ANALYSIS OF DETERMINANTS OF BUSINESS DEMAND FOR INTERNET ACCESS IN ADDISS ABABA

By :- Dereje Fekadu

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Advisor Dr. Mulat Demeke

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Abstract

Recognizing the benefits of Information Communication Technologies (ICTs) in general and Internet in particular to the overall advancement of social, economic and politics of a country, developing countries are investing on network infrastructures. However, the penetration level of the countries such as Ethiopia has been very low which will hinder the country not to reap the benefits of the technologies. The purpose of this study was to identify the determinants of Internet diffusion among business organization in Addis Ababa. Hence, a survey was conducted on a random sample of businesses and a logit model of Internet access was estimated. The major result of the estimated model indicate that the likelihood of access to the Internet by a firm is explained by the level of the education of the management, level of sales of the business and its openness to international trade. Furthermore, the descriptive analysis showed that among the connected businesses the use of Internet is limited to email and browsing, while advanced electronics uses such as E-commerce, E-procurement, etc. are almost non-existent.

CHAPTER ONE
INTRODUCTION

1.1. Background

Information Communication Technologies (ICTs) in general and Internet in particular have great role for socio-economic and political developments of a country, since its use is pervasive ranging from E-commerce to E-governance. ICTs are the result of the convergence between three sectors namely the telecom, the computing (the computer) and the broadcasting industry. Due to the advent of the computer, people nowadays access information (in the form of voice, data, stills, and video) through the utilization of the network of networks (the Internet). The Internet has been/is spreading rapidly throughout the world. This can be seen from the increase in the number of hosts (computers connected to the Internet) and Internet users in the world. According to Internet Systems Consortium, the number of hosts increased from 93,047,785 in July 2000 to 353,284,187 in July 2005, while the report by the International Telecommunication Union (ITU) indicated that the number of Internet users increased from 490 million in 2001 to 841 million in the end of 2004 (ITU Telecommunication Indicators, 2004).

Due to its pervasiveness in use, Internet is used by individuals, households, businesses, research and educational institutions and government bodies. Business organizations use Internet to increase efficiency, to enter new markets and to serve their customers in a new way

of marketing, delivery and support systems, which will have in turn impact on their profits levels. However, to realize the benefits of the technology, its diffusion among business organizations is a necessary condition. Empirical studies, in this regard, indicate that there exists uneven access of the Internet among individuals, households, businesses and countries of the world. In other words, there is a “Digital Divide” between individuals, households, businesses and countries in the world.

This paper tries to identify and estimate the main factors determining the access of the Internet (“Digital Divide) across business organization in Addis Ababa, where most of the businesses aren’t connected to the Internet. Furthermore, attempts are made to overview the Internet service and its development in Ethiopia.

Therefore, a survey was conducted in the capital city of Ethiopia-Addis Ababa on 250 sample businesses, in order, to identify, among other things, ICT access status and the socio-economic conditions of the firms and estimate a logistic model of Internet access for the businesses.

1.2. Statement of the Problem

Internet was introduced in Ethiopia in 1993 and was commercialized in 1997. Since its commercialization, on average the number of subscribers of the service has been growing by 44% annually. Currently, there are around a total of 26,000 subscribers of the service, which constitute individuals, households, businesses and other customer types. The Internet network started with a capacity for 2,000 dial-up subscribers, then upgraded to 15,000 dial-up subscribers. After a recent expansion works, presently the total capacity of the Internet has reached to a capacity, which will accommodate 116,500 dial-up and 3300 leased line subscribers. However, the subscription for the service couldn't exceed 26,000 subscribers, which shows a mismatch between demand and supply of the service.

To stimulate the demand for the service and make use of scale advantages from expansions, the Ethiopian Telecommunication Corporation (ETC), which is the only Internet Service Provider (ISP) in the country, has reduced prices of Internet access and usage a number of times. The price cuts, however, didn't have the expected impact on the level of demand and as a result the problem remains unsolved. Given the lower level of penetration in the country, the unutilized capacity negatively affects the profitability of the ISP (industry) and its growth, which in turn negatively affects the Internet development in the country. In addition, the lower level of Internet penetration in the country will prevent the country not to benefit from the technology. Understanding the problem requires

assessing the demand for the service and the factors that affect it in the business organizations besides other users categories, which will direct contribution in the formulation and suggestions of policies to solve the existing problems related to the penetration of the Internet service among business organization.

Therefore, this study is conducted to identify and understand the factors that affect internet penetration among enterprises by gathering primary information from the market that will be analyzed using models in such a way to suggest policies in an effort to enhance the adoption of the service by business organizations.

1.3. Significance of the study

Business organizations (in least developed countries) access to the ICTs in general and Internet in particular and its determinant factors are not deeply investigated matters, except the limited descriptive studies available. Hence, research like this one helps to understand the factors that hinder access to the Internet and will be a major input in the policy formulation to improve the penetration level of the service among businesses and increase the benefit to the ISP (industry) from the investment already made.

