of data volume.

Key 2G systems in these generations included GSMs (Global Systems for Mobile Communications), TDMA IS-136, CDMA IS-95, PDC (Personal Digital Cellular) and PHSs (Personal Handy Phone Systems).

IS 54 and IS 136 (where IS stands for Interim Standard) are the second generation mobile systems that constitute D-AMPS. IS-136 added a number of features to the original IS-54 specification, including text messaging, circuit-switched data (CSD) and an improved compression protocol. CDMA has many variants in the cellular market. CDMA One (IS-95) is a second generation system that offered advantages such as increase in coverage, capacity (Almost 10 times that of AMPS), quality, an improved security system, etc. GSM was first developed in the 1980s. It was supposed to build a digital system based on a narrowband TDMA solution and having a modulation scheme known as GMSK. The technical fundamentals were ready by 1987 and the first specifications by 1990. By 1991, GSM was the first commercially operated digital cellular system with Radiolinja in Finland. With features such as pre-paid calling, international roaming, etc., GSM is by far the most popular and widely implemented cellular system with more than a billion people using the system (by 2005). (12)

3.3.2.1 GSM

GSM (Global System for Mobile Communications) was the first commercially operated digital cellular system. Developed in the 1980s through a Pan-European initiative, The European Telecommunications Standards Institute (ETSI) was responsible for GSM standardization.

Today it is the most popular cellular technology. By mid-2009, GSMs have a user base of over 3.9 billion in more than 219 countries and territories worldwide; with a market share of more than 89% (the global wireless market is more than 4.3 billion). In addition, GSM has the widest spectral flexibility for any wireless technology – 450, 850, 900, 1800 and 1900 MHz bands; tri- and quad-band GSM phones are common. Thus it is rare that users will ever travel to an area without at least one GSM network to which they can connect.

GSM uses TDMA (Time Division Multiple Access) technology and is the legacy network leading to the third generation (3G) technologies, the Universal Mobile Telecommunication System (UMTS) (also known as WCDMA) and High Speed Packet Access (HSPA).

GSM differs from its predecessors in that both signaling and speech channels are digital and thus is considered a second generation (2G) mobile phone system.

GSM is a very secure network. All communications (voice and data) are encrypted to prevent eavesdropping. GSM subscribers are identified by their Subscriber Identity Module (SIM) card. This holds their identity number and authentication key and algorithm. Thus it's the card rather than the terminal that enables network access, feature access and billing. (12)

3.3.3 Third generation or 3G

2G networks were considered a big step in the process of mobile communication network evolution. However, in the early 2000 there was a big demand to come up with a network that could combine Telephony, Internet, and multimedia into one single device, Therefore the 3G (UMTS) network was developed. The 3G networks had much higher performance from many aspects in comparison to the previous generation of networks.
The International Telecommunications Union defined the third generation (3G) of mobile telephony standards IMT-2000 to facilitate growth, increase bandwidth, and support more diverse applications. (12)

3.3.3.1 UMTS - Universal Mobile Telecommunications System

One of the most populer cell phone thechnologies of the 3G network is UMTS (Universal Mobile Telecommunications System). It's basically a voice and high-speed data technology which uses W-CDMA (Wideband CDMA) as its fundamental radio technology standard.
The underlying concept on which the UMTS is built is derived from GSM and basically all the UMTS devices support GSM. Therefore, UMTS is also marketed as 3GSM, based on Internet Protocol (IP) technology with user-achievable peak data rates of 350 kbps.

The main benefits of UMTS include :

1. High spectral efficiency for voice and data.

2. Simultaneous voice and data for users, high user densities supportable with low infrastructure costs.

3. High-bandwidth data applications support and migration path to VoIP in future.

In UMTS, Operators can also use their entire available spectrum for both voice and high speed data services.
UMTS networks can be upgraded with high speed Downlink Packet Access (HSDPA), sometimes known as 3.5G. Currently, HSDPA enables downlink transfer speeds of up to 21 Mbs. (12)

3.3.3.2 EGPRS

Another 3G technology which enhanced data transmission can be allowed is called EGPRS (Enhanced GPRS).
The enhancement built on the top of the GPRS refers to EDGE ('Enhanced Data Ratesfor GSM Evolution' – a new radio interface technology with enhanced modulation) which isused to transfer data in a packet-switched mode on several times lots, as an extension on top of the standard GSM. This finally results in an increase in data rates of almost three-fold.
The most significant characteristic of EDGE is that it doesn't need any changes in software nor the hardware to be applied to the GSM corenetworks. No new spectrum is required and thus EDGE can effectively be launched under the existing GSM license.
EDGE was first deployed by Cingular (now AT&T) in the United States in 2003. By mid- 2009 there were more than 440 GSM/EDGE networks in 181 countries, from a total of 478 mobile network operator commitments in 184 countries. (12)

3.3.3.3 CDMA

The major competing technology to GSM is called Code Division Multiple Access (CDMA) (Originally known as IS-95).
Currently there is cdma2000 and its variants like 1X EV, 1XEV-DO and MC 3X. The technology is used in ultra-high-frequency (UHF) cellular telephone systems in the 800-MHzand 1.9-GHz bands. CDMA employs spread-spectrum technology along with a special coding scheme and is characterized by high capacity and a small cell radius. CDMA was originally developed by Qualcomm and enhanced by Ericsson. CDMA was adopted by the Telecommunications Industry Association (TIA) in 1993.

