Introduction

1.1 Introduction

1.1.1 Background of the Study

The world is evolving every day, so is information technology. Humans need to stay connected every minute of the day wherever they are. Therefore, there is an ever ready need for mobile technology for people on the go. Many telecommunication companies recognize the need for more user-friendly and more advanced systems to cater for human needs to stay connected. These systems have to powerful enough to ensure all digital software, networks and applications can be successfully operated. Besides being powerful enough, these technology systems have to be cost effective in its usage to ensure that all end users can benefit from the technology and not only to the higher income group.

1.1.2 The Internet

The development of computers back in 1950s had ignited the point to point communication between terminals and mainframe computers. This is to enable information sharing within a network. Later, the idea of internetworking was introduced to further enhance this property of information sharing. Internet had been the answer to many information seekers since the early years 1980s with the beginning with the standardization of Internet Protocol Suite (Transmission Control Protocol/Internet Protocol) and the introduction of fully interconnected Transmission Control Protocol/Internet Protocol networks.

Since the introduction of Internet, drastic changes took place in the world of communication and commerce. Internet has taken over the role of conventional postal systems by air, sea and local mail by delivering “mails” and documents instantly by just clicking a few buttons. Electronic mails (e-mails), instant messaging, Voice over Internet

Protocols (VoIP) “phone calls”, two-way interactive video calls, and the World Wide Web have been the indispensables to human life these days. Internet has also changed the commerce and banking world by allowing online shopping and online banking at the comfort of home or offices without having to physically go to the premises. This certainly is the answer to the busy community of the world these days.

1.1.3 The Mobile Phones

The introduction of mobile phones had also changed the way people communicate. If land lines and public phones used to be the way to talk to a person, mobiles phones had been the answer to stay connected in this modern world. Mobile phones had evolved from the ancient analog first generation to the current digital fourth generation “smart phones”. These devices are owned by almost everyone in the current world from all socio-economic backgrounds and all age groups. Mobile phones are not only used to make phone calls and for text messaging these days, but also as a mode of entertainment to a lot of people. Mobile phones are also used to symbolize social status by certain people.

There is however evolving need for people to stay connected to the internet not only when they are at home or in the office in front of a computer but also when they are on the go and out in the field. The clever technology systems developers then combined the wonders of internet and the handheld mobile devices to enable people to not only stay connected anytime, anywhere but also to seek information, shop, perform banking transactions and to get entertained anytime, anywhere.

1.1.4 Broadband Services Globally and in Malaysia

Broadband Leadership	Ranking		
	2010	2009	2008
South Korea	1	1	1
Hong Kong	2	3	2
Japan	3	7	4
Iceland	4	4	8
Switzerland	5	5	6
Luxemburg	5	5	9
Singapore	5	2	3
Malta	6	10	19
Netherlands	7	6	5
United Arab Emirates	8	12	19
Qatar	8	2	11
Sweden	9	8	9
Denmark	10	9	7
Malaysia	**38**	**40**	**35**

South Korea has set a new benchmark for the world

Average download speed : 33.5Mbps (increase 55% from 2009)
Average upload speed : 17Mbps (increase 430% from 2009)
Broadband Penetration : 100%

Average Global data in Three Years (2008 – 2010)

Download Speed : Increase 49%
Upload Speed : Increase 69%
Latency : Fallen by 25%

Malaysia ranked at number 38 out of 72 countries

Average download speed : 1.2Mbps
Average upload speed : 0.3Mbps
Average Latency speed : 144ms

Figure 0.1: Global Broadband Quality 2010 (Source: Cisco 2010)

Globally, broadband internet services had received tremendous adoption by end users due to its promising services. There is ever ready need for service providers to improve their services to stay competitive and to continue to receive support from end users. The biggest target advancement in terms of broadband services will be in terms of speed. The average download speed had increased by 49% and upload speed increased by 69% in the 3 years of 2008 to 2010. While broadband latency had fallen by 25% globally. South Korea is the highest record holder with 100% broadband penetration and average download speed of 33.5Mbps and upload speed of 17Mbps. Malaysia is ranked at number 38 out of the 72 countries with an average download speed of 1.2Mbps and upload speed of 0.3Mbps (Figure 1.1). Therefore, to stay competitive with other developed countries in the world, there is an impending need to improve the broadband services in Malaysia and at the same time ensure adoption of the technology by the nation.