In other words, identifying the factors that affect Internet access demand will enable the Internet service provider to come up with appropriate

pricing, marketing, and customer handling services and policy makers to draw policies to affect the variables found to be significant factors in the diffusion of the technology. Furthermore, this kind of research will be input for further studies and policy formulation in an attempt to understand and facilitate advanced uses of the Internet such as E-Commerce by business organizations in Ethiopian.

1.4. Objectives of the study

By reviewing the Internet service and its policies in Ethiopia, and gathering micro-level data in relation to Internet access of business organizations, the study will try to identify and analyze the factors that affect the penetration of the Internet service in business organizations, which can be used in the policy formulation of the country to increase Internet adoption among firms.

Therefore, the main objectives of the study are the following

- To identify and measure the major factors that affect Internet access demand of business organizations in Addis Ababa;

- To evaluate the appropriateness of the existing government policy in relation to Internet service provision;

- To draw specific policy implications for the development of ICTs in the business sector in particular and in the country in general.

1.5. Scope and Limitations of the Study

The scope of the study is mainly related to investigating the determinants of Internet access by business organizations. The study focused on the access issue due to the reason that access is not yet wide spread among business organizations. Although Internet access to business organizations has been taken as a measure to ICT penetration in the business sector, there are a number of issues that need to be investigated to have a full picture of Internet adoption. In other words, the utilization of Internet should have been investigated besides the access issue. In this regard,

- The limitation of the study emanates from the model it uses as the dependent variable that is described by binary 0 or 1 value, which creates loss of significant ‘’Information’’ regarding how firms are using the technology as it only address the issue of whether a firm is connected or not connected. Hence, effect of usage by businesses on the probability of Internet connectivity could not be analyzed in the model. In addition, Internet usage determinants aren’t investigated, which would enable us to see not only Internet access but also its usage determinants among businesses.

- Due to the nature of the Cross-Sectional data that is done in a single geographical location (i.e. Addis Ababa) it is not possible to measure price elasticity, which would have been very important to see the effect of price changes to access of the technology.

CHAPTER TWO

OVEREVIEW OF INTERNET SERVICE IN ETHIOPIA

2.1. Background

Despite being the second most populace country in Africa, with a population of more than 75 million, Ethiopia has the lowest penetration rate for ICTs even compared to the Sub-Sharan countries excluding South Africa. Presently, the penetration of telephone (including mobile) and Internet are 1.39 and 0.034 per 100 inhabitants respectively. The Ethiopian Telecommunication Corporation is the only telecom operator and Internet service provider (ISP) in the country. With recent upgrade and expansion of the Internet network (from narrowband supporting16,500 dial up subscribers) to broadband multimedia, the total capacity of the Internet network can support 116, 500 dial up subscribers, and 3,300 leased line subscribers. Currently, the number of subscribers of the service is 26,000 dial-up subscribers and around 300 leased line subscribers (ETC, Statistics report, 2005).

In general, for the underdevelopment of Internet in Ethiopia various factors could be attributed such as lower per capita income, higher costs of access, monopoly market structure and lower level of educated people. In the coming sections of this chapter, attempts are made to review briefly

the Internet network development in Ethiopia, access and usage tariff and costs, the sector's policies and the technology option available for Internet access.

2.2. Internet Network Development in Ethiopia

Internet began in Ethiopia in 1993 when the UN Economic Commission for Africa (UN ECA) established a store and forward e-mail service called PADISNet (Pan African Documents and Information Services Network) which connects Addis Ababa UN ECA head Quarters to GreenNet's Internet gateway in London on a daily direct call basis. The main users of the facility were International organizations and NGO's, some academics, individuals and private companies and at its peak it served about 1,200 users in total. In the next year, the US based NGO, Health Net, established a node at the medical faculty of Addis Ababa University, which provided e-mail access to medical researchers via the Health Sat /VITA Low Earth Orbit (LEO) satellite. Hence, up until 1996 Internet service was available to certain sections of the society.

In 1996, to create Internet access to the public, a national Internet working group was formed from different sectors supported by the Ethiopian Science and Technology Commission (ESTC). This group called Bringing Internet to Ethiopia (BITE) drew up a national Internet proposal. This together with the PADIS /HealthNet services helped build significant

demand for full Internet access which was ultimately provided by ETC in January 1997. After attempts were made to assess the demand for Internet service or its potential market, a USA firm called Global One was contracted to commission the service (called Ethio-Net) with 256kb/s satellite based gateway connection to US.