In September 1998, only three years after the first commercial deployment, there were 16 million subscribers on CDMA One systems worldwide. By mid-2009, there were around 500 million subscribers on CDMA (including variants).
Another variant of CDMA is TDS-CDMA. Time Division Synchronous Code Division Multiple Access (TD-SCDMA) or UTRA/UMTS-TDD, also known as UMTS-TDD or IMT 2000 Time-Division, is an alternative to W-CDMA. Although the name gives an impression of simply a channel access method based on CDMA, its applicability is to the whole-air interface specification. The technology is promoted by the China Wireless Telecommunication Standards group (CWTS) and was approved by the ITU in 1999. It is being developed by the Chinese Academy of Telecommunications Technology, Datang, and Siemens AG, and is China's country's standard of 3G mobile telecommunication. However, it is expected to remain as a niche market technology as it lacks a large ecosystem and would muster limited research and development. In addition, necessary competition and economies of scale to reduce investments and generate demand might be missing, besides the fact that its delayed arrival has given rival 3G technologies a good head start. TD-SCDMA came under spotlight as one of the technologies used in the 2008 Olympics at Beijing, China. (12)

3.3.4 Forth generation or 4G

4G is the fourth generation of mobile phone mobile communication technology standards which has evolved in the path of high volume data transferring and comes as a revolutionized feature of 3G networks. The main feature of 4g networks is to get close to the point that would make it possible to transfer a relatively same amount of data as in wired networks, to make this possible IP comes in hand.
The 4G network can be used as a network to transfer data related to amended mobile web-access, IP telephony, gaming services, high-definition mobile TV, video conferencing, 3D television, and cloud computing.

The main 4G standards include Mobile WiMAX and LTE (Long Term Evolution). (13)

3.3.4.1 LTE

LTE (Long Term Evolution) was made by a collaboration of national and regional telecommunications standards bodies known as the Third Generation Partnership Project (3GPP) and is known in full as 3GPP Long Term Evolution in 2004. LTE was developed from an earlier 3GPP system which was known as the Universal Mobile Telecommunication system (UTMTS), which originally evolved from the Global System for Mobile Communications (GSM). (14)
The LTE technology is supposed to offer a number of advantages in comparison to other wireless technologies. These advantages cover increased performance attributes, high peak data rates and low latency and greater efficiencies in using the wireless spectrum.

- High spectral efficiency
- Very low latency.
- Support of different bandwidth.
- Simple protocol architecture.
- Compatibility and interworking with earlier 3GPP releases.
- Interworking with other systems, e.g., cdma2000.
- FDD and TDD in a single radio access technology.
- Efficient multicast/broadcast. (13)

3.3.4.2 Mobile WiMAX

Globally Interoperability for Microwave Access (WiMAX) refers to IEEE 802.16, a standard developed by the Institute of Electrical and Electronics Engineers Inc. (IEEE) for the global deployment of broadband Wireless Metropolitan Area Networks. WiMAX is accessible in two variations – fixed and mobile. Fixed WiMAX, which is based on the IEEE 802.16-2004 standard, is ideally developed for delivering wireless, last-mile access for fixed broad band services.

It is similar to DSL or cable modem service. Mobile WiMAX, which is based on the IEEE 802.16e standard, supports both fixed and mobile applications while making it possible for the users to improve performance, capacity, and mobility.

Mobile WiMAX provides the users with higher data rates with Orthogonal Frequency Division Multiple Access (OFDMA) support and introduces different key features which might be need for delivering mobility at vehicular speeds with Quality of Service (QoS) comparable to broadband access alternatives.

Several features that are used to increase the quality of data throughput are Adaptive Modulation and Coding (AMC), Hybrid Automatic Repeated Request (HARQ), fast scheduling, and bandwidth efficient handover. Mobile WiMAX is nowadays Time Division Duplexing (TDD) operating at 2.5 GHz. Mobile WiMAX has higher resistance to multipath and self-interference and provides orthogonal uplink multiple accesses with frequency-selective scheduling and fractional frequency reuse. (13)

3.3.4.3 Wi-Fi

Wireless Fidelity (Wi-Fi)-based system is used to make the broadband wireless possible.

It is based on the IEEE 802.11 family of standards and is basically a Local Area Networking (LAN) technology made to provide in-building broadband coverage. Nowadays Wi-Fi systems are based on IEEE 802.11a/g and support a peak physical layer data rate of 54 Mbps and typically provide indoor and outdoor coverage over a few thousand square meters, which make them suitable for enterprise networks and public hot spot scenarios such as airports and hotels.

Wi-Fi supports remarkably higher peak data rates in comparison to 3G systems, regarding the fact that it operates over a larger 20MHz bandwidth. The inefficient Carrier Sense Multiple Access (CSMA) protocol used by Wi-Fi, along with the interference constraints of operating in the license-exempt band, is supposed to significantly reduce the capacity of outdoor Wi-Fi systems. Further, Wi-Fi systems are not designed to support high-speed mobility.

A major benefit of Wi-Fi over WiMAX and 3G is the wide availability of terminal devices. A huge majority of laptops shipped today have a built-in Wi-Fi Interface. Wi-Fi interfaces are now also being built into different devices, including Personal Data Assistants (PDAs), cordless phones, cellular phones, cameras, and media players. This will make it possible to have an easy use of the services of broadband networks using Wi-Fi. As with 3G, the capabilities of Wi-Fi are being increased to support even higher data rates and to provide better QoS support. In particular, using multiple antenna spatial multiplexing technology, the emerging IEEE 802.11n standard will support a peak layer 2 through put of at least 100 Mbps. It is expected that MIMO antenna use multiple antennas to coherently resolve more information than possible using a single antenna. (13)

3.4 Telecommunication and the Internet

3.4.1 Internet users by region

Currently there are over 2.7 billion Internet users in the world. It means that39% of the world's Population use Internet. In the developing countries 31% of population is online, compared with 77% in developed countries.
In the first place is Europe with 75% of its population online and in the second place come America with 61% of its population.
In Africa, 16% of people are using the Internet, which would practically be only half the penetration rate of Asia and the Pacific.