The National Broadband Implementation Strategy or better known as National Broadband Initiative (NBI) of Malaysia has put in place a strategy to bring about broadband services to the Malaysia population. In the year 2007, The Malaysia Government has set a target of broadband household penetration at 50% by the end of 2010. Therefore few strategies had been identified encompassing both the supply and demand aspects of broadband. From the supply point of view, broadband infrastructure and services will be delivered throughout the country. This will be done through wired and wireless connectivity. At the same time, the existing broadband and cellular coverage will be expanded under the Universal Service Provision (USP) initiative. There is also need to upgrade the existing broadband services in high economic impact areas to achieve broadband speed of more than 10 Mbps. As an effort to target this aspect, the Malaysia Government has lay out a project called the High Speed Broadband Project which is a Private Partnership agreement with Telekom Malaysia Berhad to provide high speed

broadband services to selected areas. In December 2009, Malaysia Communications and Multimedia Commission (MCMC) had awarded a Universal Service Provision project tender worth over RM41.5 million to provide broadband to underserved areas in Malaysia to Packet 1 which is in the state of Perak and Kedah. Meanwhile, another player in the field, Asiaspace WiMAX Sdn. Bhd. also started project called the "Amax City" targeting to form a virtual city within Technology Park Malaysia , with coverage over 700 hectares of land including universities, colleges and major businesses.

According to the latest update from Malaysia Communications and Multimedia Commission (MCMC), the penetration of broadband in Malaysia has surpassed the 50% initially targeted by the government. Subscribers of broadband are also forecasted to be at an increasing trend in the coming years which is directly proportionate with the increase in internet users (Figure 1.2).