Ethio-Net began its operation from a single Point-of-presence (Pop) in Addis Ababa with limited services of a dial-up access and local website hosting. After a year of operation in February 1998 Ethio-Net had 1,750(including 200 in other towns) customers and 2,500 by December 1999. As the customer base increased, the traffic level grew making the network congested, thus Ethio-Net was expanded using a fund (USD 1.6 million) obtained from the United Nations Development Program (UNDP) having 8 more PoPs in the country. Four of the PoPs were large (64 dial up modems each) and were installed in Mekele, Diredawa, Awwassa and Jimma and the rest four were small PoPs(32 dialup modems each) in Dessie, Bahr Dar, Nekemte and Shahemene. This enabled the customers in the various regions to dial to their near-by POP to connect to the Internet unlike the previous experience of dialing to Addis Ababa to connect to the Internet. As a result of the expansion work, starting from July 2001 Ethio-Net was upgraded to support 14, 000 additional dial up customers, making the total capacity of the Ethio-Net network to support 16,500 dialup customers.(ETC, Internet Tariff Revision, 2002)

In 1999, ETC began to deploy a limited digital circuit for leased line customers following increasing demand for leased lines Internet access. This network was basically designed and implemented for dedicated data communication services (end-to-end digital connectivity). In 2001, a Dedicated Digital Network (DDN) service was developed which provided the underlying infrastructure for ETC leased line Internet service. The public data network is called Ethio-stream and it comprises 6 nodes (local exchanges) in Addis Ababa and 10 other nodes outside Addis Ababa. In 2003, Ethio-stream had a total of 65 customers on 129 circuits and 34 waiting subscribers. (Ibid)

In 2004, in relation to three wide area network (WAN) projects ETC was required to implement by the Ethiopian government the Internet network was expanded becoming a multimedia and broadband platform with the capacity of additional 100,000 dialup and 3,000 leased line Internet customers. The SchoolNet, WordaNet and AgriNet were the three WANs the government wanted to be implemented by ETC to connect all high schools, woredas and agricultural and research institutions in Ethiopia respectively. Due to this expansion, the existing broadband Internet network in Ethiopia supports video, data and voice services at the same time and enable to accommodate a total of 116,500 dialup and more than 3300 leased line customers. The multimedia broadband network is supposed to improve speed of connection to the Internet, which was the main problem with the network. However, the problem has persisted as shown in the survey result of this study. Most users have indicated that

slow data communication was their main source of dissatisfaction in using the Internet.

Therefore, as can be seen from the history of the network development of Internet services in Ethiopia, various groups or institutions are involved from commencement up to the current status of the service. In addition, the network development has gone through major changes that are aimed to accommodate the growing demand of Internet and to improve the quality of the services in terms of speed and number of applications it can support.

In general, from the brief history of the Internet in Ethiopia we can see that the government has played the major role in the development of the Internet as catalysts to promote and introduce the service in the country. However, once it is introduced private sector participation and the competition in the sector play critical role in the diffusion of the technology in the society, which is a necessary condition to realize the benefits of the technology in the socio-economic development of a country.

2.3. Internet Demand

The demand for Internet service in Ethiopia can be seen into three segments of users. These are subscribers of dialup and leased line Internet services, those that access Internet through public access points such as Tele centers and government networks that is high schools,

woredas and Agricultural institutes and universities.(i.e. SchoolNet, WoredaNet, and AgriNet).

The first category of Internet users refers mostly for individuals, households and business organizations. This segment of the Internet subscribers (i.e. Number of dialup and leased line subscribers) is taken as the main indicator of a country's Internet access to the Internet service and in general access level to ICT. The computed access level for the country using this segment of users is about 0.034 per 100 in habitants. Currently, the demand for Internet as described by the total number of subscribers is around 26,000 dialup and 200 leased-line subscribers. The average annual growth rate of the customer base has been 44% for the last eight years since the commercialization of the service. The growth has been slow except for some years where the growth has been large (see Table 2.1 below). In the beginning there were supply constraint problem that made negative impact on the growth of the customer base. The main problem exhibited to the early slow development of the service could be the limited network capacity built that compared to the population of the country was very small. However, the expansion work carried out by the ISP has resolved the problem and at present the problem has turned out to be low take up of the service.

Table 2.1:- Growth of Internet subscribers in Ethiopia

Year	No. of Internet Subscribers	Growth rate(%)
1997	1,042	-
1998	2,068	98.5
1999	2,163	4.6
2000	2,461	13.8
2001	4,073	65.5
2002	6,740	65.5
2003	9,534	41.5
2004	12,155	27.5
2005	21,000	72.8

Source:- Annual Statistical Report of ETC, 2005

The maximum growth rate exhibited is in year 1998 and the minimum growth rate is in 1999. The ISP might explain this due to the supply constraint and the subsequent expansion works carried out. Because a close observation as to the years expansions carried out and the growth of the number of subscribers showed demand growth has been affected by the supply constraints at the time. In general, it can be said that the Internet market has been supply driven rather than demand.