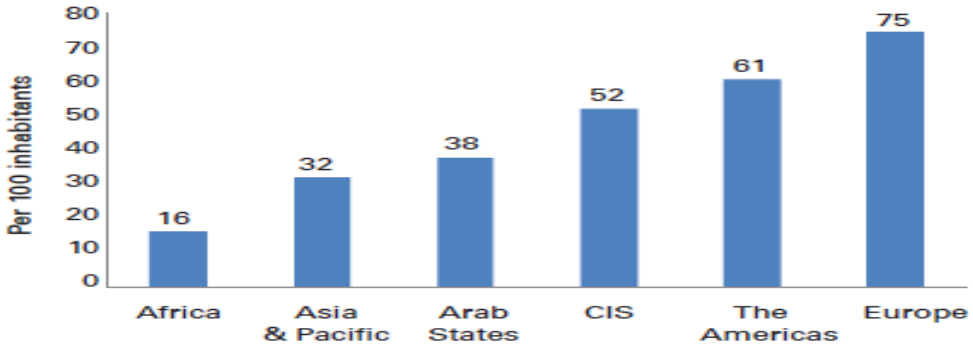


Chart 1: Percentage of Internet users based on their regions

Source: (15)

3.4.2 Internet users by gender

Men have got the lead in being online compared to women. 37% of all women are online, compared with 41% of all men in the globe. This corresponds to 1.3 billion women and 1.5 billion men.
The developing world is home to about 826 million female Internet users and 980 million male Internet users. The developed world is home to about 475 million female Internet users and 483 million male Internet users.

This means that in the developed countries there is a gap of 2% between the female and male internet users while this number is 16% in developing countries.

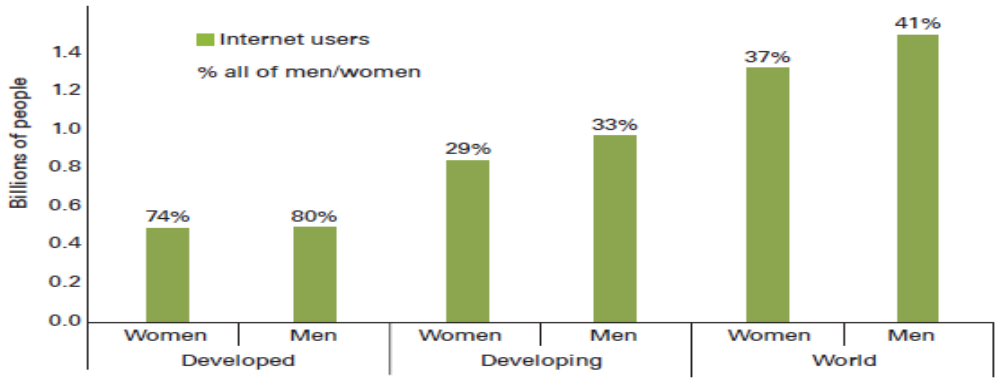


Chart 2*:* Internet users based on their gender in developed and developing countries

Source: (16)

3.4.3 Internet access in Iran

From the first appearance Internet in Iran, the access to the Internet has been growing. Based on the surveys about the Internet usage factor done in 2008, Iran stands in the fourth place in Middle East. Based on this survey there are a number of 23 million Internet users in Iran. In 2011 another survey showed that the number of Internet users in Iran has grown to 32.200.000 out of each 700,000 are high speeds Internet users.

In Iran there are around 6000 Internet providers. The lowest cost Internet in Iran is a low speed dial-up network connection. The price of high speed Internet varies based on connection speed and bandwidth. The Internet price in Iran is the highest in the world based on the speed and the download amount.

The ADSL connection became a possibility for Iranian Internet users. Some of the Internet provider began to provide users with wireless Internet connections such as WiMAX technology. Since 2007 three main telecommunication companies (Hamrah Aval, Taliya, and Iran cell) began to provide the users with mobile Internet connection. These companies provide Internet as GPRS technology. (17)

3.4.4 Internet filtering in Iran

The issue of filtering the Internet is taken very serious in Iran. The main governmental authority in this field is the Supreme Council of the Cultural Revolution.
The filtering of Internet in Iran includes: applying structured censorship, limitation and observation on access to the content of web pages and the use of Internet services for Iranian users. Filtering in Iran is applied through the laws passed in the Islamic Consultative Assembly and contains a wide content of material, especially political contents. Although Internet filtering has a legal aspect in Iran , but it does not hold a defined and clear meaning in terms of its application from the political and social points of view.
In 2013 there was a report published by the Reporters without Borders in the global day of fighting against Internet censorship which said that Iran, along with China, Syria, Bahrain, Vietnam are the five countries call as the Internet enemy. (18)

3.4.5 Telecoms & the Internet in EU

From landlines to mobiles to broadband, telecommunications networks and services play a very important role in today's world of information. The EU's policy leaves more room for competition, motivates innovation, and increases consumer rights within the EU single market.
In recent decades, EU action for telecommunications has led to greater consumer choice, falling call costs, and higher standards of service, through

- A whole set of sound regulatory for electronic communications in which it promotes competition and consumer rights;

- Advancing investment in broadband networks which support high speed Internet;

- Supporting wireless technologies, such as 3G and LTE, through the radio spectrum policy program;

- Protecting mobile users from high roaming charges when travelling in the EU or internationally;

- Participating and leading international discussions on Internet development and governance. (19)

3.4.5.1 Open Internet

The main purpose of open Internet is to let the Internet users access the content, applications and services of their desire, and promotes competition among network, services and content providers. Over the past 20 years, the Internet connectivity market has been the ground for a huge level of innovation and facilitated cross-border trade through e-commerce and it has helped to further develop the internal market and contributed to the advance of entry barriers around the globe.

But the Internet owes much of its success to the fact that it is open and easily accessible. Any content providers have had the chance to try their ideas and their relative value in the marketplace. Since the required investment, such as buying a domain name, renting a space on a server and implementing its application or software has been relatively low, new services have been made available to consumers: browsing, mailing, Peer-to-Peer (P2P), instant messaging, Internet telephony (Voice over Internet Protocol ‘‘VoIP’’), videoconference, gaming online, video streaming, etc. This development has taken place mainly on a commercial basis without any regulatory intervention.