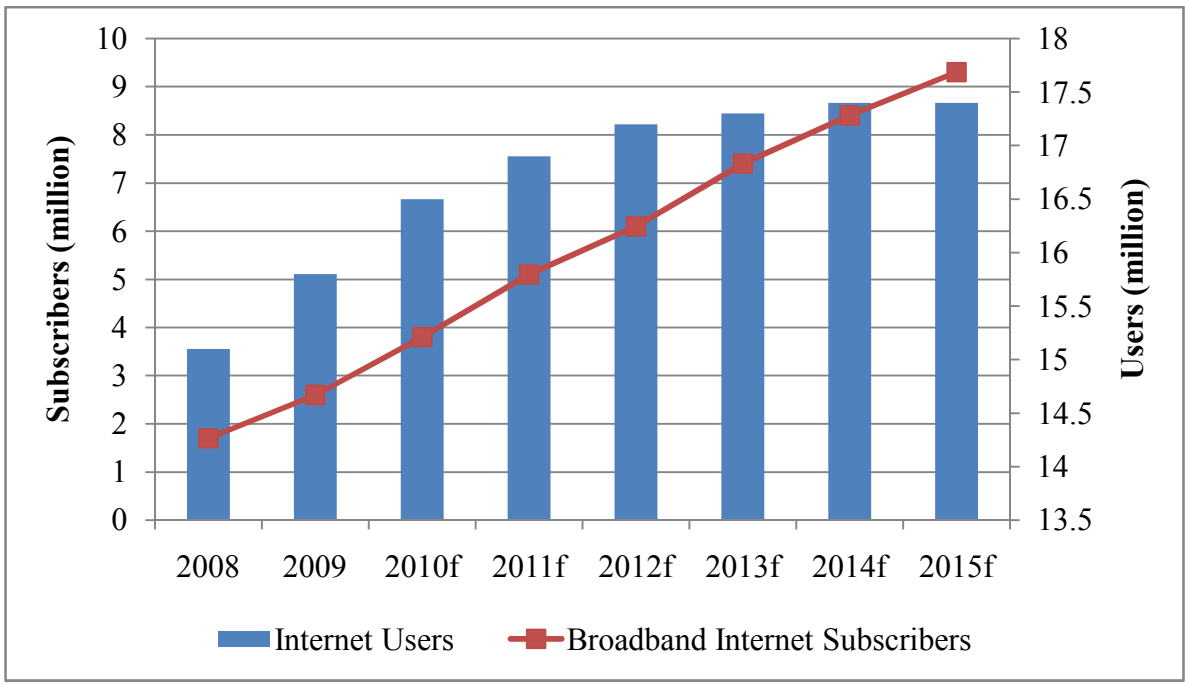

Figure 0.2: Malaysia Internet Users and Broadband Subscribers Forecast, 2010-2015
(Source: Business Monitor International, 2010)

1.1.5 3G (3rd Generation Mobile Telecommunications)

3G or 3rd generation mobile telecommunications is a generation of standards for mobile phones and mobile telecommunications services that fulfilled the specifications by International Telecommunication Union, the International Mobile Telecommunications-2000 (IMT-2000). 3G is a wireless broadband service. Application services that are supported by 3G include wide-area wireless voice telephone, mobile Internet access, video-calls and mobile television.3G services was introduced in Malaysia back in 2005 (Malaysian Communication and Multimedia Commission, 2009). The current players in this technology include Maxis Communications Berhad, DiGi Telecommunications Sdn. Bhd., Celcom Axiata Berhad and U Mobile Sdn. Bhd. 3G received tremendous support by the Malaysia population. Today, there are over 7.3 million subscribers of 3G services in Malaysia. The number of subscribers had increased exponentially from the time it was introduced with 0.43 million subscribers back in 2006, 1.56 million in 2007, 4.47 million in 2008 and 7.35 million in 2009 (Figure 1.3). However 3G has a main disadvantage. It is only able to provide download speed of 384 kbps and this definitely will cause latency during the usage of bandwidth hunger applications like Voice over Internet Protocol, Internet Protocol Television, video streaming, online gaming and etc.