The limitation of taking the number of subscribers as the level of access for Internet in country ignores those that access Internet through public access points like Tele centers and those that get access through government networks such as SchoolNet, WoredaNet and ArgiNet. In least developed countries like Ethiopia the costs of access for Internet (including PC costs) will be very expensive compared to income. As a result people will prefer to use Tele centers, which enables the Tele centers to flourish in these countries. Hence, the number of subscribers as

indicator of the level of access in a particular country especially in LDCs may not give the full picture.

Presently, the supply constraint has been removed as the total capacity available exceeds the expressed demand level for the service. Now, the problem is lower level of take up. To stimulate demand for the service and increase sales, access and utilization charges reduction were taken in the part of the Corporation. In addition, recently, to increase the number of outlets, marketing of the service and customer handling, the corporation has announced its plan to work with the private sector as Virtual Internet service providers (VISP).

2.4. Tariff and Costs of Internet Access and Utilization

2.4.1. Tariff

ETC has been using a cost based pricing policy for all telecommunication services pricing before 1999, which led to inefficient resource allocation and loss of welfare to the society. In addition, the operator has been/ is managing the complete system of telecommunication in the country, it cross-subsidizes tariff typically from business to residence and from long distance (especially international) to local. After 1999, however, a reform of the telecommunication pricing policy regime brought efficient pricing policy, which according to the Council of Ministers Regulations No. 47/1999, is based on the principles of economic efficiency, public interest and economic viability of the operation of the service.

At the commencement of the Internet service in Ethiopia the Internet tariff was discriminated to five categories. Category one, two and four were for individuals and businesses. Category three was for non-profitable government organization and category five was for public education, Health & agriculture sectors.

Table 2.2. Tariff for dial up Internet service (up to June 2002)

Category	Connection Charge (USD)	Monthly fee (USD)	Allowed hours /month	Extra hour /month (USD)
1	56	19	8	4
2	75	34	15	4
3	56	38	40	2
4	113	75	40	4
5	38	25	40	4

Source:- Ethiopian Telecommunication Corporation

The tariff structure as indicated in the table above had flat rate structure as opposed to a structure that is based on utilization. It can be seen clearly that the access costs to Internet were expensive to all categories of subscribers as it is compared to the current rate of subscription charge (Birr 156 for all customers). The comparison of connection charge of the first category for the present connection charge reveal that it was triple times higher (using 1USD= Birr 9 exchange rate), while the utilization charge has been for the same number of hours (i.e. 15 hours) 6.6 times higher (Birr 60 current and Birr 399.5 before).

ETC had also another tariff structure it came up with in June 2002 before the current tariff structure was in place, in May 2004. The then tariff structure had three components that are connection charge, monthly fee and utilization fee. The access charge was Birr 332 for all types of customer and the monthly rental fee was Birr 23. The utilization charges had different costs per minute in the different number of minutes of utilization i.e. up to 1800 minutes it was 0.11 cents, Between 1801-3600 minutes it was 0.08 cents and above 3600 minutes 0.06 cents per minute. This tariff structure was designed to encourage the utilization of the service as the number of minutes consumed increases the rate of utilization costs decline. In fact the access charge was also lower than previous by 30% compared to the first category of the commencement tariff structure.

The access and utilization tariff reduction carried out twice in the part of the operator could be attributed to scale of economy as the network size is expanded from 2,500, 16,500 to the present day 116,500 dialup subscribers supporting capacity. In addition, the operator has been trying to stimulate demand by reducing costs of access and utilization as this has been thought to be barrier to Internet access demand. Though prices could be one factor that affects the demand for Internet access and utilization, focus has to be given to other factors that may affect the take up of the services such as content development, promotion, quality of the service, and facilitating access to computer.

2.4.2. Costs

In order for an individual/firm to have access to the Internet it should have computer, modem, and telephone lines and subscribe an Internet account from the ISP Company, the total cost of which could be estimated to be Birr 6,500[1]. The utilization of the service requires usage payment to the ISP Company and to the Public Telecommunication Operator (PTO). Accordingly, the usage payment for 15 hours of Internet connection will cost Birr 60, and Birr 30 to be paid for the ISP and for the PTO respectively. Hence, for a firm to have Internet access and utilize for 15 hours per month it will cost one time payment Birr 6,500 and a monthly payment Birr 90. However, in an environment where telephone line and computer with modem are already available for office communication and data computing purposes, the cost of access to the Internet will be incremental as a result access costs to businesses will be lower and insignificant.