The openness of the Internet is closely linked to the application of the principle of network neutrality or net neutrality**.** The Electronic Communications' Framework defines it as the ability for consumers to "access and distribute information or run applications and services of their choice." (20)

3.4.5.2 High Speed Broadband

There have been a lot of broadband targets estimated to be achieved for Europe. DAE or Digital Agenda for Europe is the name of an agenda, in which the goal is to:

- Create basic broadband for all by 2013.
- Provide Next Generation Networks (NGN) (30 Mbps or more) for all by 2020 all across the Europe with 50% of households having 100 Mbps subscriptions or higher.

In order to achieve these goals there are a few action need to be done by the European Commission. There should be a mutual cooperation with Member States to design national broadband plans. Make rules providing a good environment in which broadband investment can take place helping to complete single market in network communications. The European Commission finances broadband projects through the structural Funds. The Commission has proposed the Connecting Europe Facility (CEF); however, following the agreement on the future EU budget at European Council in February 2013, the Connecting Europe Facility will primarily finance pan-European digital services: cross-border projects for European citizens, enterprises and public administrations. (21)

3.4.6 Digital divide

It's a term which refers to the distance between people who have access to the digital and informational technology and those who have very limited or no access to this technology. In other words it's the lack of balance in physical access to technology or the lack of sources or skills to access technology. In other words digital divide is the unequal access of some parts of the society to information technology. Digital divide can be based on gender, income or race of the members of society. In addition to the digital divide in a society, the existence of digital divide between the countries is called the global digital divide.

It can be said that digital divide to some instance is the sign of the threatening of powers which have divided the world into different parts from the point of access to information technology.
It can be also defined as the inequality of different countries in the way that they use information technology to advance from the economic and social point of view. Some argue that these powers have caused many countries to remain undeveloped. (22)

3.4.6.1 Consequences of the digital divide

Digital divide will have a lot of effects in electronic commerce, economics and education. This results on poverty and being back warded in the developing countries. The Strengthening of this divide means getting more distant for countries in terms of economy, politics, culture and society which results in imposing the produces and culture of the developed countries to the developing countries to weaken their beliefs, and cultural values.
Digital divide in general is the reflection of poverty lacks of education and other social needs. In this definition it is supposed that computer and other technologies are essential but no one can make the societies to fill the digital divide unless education and poverty would become the center of attention. (23)

3.5 Growth of mobile Internet traffic

3.5.1 The Mobile Internet traffic in 2012-2017

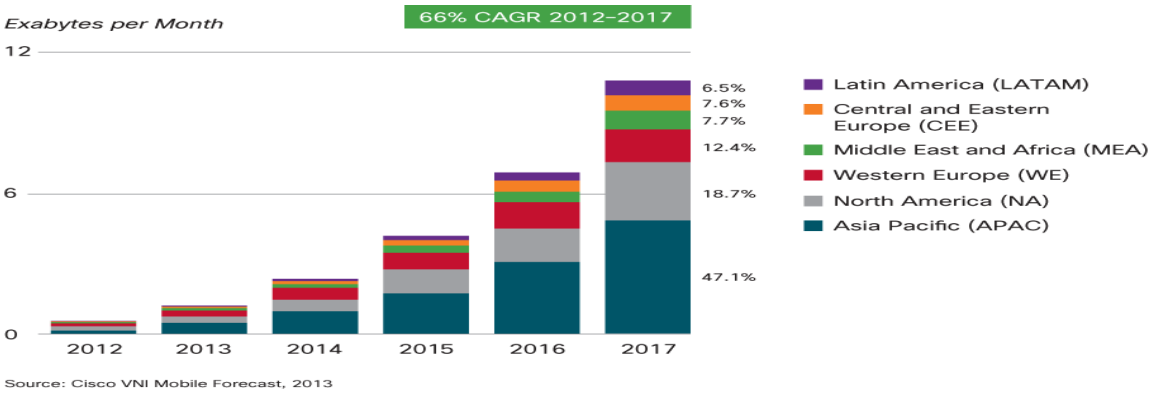
The number of Internet users in 2012, was 2.3 billion which would represent about 32% of the world's population; however, by 2017, it is estimated that there will be about 3.6 billion Internet users which would practically mean more than 48% of the world's anticipated population (7.6 billion).

Global mobile data traffic grew 70 percent in 2012, and growth rates varied widely by region. Western Europe, in particular, experienced a slowdown in mobile data traffic, with growth of 44 percent in 2012, substantially lower than the global average. Mobile data traffic in Asia Pacific, on the other hand, grew at 95 percent in 2012, a near-doubling of traffic. Overall mobile data traffic is expected to grow to 11.2 exabytes per month by 2017.

The Asia Pacific and North America regions will account for almost two-thirds of global mobile traffic by 2017, as shown in Chart 3 Middle East and Africa will experience the highest CAGR of 77 percent, increasing 17.3-fold over the forecast period. Asia Pacific will have the second highest CAGR of 76 percent, increasing 16.9-fold over the forecast period.