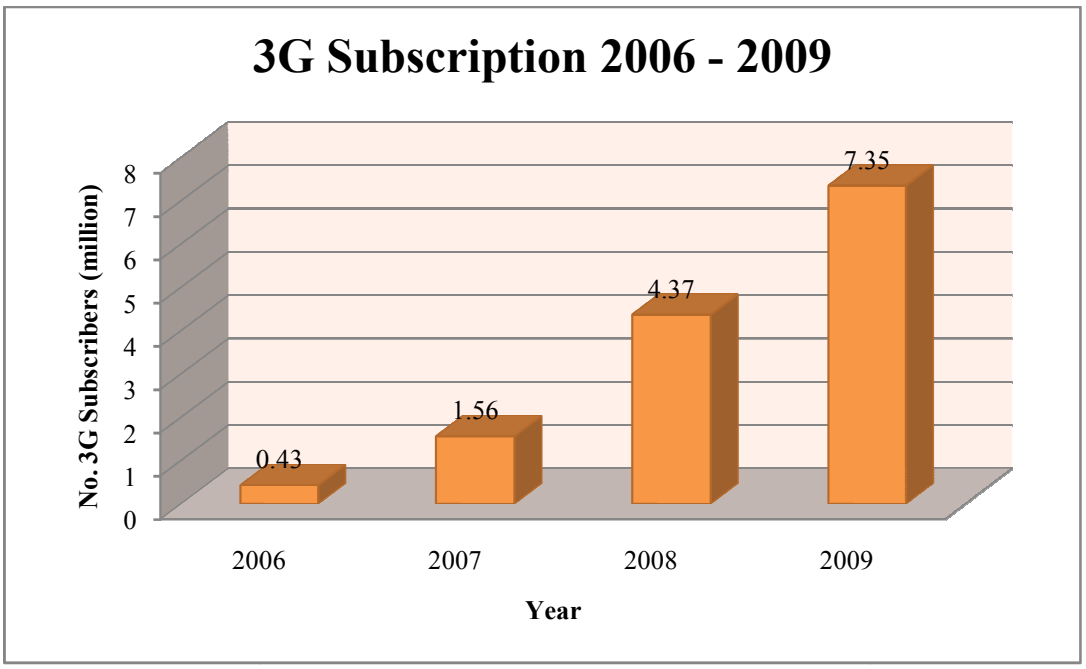

Figure 0.3: 3G Subscription 2006-2009 (Source: Malaysian Communication and Multimedia Commission, 2009)

1.1.6 WiMAX

Of late, WiMAX (Worldwide Interoperability for Microwave Access) has emerged as promising technology for broadband access as it is the only wireless technology with true wireless broadband experience. WiMAX is also known as IEEE 802.16e. WiMAX can provide Broadband Wireless Access (BWA) up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. By using WiMAX based network to connect Wi-Fi hotspots to the internet, costly wired infrastructure can be avoided besides being able to provide mobile hotspot services. By avoiding the time consuming and high cost involved with laying fiber or upgrading cable networks, service provider can start providing the service quickly and deliver broadband services at relatively low costs. Mobile WiMAX technology is based on Internet Protocol (IP) which allows seamless compatibility with existing Internet applications. Capital expenditure and operating expenditure can be greatly reduced by maintaining a unified all-IP-based network rather than multiple legacy networks

for various services. Therefore, service providers can offer better mobile internet access services to end users at lower cost than other technologies.

Much is said of the advanced technology of WiMAX, comparison has been made between this new technology and its predecessor 3G services. As mentioned earlier, WiMAX has an edge over 3G for its low cost spectrum. The average cost for 3G is almost 1000 times more the average cost of WiMAX per Hertz in Europe (Fellah, 2007). The high speed services that can be provided by WiMAX technology is another added advantage. WiMAX can provide mobile internet speed up to 3 to 5 times faster than 3G. The rapid increase in high bandwidth applications and services is putting pressure on service providers to cater to the needs. Sooner or later, traditional mobile operators will have to deal with congestion in their network by shifting the data traffic. Their option will be WiMAX as WiMAX can provide data centric standardized network.

1.1.6.1 WiMAX in Malaysia

WiMAX is a wireless digital communications system intended for wireless "metropolitan area networks". WiMAX is getting attention in both developed and developing countries in the market of providing mobile broadband internet access due to the low cost and rapid deployment besides other advanced features of the system. In Malaysia the government welcomes investors into this new technology, to enhance the Multimedia Super Corridor (MSC) program in order to accelerate the objectives of Vision 2020; to transform our country into a modern state by the year 2020, with the adoption of a knowledge-based society framework.

Commercial services of WiMAX started in August, 2008 in Malaysia. The Malaysia Communication and Multimedia Commission had offered WiMAX licenses to a few players in the field namely, Packet One Networks (Malaysia) Sdn. Bhd. (P1), YTL Communications Sdn. Bhd. (YES), Redtone CNX Broadband Sdn. Bhd., AsiaSpace

WiMAX Sdn. Bhd. At the initial phase of deployment, these companies are allowed to operate in a certain areas. Packet One Networks (Malaysia) Sdn. Bhd, YTL Communications Sdn. Bhd. and Asiaspace WiMAX Sdn. Bhd. were allowed to deploy their services in Peninsular Malaysia while REDtone CNX Broadband Sdn. Bhd. was limited to Sabah and Sarawak. These targeted operation areas are based on population density and commercial viability such as Klang Valley and Kota Kinabalu (Malaysian Communication and Multimedia Commission, 2009)