In general, leaving PC costs aside, the monthly dialup costs in Ethiopia compared to African countries shows Internet charges in Ethiopia are lower. In fact, the GDP per capita of Ethiopia and the market openness is also lower compared to other countries in Africa. The difference in economic growth and the degree of openness of the market might contribute to the price differences among African countries. The ISP costs added to telephone costs for Internet connection calculated for African

[1] Assembled Personal Computer with internal modem price Birr 6000, telephone line Birr 242 and Internet account subscription Birr 156 is taken

countries reveal that Ethiopia belongs to the lowest position of the other countries. Even with lower Internet access charges, Ethiopia has the lowest number of Internet users. (researchICTafrica.net, 2004)

2.5. Private Investment

Private investments aren't allowed in the telecom industry in Ethiopia except in partnership with the government to be a telecom operator. But recently the private sector is allowed to operate in the areas of end terminal apparatus supply, Telephone and Internet resale (Tele centers), Mobile SIM and voucher card distribution and recently Internet connection sale (Virtual Internet Service Provider-VISP). This shows that the private sector is allowed in the periphery of the sector, where investment is not that much required for the development of the sector by the private investors.

Recently, the Introduction of private virtual Internet service providers (VISPs) to distribute the service could be considered as a starting point to have positive gains in the content development and promotion of the service. However, the model of VISPs currently introduced is restrictive for the private sector to contribute its role in the local content development of the Internet. This is due to the business model that considers VISP as mere reseller of connection rather than content developers having their own access server, which is not allowed at present. By doing so it seems that the operator is only considering short term benefits and costs of the

service rather than considering long term benefits the country could reap due to the diffusion of the technology.

Due to monopoly market structure, the operator will not be forced to promote the Internet services and try to increase the customer satisfaction, since no treat is imposed on its market share by a competitor in addition, the profit motive of the corporation could be lower in case of public service issue. However, if private competitors are allowed in the Internet market the incumbent will be forced to improve its market share by aggressive promotion and improve the quality of the service to retain the existing customers. The result of the survey indicated in the coming chapter shows that the monopoly is not doing any of the above-mentioned activities. It is rather recognized the role of the private sector and tries to integrate them as agents for promotion and distribution of the service.

As described in the literature review section of this study, the benefit of Internet increases as more people get connected to the network, which will be possible only if there are policies that encourage more people to get connected. However, with such short-term business strategies, the needed critical mass to create the network externalities will not be possible by changing tariff structures of the operator alone. This coupled with the monopoly market structure of the Internet market contributed to lower level of penetration of the service as it is 7.42 users per 10,000 inhabitants in Ethiopia compared to Sub-Sharan average (excluding South Africa) 50.66

users for the same number of inhabitants (Connecting Sub-Sharan Africa, 2005).

2.6. Regulation of the Industry

Regulation is an important component of competition policy in the telecommunications Industry. The ICT policies that developing and developed countries employ to balance their ICT sector tend to be remarkably consistent. The main policy balances that countries try to maintain to promote their national interest and permit them to capture global benefits of ICT are the balance between public and private initiatives, monopoly and competition, domestic and foreign ownership, and centralized and decentralized administrative controls (Wilson &Wong, 2003).

With the coming of the Information technology advancements more and more national governments were compelled to adjust the balances between public and private initiatives, monopoly and competition, domestic and foreign ownership and centralization and decentralization. Technological advance has facilitated the contestability of incumbent communications providers. The major technological advancements in the telecom industry have been Internet and mobile telephone. The introductions of these services in addition to the increasing globalization, internal political pressures from dissatisfied (non)customers and growing external demands of international financial institutions have started to

pressurize many countries to come up with new ICT policies or regulations(Wilson &Wong, 2003).

The emergence and subsequent growth in the number of regulator agencies in African countries has showed a shift in the policy balance to private, competition, foreign, and decentralized pattern. In 2003, ITU regulatory database shows that out of the 48 countries in Africa 36 have got separate regulatory bodies, 17 have privatized incumbent operators, 37 have two or more cellular operators. On the same database for the same year, out of the 35 African countries the data is available only two countries have monopolies in the Internet services market namely Ethiopia and Niger. The remaining countries have partial or full competitions.

In preparation to the market reform in the telecommunication services, the government of Ethiopia divided the then Ethiopian Telecommunication Authority into Ethiopian Telecommunication Agency (ETA)-regulator and Ethiopian Telecommunication Corporation (ETC), which is the sole operator of all telecommunication services in the country. Proclamation No. 49/1996 gives ETA all responsibilities of regulating the telecommunications market in Ethiopia.

Regulation No. 10/1996, was issued by the Council of Ministers to set up ETC in which all duties and responsibilities to operate in the country were given to the corporation. According to the regulation, ETC will operate as

state-owned enterprise in the market under the supervision of ETA to maintain and expand telecommunication services and provide domestic, international and value-added services. The regulation also determined that ETC be the sole provider of any telecommunication related service including the provision of Internet.