The emerging market regions of Latin America and Central and Eastern Europe will have CAGRs of 67 percent and 66 percent respectively, and combined with Middle East and Africa will represent an increasing share of total mobile data traffic, up from 19 percent at the end of 2012 to 22 percent by 2017. (24)

Chart 3: Global Mobile Data Traffic Forecast by Region



Source: (25)

3.5.2 Smartphones Lead Traffic Growth

Chart 4 shows the devices responsible for mobile data traffic growth. Laptops generate a disproportionate amount of traffic today, but smartphones and newer device categories such as tablets and M2M nodes will begin to account for a more significant portion of the traffic by 2017. (24)

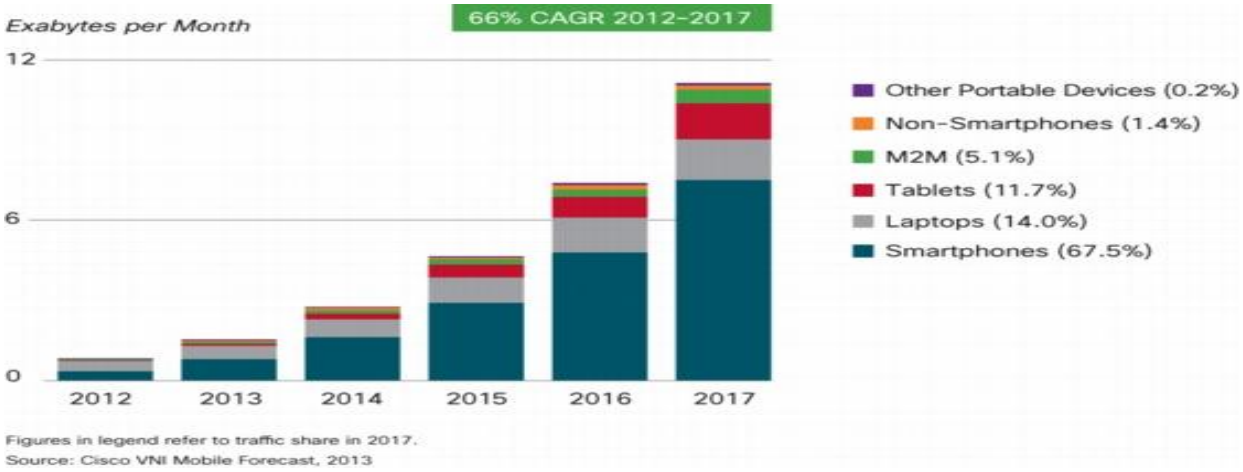


Chart 4: Devices for mobile Interne

Source: (26)

4. Practical part

The practical part is about mobile Internet access in Iran. To measure the influence of skill of Internet usage, quality of mobile Internet and obstacles of Internet, an online questionnaire was completed by 102 persons in the period from 24 September 2013 until 29 September 2013. From the survey, gathered data will be processed with SPSS statistic software of IBM.

4.1 Results of the Survey

Tables 1 to 3 show the gender, age and their education level.

Male	61
Female	41

Table 1: Gender

Source: Own input and calculation.

0-20	28
21-30	32
31-40	22
41-50	11
51-60	9

Table 2: Age

Source: Own input and calculation.

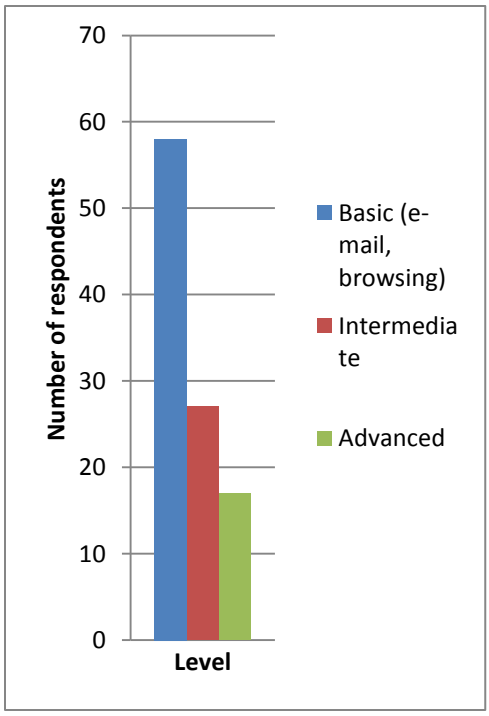
Table 3: Education

Elementary	Secondary	Vocational	Bachelor	Master	Doctoral
0	23	18	37	14	10

Source: Own input and calculation.

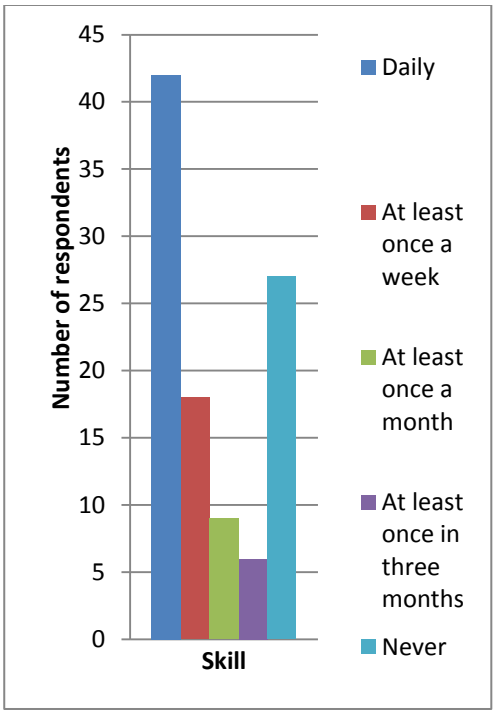
Most of the participants rated their skills as basic in use of Internet with knowledge of use of email and Internet browsing (see Chart 5). About 40 % of the participants expressed that they use Internet on a daily basis followed by 28% of the users never used mobile Internet (See Chart 6).

As Chart 7 shows the majority of the participants don't know the advantage of mobile Internet over fixed line Internet.
As Chart 8 shows the majority of the participants recognize worse availability of the mobile Internet as a major disadvantage over fixed line internets, which means that mobile Internet doesn't cover all parts of Iran.
As it was anticipated around 50% of the participants consider the quality of the mobile Internet communication as not sufficient which means that the structure of the Internet facilities in Iran needs a lot of work (see Chart 9).
Chart 10 shows most of people can see obstacles in using Internet from the government and local authority.



Source: Own input and calculation.

Chart 5: Skill of Internet usage



Source: Own input and calculation.