The government of Malaysia had mandated these companies to commercially launch their services by the end of august, 2008, to cover 25 percent of Malaysia's population by end of March 2009 and 40 percent of the population by March, 2011. Companies that do not comply with this ruling will risk having their licenses revoked or losing their performance bond of up to RM7.7 million. These service providers have invested extensively in the infrastructure for WiMAX services in Malaysia. However, the growth of WiMAX in Malaysia is generally slower than expected. By the end of 2009, only Packet One Sdn. Bhd. had achieved the targeted 25% population coverage in April 2009 and the other two players are still struggling to achieve the targeted population coverage. Service providers are concerned that their heavy investments towards WiMAX are not paying off due to the slow adoption by Malaysian consumers. This has probably caused the failure of these companies in achieving the targeted population coverage mandated by the government.

1.1.6.2 Packet One Network Sdn. Bhd.

Packet One Network Sdn. Bhd. is a wireless telecommunications company which is wholly owned by subsidiary of Green Packet Bhd. It was registered in February 2002 but only started business in 2007 after gaining license to operate WiMAX in Malaysia. The license that was granted to P1 is for access to 30 MHz of spectrum in the 2.3 Ghz band.

Following the acquisition of the spectrum, P1 had rolled out a series of strategic plans to ensure fast and efficient delivery of WiMAX services to its targeted population. It has gathered a few alliances to help in its deployment of the WiMAX services. P1 had awarded its network build-out to Alcatel-Lucent which is a deal valued at RM220 million to provide a complete end-to-end WiMAX broadband solution. At the same time, it also partnered with Oracle Systems, EMC Corporation and Firberail besides getting a RM50 million investment from Intel.

By August 2008, P1 became the first WiMAX operator in Malaysia to launch a commercial network. The commercial network was initially made available in selected areas in and around the vicinity of Kuala Lumpur. By the end of 2008, the commercial network expanded to Johor, the southern region of Peninsular Malaysia. P1 also claimed to have early subscribers even before the official launching of the WiMAX services. During launching, they expected to cover 30% of the country by first half of 2009, 40% by 2010 and 60% by 2012. The company also expected to invest RM1 billion in the next 5 years into the technology after launching. P1 also projected that they will be able to provide WiMAX services all over Malaysia.

As part of their strategy to ensure adoption of the WiMAX technology, P1 formed partnership with Sunway Group and was made the preferred technology partner for broadband connectivity and communications requirements. The first phase of the project was successfully deployed and provided wireless broadband to up to 80% of Sunway home and business users, students and visitors. The success of the project saw Bandar Sunway as the first integrated wireless township in Malaysia. P1 was also selected by Dewan Bandaraya Kuala Lumpur and Malaysian Communication and Multimedia Commission (MCMC) to set up WiFi-WiMax KL Wireless Metropolitan Project called Wireless@KL. It

currently has 400 hotspots serving more than 70,000 users with free wireless broadband internet access Kuala Lumpur.

1.1.6.3 YTL Communications Sdn. Bhd.

YTL Communications Sdn. Bhd. is a subsidiary and the communication utility of YTL Power International Bhd. Powered with the license granted by the Malaysia government to deploy a 2.3GHz wireless broadband in Malaysia, it launched the first nationwide 4G Mobile Internet service with voice back in November 2010 branded YES. The company came up with specific strategies to ensure success of its WiMAX service. The main selling point of the product offered by the company is that all Yes account comes with high speed Internet access (3 to 5 times faster than 3G) and a phone number, making the convergence of data and voice seamless. Therefore, the subscribers of YES will have access to high speed internet access besides enjoying voice, online chat and Short Messaging Service services that can be accessed from anywhere in the world through Internet. This greatly benefits consumers as with the service, they can stay connected with their acquaintances while away from the country at local rates minus the costly roaming charges.