The key duties of the regulator include maintaining standards and quality in the telecommunication sector, regulating tariff related to telecommunications services, licensing and supervising operators, and promotion of research and education in telecommunication sector. ETA started regulating activities in early 1999 and the regulator has done little in transforming the sector. According to Tilahun (2005), this is due to lack of enforcement mechanism when the operator doesn't meet service roll out targets, the dependence of the regulator on the government source of finance and the structure that make responsible both the regulator and the operator to the same Ministry. Therefore, the monopoly market structure, the inefficiency of the operator and regulator, the Ethiopian ICT sector is performing so poorly making the country the lowest in terms of ICT penetration.

So far the only policy issue in the telecom sector has been the resale option opened for the private sector to participate in the distribution of the telecommunication services. The proliferation of the private Tele centers that will resale Internet services among other are the result of this policy measure taken by the regulatory body. Using this resale option ETC has

recently started to work with the private sector (as Virtual Internet Service Provider) in the resale of the Internet connection to the market.

However, as indicated in the previous section, since the resellers aren't allowed to operate having their own server further content development and stimulating the demand will not be possible. This is done because of fears that the private resellers will use the servers to voice over IP and International telephone by-pass services, which will have revenue loss to the operator. In Ethiopia voice over IP is by law prohibited. In order to allow the private sector participate in the content provision service and to develop Internet service in general, the regulator should in this regard modify the policies; otherwise, the demand stimulation due to content development will not be realized and hence the development of the service will be hampered.

2.7. Technological Options for Internet Access

Available technologies of access networks and end-apparatuses for Internet access will affect the cost of access and prices of Internet services. In this regard, technological changes also affect demand level through increasing service portfolio on the existing network and inventing easier ways to access and use the service. The technological developments in the telecommunication networks that have major impact in the access to the Internet service are end-terminal (such as PC or Mobile) and access network technologies are discussed in this section.

The access network is that part of the telecommunication network that connects subscribers to the local exchange.

The fixed telephone network which is know as the Public switched Telephone network(PSTN) has been the most common access network for Internet connectivity. Basically, this network has been designed to transport voice communications. However, due to modem technologies this network is also used to transport data as modems help the conversion of data transmitted from analog system (PSTN) to digital which will be understandable by computers.

Besides accessing to the Internet using the fixed telephone line, recently wireless telephones have also been used to dial for the Internet. In areas where fixed telephone is not available and difficult to deploy wireless telephones are serving the basic telephone connection and access to the Internet. Generally, the two access options that are fixed telephone and wireless telephone constitute what is called dial up Internet connection, which is the main subject of this study. Other than the above mentioned access networks, Shared DSL (Digital Subscriber Line) which is a kind of dedicated (leased) line access and Satellite access (VISAT) are possible options to connect to the Internet. However, these access options are expensive to most businesses in Africa.

Regarding end-apparatus access options, access for the Internet as a result of technological advancements is becoming possible using mobile apparatuses besides Personal computers. The emergence of mobile as access device to the Internet network is expected to allow higher number of people to access Internet easily and from anywhere. Though mobile Internet is not yet widespread there is a potential to grow in the near future. The Ethiopian Telecommunication Corporation has made a test for its mobile customers to try for free and the service is expected to commence. As mobile access to the Internet decreases the access costs (compared to PC cost) significantly connectivity could increase immensely in the near future. In fact, the higher level of mobile telephone penetration, as supported in the survey, will facilitate connection of more businesses to the Internet when mobile Internet is commercialized.

CHAPTER THREE

LITERATURE REVIEW

A number of macro and micro level, and a combination of the two, studies have been done on Internet diffusion across countries, households, individuals and firms. Most of the studies are descriptive and case studies between two variables where the authors attempting to explain the general factors that affect diffusion process using given figures in the former case and surveys in the latter cases. There exist few academic studies that try to explain the main determinants of Internet technologies diffusion. Difficulty to estimate the economic, social and political aspects that are required for deep understanding of the issue and unavailability of data has been the explanation for the limited number of studies (Viktoryia Menkova(2004)).

Despite these problems there are few studies that attempt to deal with the issue empirically. In the following sections the theoretical and empirical works in the area of Internet technology diffusion determinants analysis in relation to business organizations have been discussed briefly.

3.1. Theoretical Literature

Most of the studies on the Technology diffusion used diffusion theory and utility basic ideas. Using diffusion theory or utility, these researches try to find the most statistically significant factors to explain the Internet diffusion process in a particular country or among individuals, households, businesses or countries. The main assumption underlying the diffusion theory is that the process of technology adoption follows an S-shaped curve (Rogers, 1995) as quoted by Viktoryia Menkova(2004).