Chart 6: Level of Internet usage

Source: Own input and calculation.

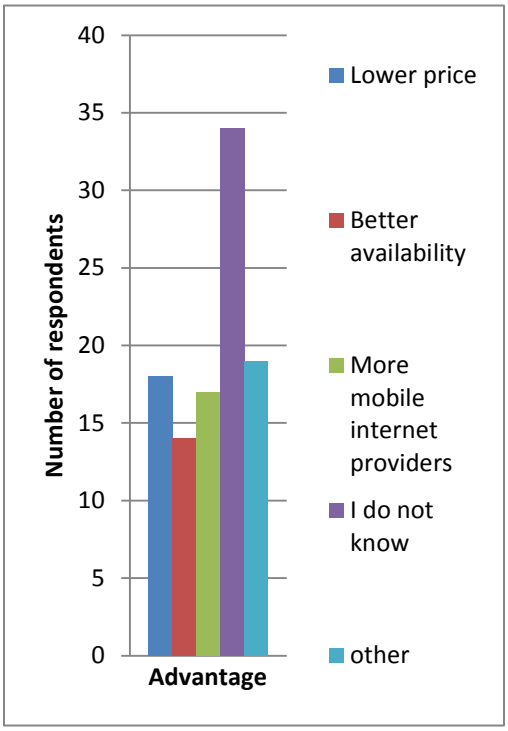


Chart 7: Advantage of mobile Internet

Source: Own input and calculation.

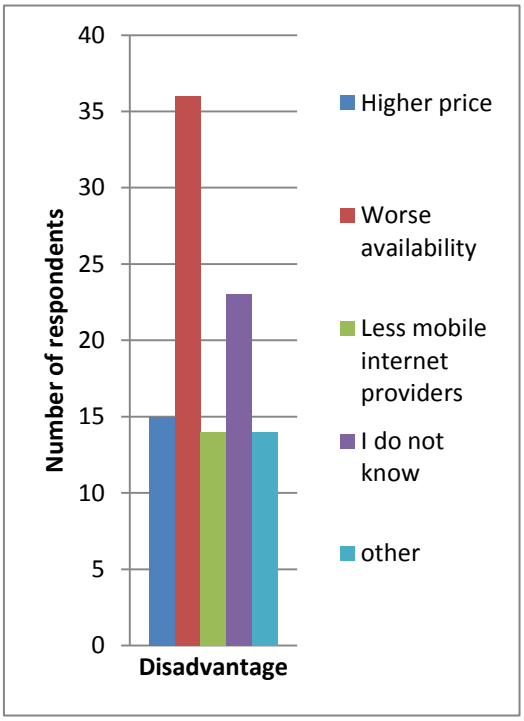


Chart 8: Disadvantage of mobile Internet

Source: Own input and calculation.

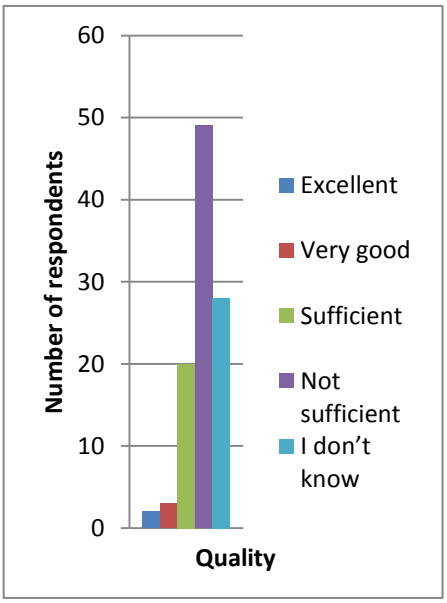


Chart 9: Quality of mobile Internet

Source: Own input and calculation.

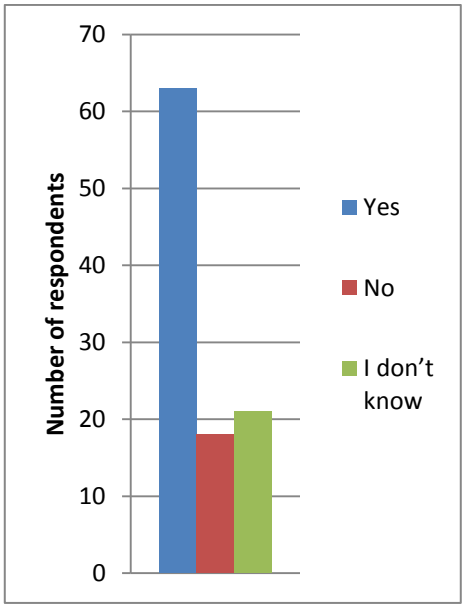


Chart 10: Obstacles in mobile Internet

From 68 persons that see restrictions in using Internet from the government 26 persons believe blockade of particular web pages has priority to the other restrictions.

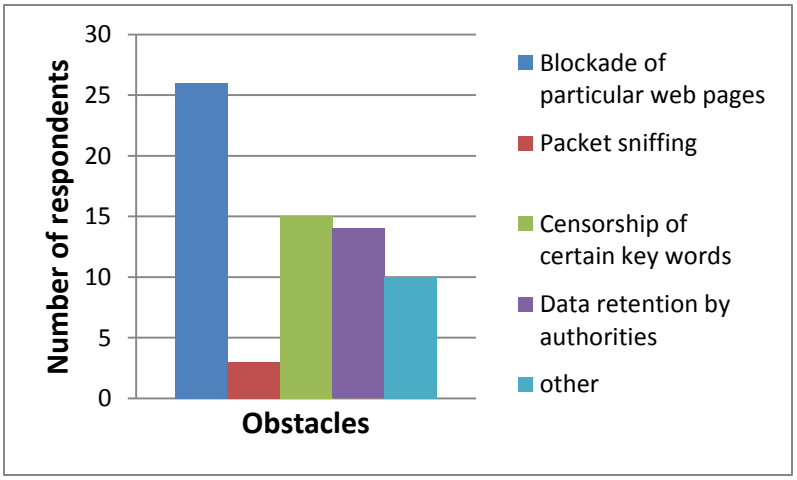


Chart 11: Internet Obstacles in Iran

Source: Own input and calculation.