YTL Communications Sdn. Bhd. planned to spend RM 3.3 Billion for deployment of base stations to provide WiMAX services in the country. They have targeted to set up 2500 base stations to cover the whole of Peninsular Malaysia, which make to 80% of targeted population coverage. With that, the company expects to be able to provide services to 14 million customers. However, the company only reported around 300,000 subscribers in July 2011 and is way far from their targeted number of customers.

1.1.6.4 Redtone WiMAX Sdn. Bhd.

Redtone WiMAX Sdn. Bhd. was awarded the WiMAX license to operate in Sabah and Sarawak by the Malaysia government. The WiMAX services currently provided by the company cover the main cities of Kota Kinabalu and Kuching. In 2009, the company reportedly failed to achieve the 25% population coverage as mandated by the government when they first secured the license to deploy WiMAX in Malaysia. This has caused Malaysian Communication and Multimedia Commission, to impose RM200, 000 fines to the company. Subsequently in 2010, the company claimed that they had achieved 25% population coverage as per required of them by the government.

1.1.6.5 Asiaspace WiMAX Sdn. Bhd.

Asiaspace WiMAX Sdn. Bhd. is the last of the 4 companies that was awarded the license to operate WiMAX in Malaysia. The company had launched its WiMAX services to selected areas in Klang Valley. This company is relatively low profile in promoting their services claiming that they are making sure the necessary infrastructure was in place before offering full spectrum of service to its WiMAX subscribers. The biggest achievement by the company so far, is the launch of its "Amax City" which is a virtual city project within Technology Park Malaysia. The project is aimed at providing unlimited online access to services and facilities in the area. They are targeting the tenants within the vicinity of Technology Park Malaysia which includes media agencies, content providers, online game developers, IT companies and software developers.

1.2 Statement of the Problem

Broadband has been in recent years becoming the "in thing", the "must have" for people from all walks of life to stay informed and to stay connected. This has boost mushrooms of new applications that are bandwidth hunger, i.e. need fast and huge

bandwidth to support different applications for example voice over internet protocol, m-commerce, online game, file sharing, user generated contents, managed/ hosting services to business customers and Internet Protocol television (IPTV). The current situation is impinging pressure to network operators to deploy high speed bandwidth internet technology in access and core network. The predecessor 3G wireless internet services is only able to provide broadband speed of 384 kbps while WiMAX is 3 to 5 times faster. This has further ignited with the encouragement from the Malaysia government to adopt latest technology.

The industry players had for the fact invested huge amount of fund to setup infrastructure such as base stations as well as enhancing their services besides promotional efforts to ensure the success of the implementation of their services. Immense amount of fund is also spent in terms of staff employment as fast delivery of the services is required of them as part of the requirement in securing the WiMAX license from the government. The high expectancy of the government to these companies to ensure WiMAX penetration in the Malaysia nation added further pressure in their deployment of their services. Unfortunately, the adoption of WiMAX is far from ideal and this has created fears among the players in the field whether they are indeed fighting a losing battle.

Before the implementation of a new technology, it is crucial to clearly understand the needs of the end users and factors that will affect their adoption. This clear understanding will then allow the various concerned parties to use the right strategies to gain business opportunities and to improve return of investments. After implementation, there is also a continuous need to enhance the technology to further improve the infrastructure. Therefore, there is a call for researches in this particular field to find out from users the indices for adoption of the technology to enhance implementation. In line with the above situation, the current study aims to examine the factors that affect the

consumers' intention to use WIMAX among working adults in Klang Valley as a stepping stone to future researches of a bigger scale.

In addition to that, there are a lot of previous studies on technology adoption based on various theories namely Technology Acceptance Model (TAM), Diffusion of Innovation (DOI), Theory of Planned Behavior (TPB), Theory of Reasoned Action (TRA) and Unified theory of acceptance and use of technology (UTAUT). However these models have their limitations and might not be able to explain sufficiently the decision for users to adopt WiMAX. The purpose of this study is to address the gap in existing literatures by extending the traditional models to understand Malaysian users in their intention to adopt WiMAX. This study will also apply structural equation modeling to analyze the data.