According to this theory, at the very beginning of the introduction of a new product the number of users will be very small but as time passes and a number of individuals become aware with the product the number of users rises so that saturation point is achieved. As quoted by the same author, Rogers (1995) claims that the diffusion of innovation consists of five stages: Knowledge-individuals become aware of an innovation and have some idea how it functions, persuasion-individuals form their own attitude towards an innovation, decision-individuals decide whether to adopt or not to adopt innovation, implementation-individuals start using an innovation, and confirmation-individuals evaluate the results of their decision to adopt an innovation. The decision to adopt an innovation will be based on cost-benefit with the main goal for individuals to increase their utility (firms their profits). According to Rogers, all individuals can be divided into five groups with respect to their response to products: innovators (2.5%), early

adopters (up to 13.5%), early majority (34%), late majority (34%), and laggards (16%).

Regarding determinants of diffusion, the study by Christopher Forman (2004) summarizes briefly, there are three theories of Organizations determinants of Internet adoption, which are discussed in the following paragraphs. These are leader user, competing effects of Installed base and geographic concentration theories.

According to leader user theory, innovative organizations, or those that are traditionally closest to the technical frontier, have high likelihood to be the first to adopt Internet technologies. The first reason mentioned is that technical sophistications of organizations may enable them to have internal skill that helps them to adapt Internet technology easily to users need. The second reason is the easy transition that organizations at the technical frontier will be more likely to make from their existing system to Internet technology. As noted by the author the cost of adapting Internet to these organizations will be lower because most Internet technologies are a natural extension of the available technologies of the organizations.

According to the competing effects of installed base theory, as organizations have developed competency or made complementary investments that are incompatible with the new technologies adoption to new technology can be slow. As a result of tangible and intangible investments in the installed base, the costs of switching to the new

technology may raise which lead to effective locking in users. Lock in can be in the software, in investment in proprietary vendor technologies, in large installed base in mainframe systems, which will likely slow migration to the Internet because of the considerable costs of migrating from host-based to C/S-type Internet platforms.

The geographic concentration theory says that geographically concentrated organizations and those located in urban areas will benefit less from the decrease in communications costs caused by the adoption of Internet technologies. Saving costs with virtual private network (VPN) over alternatives such as face-to-face communication, traditional mail, or even data communications over private line services will be possible for those organizations with their multi establishments at various geographical locations. Organizations with these characteristics will be less likely to adopt access to the Internet, as the marginal benefits to Internet adoption will be lower for organizations primarily located in urban areas. Electronic coordination between multiple organization department, suppliers and customers is likely to be less important for these organizations than for those located in rural areas (The Corporate Digital Divide, Christopher Forman, 2004)

3.2. Empirical Literature

Various empirical studies on Internet diffusion have been done at the micro level, some of which include macro variables as well. At the micro level, a review of empirical researches on Information technology diffusion done by the Robert(1992) includes eighteen studies. Most of the studies are on diffusion of computers, software, computing systems, and in general Information Technology by individuals, industrial firms and educational institutes. Sources of data for the studies are mostly primary using surveys questionnaires filed by respondents.

The various studies used different independent variables to build their diffusion model. The independent variables in general were personal characteristics, managerial influences, adopters industry competitiveness, supply-side factors (Vertical coordination, supplier incentives), organizational characteristics (centralization), decision maker characteristics (information preference, exposure), educational commitment, perceived innovation characteristics, IT group characteristics, Information sources, Innovation characteristics, number of previous adopters, time, and level of previous IT spending.

Major results of the studies were:

- Adoption is associated with high vertical integration and high supplier incentives in the supply industry, and high industry

concentration and low competitive price intensity in the adopter industry

- Phase of diffusion significantly related to level of educational activities

- Client's preference and adopter attitudes strongly discriminate adopters from non-adopters. Years of experience, perceived accessibility of consulting, supervisor desires, and acquaintance with an advocate are moderately discriminating.

- Organizations with high R&D commitments and a large number of engineers and scientists in management are more likely to be early adopters

- Hypothesis linking characteristics of information sources and communication channels to diffusion not supported

- Centralization positively associated with initiation of compatible administrative innovations

- Easy of use appears to be a causal antecedent of usefulness, with little direct effect on use

The study of Internet adoption in an attempt to identify both micro and macro level variables has also been done. A study by Vagliasindi(2003) as quoted by Viktoryia Menkova(2004), has tried to analyze the determinants of Internet adoption at the enterprise-level and then add country level variables(“GDP per capita”, “fixed line penetration”, “democracy”, and “corporate governance”) for the case of transition countries. The main purpose of the study was to find the micro-level evidence on the rate of diffusion of the Internet. The Inclusion of the macro-variables were aimed to gather macro level evidences on Internet penetration. As a result the author(s) find about the importance of the level of basic telecommunication infrastructure, high per capita Income and democratic political regime to have higher level of Internet diffusion.