Most of the participants disagree with access restriction for the users (See Chart 12).

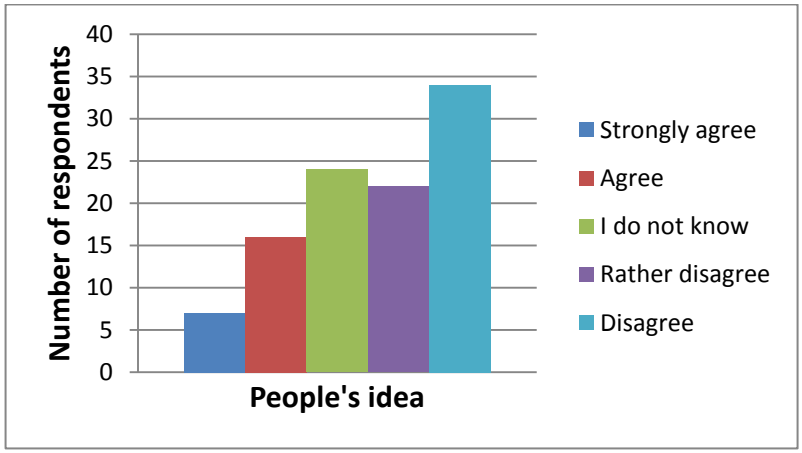


Chart 12: People's idea about Internet restriction

Source: Own input and calculation.

Most of the participants believe that the government plays an important role in manipulation of mobile Internet by blockage of particular web pages and censorship of certain key words or data retention (See Chart 13). This is another testimony to what we constantly hear about the Internet blockage and filtering in Iran.

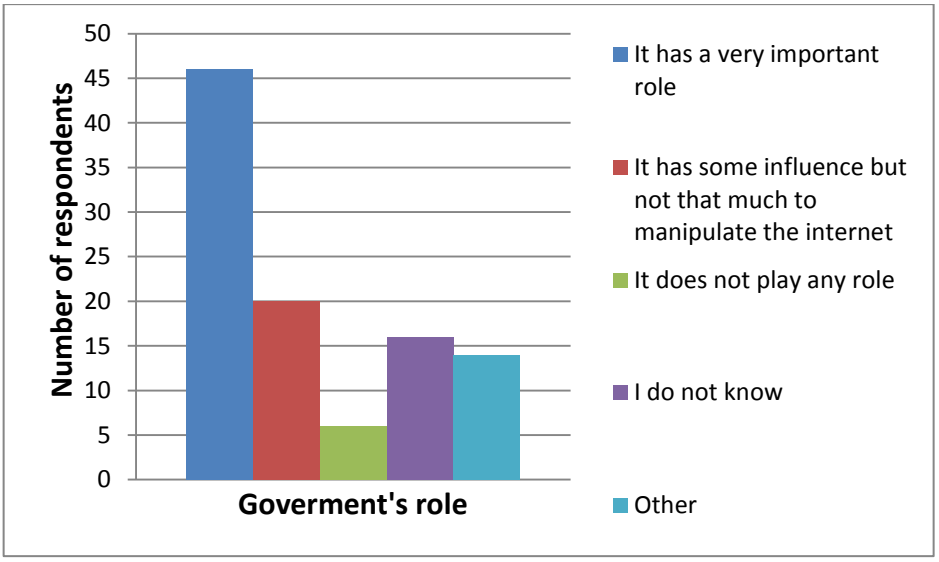


Chart 13: Government's role and regulation

Source: Own input and calculation.

4.2 Hypothesis testing

By using SPSS software of IBM, the function of statistical relationship will be created with the correlation equation: **Y= a*X1 + b*X2 + c*X3 + const.**
Where Y user's usage of mobile Internet, X1, X2, X3 are independent factors as following of level of Internet usage (X1), quality of mobile Internet (X2) and obstacles in using Internet (X3).
A, b, c and const. are the correlation coefficients, which indicate the statistical relationship between independent and dependent variables.
For the hypothesis testing, p-value stands for the probability level of each correlation coefficient in the equation. If the p-value is higher than 0.05 (5%), the null hypothesis will be accepted as the statement "there is no statistically significant relationship between two variables"; however, if it is less than 0.05 (5%); the null hypothesis will be rejected as the statement "there is a statistically significant relationship between two variables".

4.2.1 Collected data

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Level of Internet usage	102	2.00	1.00	3.00	1.5980	.76118	.579
Quality of mobile Internet	102	4.00	1.00	5.00	3.9608	.87791	.771
Obstacles	102	2.00	1.00	3.00	1.5784	.80144	.642
Valid N (list wise)	102						

Table 4 Descriptive statistics

Source: Own input and calculation.

4.2.2 Generated model

Using the SPSS program of IBM, data collected from the questionnaire survey has been successfully imported and processed.
The table below is the Coefficient table with the dependent variable is the time of using mobile Internet in Iran in 3 months of respondents and independent variables are level of Internet usage, quality of mobile Internet and obstacles of Internet in Iran. From these data, the model is generated as the function below:

Y= 15.258*X1 + 1.961*X2 – 11.679*X3 + 25.782

Y … the dependent variable of user's usage of mobile Internet.
X1 … the indicator of level of Internet usage.
X2 … the indicator of quality of mobile Internet.
X3 … the indicator of obstacles in Internet.

Table 5: Coefficients

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	25.782	23.481		1.098	.275
Level of Internet usage	15.258	5.385	.272	2.833	.006
Quality of mobile Internet	1.961	4.576	.040	.429	.669
Obstacles	-11.679	5.074	-.219	-2.302	.023

a. Dependent Variable: Mobile Internet usage in 3 months.
Source: Own input and calculation.