Malaysia is a country situated in South East Asia and its nation consists of multicultural people from various social backgrounds. It is also a developing country aiming to be "developed" and to be competitive among the other countries in the world. There is generally lack of current literature studying the adoption of WiMAX in the local scenario. Therefore, there is a pressing need for researches aiming to study factors affecting WiMAX adoption in Malaysia. Only then, the deployment of the advanced technology of WiMAX will be smooth sailing. This will further contribute towards the government aim to ensure successful penetration of broadband services to the Malaysian population where WiMAX is currently one of the leading broadband technologies. The current study hopefully will help to address the other gap in the current literature in this particular field of understanding the factors affecting adoption of WiMAX in the Malaysia scenario.

1.3 Objectives

The objective of this study is to carry out a survey to find out the factors that can affect the adoption of WiMAX by working adults in Klang Valley. This study will be carried out in a group of Master in Business Administration students, University of Malaya. The study aims to find out the causal relationship between few constructs in technology acceptance in determining the ultimate factors that will bring about the adoption of WiMAX by working adults.

1.3.1 General Objectives:

The general objective of the current study is:

1. To apply the extended Technology Acceptance Model in understanding the factors that affect the adoption of WiMAX in Klang Valley

1.3.2 Specific Objectives

The specific objectives of the current study are:

1. To find out factors that has impact towards consumers' decision to adopt WiMAX Technology among working adults in Klang Valley
2. To find out the demographic data of the respondents and correlating them with the intention to adopt WiMAX
3. To recommend future implementation tactics or programme for WiMAX implementation after understanding the factors that can affect WiMAX adoption

1.4 Research Questions

Malaysian Communication and Multimedia Commission (MCMC) had granted WiMAX licenses to few main key players in Malaysia such as Packet One Sdn. Bhd., YLT Communications Sdn. Bhd. and others. These service providers had invested huge amount of investment and yet there is no study to clearly understand end consumer behavior and

factor that affect their decision to adopt this new technology. With that, the main research questions for this study are:

1. Do social influences have positive impact on perceived usefulness of WiMAX?
2. Do social influences have positive impact on perceived ease of use of WiMAX?
3. Do social influences have positive impact on intention to adopt WiMAX?
4. Does personal innovativeness towards information technology have positive impact on perceived usefulness of WiMAX?
5. Does personal innovativeness towards information technology have positive impact on perceived ease of use of WiMAX?
6. Does personal innovativeness towards information technology have positive impact on intention to adopt WiMAX?
7. Does perceived usefulness have positive impact on intention to adopt WiMAX?
8. Does perceived ease of use have positive effect on intention to adopt WiMAX?
9. Does perceived ease of use have positive effect on perceived usefulness of WiMAX?

1.5 Significance of the Study

The current study has the following significance:

1. Filling the gap in the current literature to understand the adoption of WiMAX among working adults in Klang Valley
2. Understanding the current obstacles faced in implementation of WiMAX
3. Understanding the factors that will bring about the adoption of WiMAX
4. Recommend future promotional tactics to enhance WiMAX adoption to ensure lucrative monetary returns for players in the field of WiMAX

5. Recommend future promotional tactics to ensure optimal penetration of WiMAX broadband technology to the end users

1.6 Organization of Study

This research paper is structured into five different chapters. Chapter One, provides introduction to this study, objective of the study, research questions, significance of study and followed by organization of this study.

Chapter Two reviews of the literature on existing technology adoption theories such as Theory of Reasoned Action, Theory of Planned Behavior, and Theory of Technology Acceptance and is followed by WiMAX adoption factors.

Chapter Three consists of theoretical framework and hypothesis design, sample design, data collection procedures, questionnaire development and survey instrument followed by data analysis strategies.

In Chapter Four, data analysis results and findings followed by discussion will be covered. Last but not least, conclusion and implication will be presented in Chapter Five.