4.2.3 Verification of Statements

The verification of the paper is based on the comparison of each coefficient p-value with a significant level of 5%. In each statement of coefficient, null hypothesis is considered as equivalent to 0 (coefficients a, b, c = 0).
If p-value < 0.05; H0 is rejected. In contrast, if p-value > 0.05, H0 is accepted.

S1: The Level of Internet usage has a significant impact on the use of mobile Internet for each user in Iran(X1 <–> Y).
H0: a = 0; p-value = 0.006 < 0.05 => H0 is rejected.
After comparison of the p-value and significant level, the null hypothesis is rejected. It means the coefficient of indicator of the level of Internet usage has a statistically significant influence on the use of mobile Internet for each user in Iran. The parameter has a positive sign, which points out that the Level of Internet usage has a positive impact on the use of mobile Internet for each user in Iran.

S2: The Quality of mobile Internet has a significant impact on the use of mobile Internet for each user in Iran(X1 <–> Y).
H0: a = 0; p-value = 0.669 > 0.05 => H0 is accepted.
In this case, the p-value was equivalent to 0.669, which was bigger than 0.05. Therefore, there was no statistically significant relationship between the quality of mobile Internet and use of mobile Internet for users in Iran.

S3: The obstacle in Internet has a significant impact on the use of mobile Internet for each user in Iran (X1 <–> Y).
H0: a = 0; p-value = 0.023 < 0.05 => H0 is rejected.

After comparison of the p-value and significant level, the null hypothesis is rejected. It means the coefficient of indicator of obstacles in Internet has a statistically significant influence on the use of mobile internet for each user in Iran. The parameter has a negative sign, which points out that the obstacles of Internet have a negative impact on the use of mobile Internet for each user in Iran.

4.2.4 Summary

With the result from the above table and the verification of the research statements, it was concluded that obstacles of Internet in Iran had a negative impact, and the level of Internet usage and quality of mobile Internet had a positive impact on the use of mobile Internet for users in Iran. On the other hand, there was no statistically significant influence between the user's usage of Internet and the quality of mobile Internet in Iran.

With increase of level of Internet usage(X1) and quality of mobile Internet (X2) and decrease of obstacles of Internet in Iran (X3), use of mobile Internet (Y) increases. And with decrease of level of mobile Internet (X1) and quality of mobile Internet (X2) and increase of obstacles of Internet in Iran (X3), use of mobile Internet in Iran (Y) decreases.

5 Results and discussion

5.1 Comparison of Iran and EU

Based on our survey and overall conclusion from the thesis, There are many differences in Internet and the access to Internet between Iran and Europe .In fact there are a lot of negative characteristics that the Internet in Iran has in comparison to EU which includes the lack of speed in Internet, continues imbalances in the condition of Internet. Blockade of some web pages and high Internet price.

Access to the Internet is not the same in all parts of Iran. For example people in small and distant cities do not have any access to the Internet since there is no Internet coverage there.

That is while all the Europe is covered with broadband Internet and the mobile broadband networks (2G, 3G, 4G) are accessible in 99.4 % of EU.

Iran has an influence rate of 26% of the users connected to the Internet from which 4% are the users of high speed Internet with fixed line like ADSL and about 1.4 % with wireless technology as WIMAX and mobile. (27)

5.2 Future trends

It is anticipated that with the wave of globalization and the current political situation in Iran and the willingness of the Iranian people to have access to free and high speed Internet without any censorships and restrictions like the developed countries, The Internet in Iran will step by step move toward the path of freedom and stability covering all parts of the country.

6 Conclusion

The overall conclusion of the whole survey shows that Iran as a developing country needs many fundamental effort in building its structure of network coverage in Internet access. The majority of the Iranians are fed up with the restriction and censorship which put them apart from the rest of the world. Therefore there is a strong urge especially from the young and educated generation to the government to achieve their right of free Internet.

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8 List of Charts

9 List of Tables

10 Questionnaire

1. You are:

- Male
- Female

2. Your age is: …….

3. Your achieved education is:

- Elementary
- Secondary
- Vocational/Professional
- Bachelor degree
- Master degree
- Doctor degree

4. How would you rate your skills using Internet:

- Basic (e-mail, browsing)
- Intermediate (shopping online, electronic transactions)
- Advanced (blogging, maintaining website)

5. How often do you use mobile Internet in daily life?

- Daily
- At least once a week
- At least once a month
- At least once in three months
- Never

6. Which advantages you see in mobile Internet over fixed line Internet?

- Lower price
- Better availability
- More mobile Internet providers
- I do not know
- Other…….

7. Which disadvantages you see in mobile Internet over fixed line Internet?

- Higher price
- Worse availability
- Less mobile internet providers
- I do not know
- Other…….

8. How do you see the quality of mobile Internet communication in Iran in comparison to other parts of the world?

- Excellent
- Very good
- Sufficient
- Not sufficient
- I do not know

9. Can you see any obstacles in using Internet from the government or local authority?

- Yes
- No
- I do not know

10. If you replied yes in question no. 11, which obstacles you could see?

- Blockade of particular web pages
- Packet sniffing
- Censorship of certain key words on search engines
- Data retention by authorities
- Other …….

11. What do you think about Internet access restrictions?

- Strongly agree
- Agree
- I do not know
- Rather disagree
- Disagree

12 .Which kinds of activities should be done by government or local authority to improve accessibility to mobile Internet?

- Build infrastructure to extend mobile Internet areas
- Decrease regulations for mobile Internet providers
- Do not intervene at all
- Other ……
- I do not know

13. How do you see the Iranian government's role and regulations in mobile Internet communication in Iran?

- It has a very important role
- It has some influence but not that much to manipulate the Internet
- It does not play any role
- I do not know
- Other