The authors used the two outcomes probit model to identify the main factors that affect Internet diffusion at the micro-level and analyze the type of enterprises that will have high probability of Internet adoption. Controlling for the firm size, geographical location, export/import orientation, rate of growth of sales, ownership, hardening of budget constrains, and network externalities effect the main findings are: outward oriented firms exploring cost-reducing innovations and that have foreign competitive pressure are more likely to adopt the Internet. Network effects (measured as a population density dummies) are also highly significant, that is, the value of the Internet increases with the number of actual users.

Another study Clarke (2001) quoted by the same author analyses over 3000 enterprises from 21 transitional countries based on Micro-level data to determine the factors that influence whether enterprise in a country have Internet access. The author used the standard maximum likelihood approach to estimate a model that includes enterprise characteristics. The characteristics were how it was established, ownership, size, sector of operation, competition, and performance. And the country characteristics were Income per capita, population, urban population, telephone infrastructure, openness to trade and Investment. The result shows that foreign ownership, openness to trade and competition (from foreign) increase the likelihood that enterprises are connected to the Internet. Furthermore, enterprise origin of private or joint ventures, and performance (sales growth, employment, etc), have higher probability of Internet connection.

For the country level indicators, the study found that Income per capita, population, the development of the telecommunication system and small countries with large urban population have positive effect on the probability of Internet adoption. However, according to the study foreign direct investment doesn't have significant effect on the probability of enterprises to adopt the Internet.

Various empirical research works done on the determinants of ICT adoption of enterprises have used the different variables related to structural characteristics, organizational and performance variables of a

firm. The structural characteristics include size, sector, location and age of a firm. Most studies have used size as a determinant of ICT adoption. The most common reasons put forward are, as quoted by Chris Forman and Avi Goldfarb(2005), economies of scale, slack resources, access to outside resources, and ability to bear adoption risks.

Industry is another factor identified in the analysis of determinants of firm adoption of Information technology. According to Anna Giunta and Francesco Trivieri (2004), to see the effect that belonging to a specific industry has on IT adoption means considering two factors into account. First, it means considering how pervasive IT is in the industrial sectors. Secondly, it means analyzing the extent to which its use may be influenced by a specific industrial structure. The evidence so far shows that ICT is a general-purpose technology, though the productivity gain differs on the industries in which they are employed and on certain organizational changes (Anna Giunta and Francesco Trivieri, 2004).

Location of a firm is also a variable taken in the analysis of IT adoption by a firm. The argument forwarded is that geographical proximity fosters the transfer of technological knowledge, i.e. firms can enjoy spill over effects (Ana Faria, Paul Fenn and Alistair Bruce,2002).

Another firm characteristics taken in the study of ICT adoption of firms is the company structure, i.e., whether the firm is a single plant or a multiple plant. As ICTs help information flows within an organization, their adoption

may be more critical to a larger organization in which there is more information to manage than in a smaller organization (Ana Faria, Paul Fenn and Alistair Bruce,2002). As noted by the same study, previous empirical studies have shown a positive impact of this variable on the likelihood of adoption of the new automated technologies.

Age has been used as a proxy for the accumulation of experience in general and reduction in the perceived risk of investment in IT. Hence, age is expected to increase the probability of IT adoption by firms. However, there is also explanation that shows younger firms might be ready to embrace innovative developments and carry out the company reorganization that goes along with IT investment. In this case, it is considered that there will be a negative relationship between age and IT adoption.

Work force characteristics have been taken to have relationship with ICT adoption of firms. ICT changes are considered by some authors (Ana Faria, Paul Fenn and Alistair Bruce,2002)as a skill-biased technical change as a result ICT is related negatively with blue color workers and positively with labor costs.

Export propensity is a factor used in the investigation of ICT adoption of firms as export by a firm is seen as a motivation to adopt new technologies since they allow firms to overcome entry barriers into new markets (Ana Faria, Paul Fenn and Alistair Bruce,2002). As indicated by the same study,

exporting firms can be expected to face increased competition. And these arguments have received empirical support from various studies of technology adoption.

As quoted by Chris Forman and Avi Goldfarb(2005), some research works have emphasized how prior investment in IT influence the value of adopting new ICT. The reason mentioned is the compatibility with new innovations influences the costs of adoption. Prior investments in hardware and software can also be proxy for organization‘s overall technology competence (Bharadwaj,2000) or technological sophistication(Raymond and pare, 1992). Technological sophistication is described as the number and diversity of information technologies used by the organizations. As it is noted by the same study, organizations with technological sophistication are less intimidated by technology and are more likely to have access to the technological and managerial resources necessary to adopt new technologies. Other empirical studies reviewed in this same study, have shown that organizations information department with technical competence or more infrastructure investments are more likely to adopt new ICT. However, some of the studies have shown that if the investments are specific to prior generations of ICT, they may in fact slow adoption.

Furthermore, R&D activities facilitate firms in absorbing new technologies, collaboration with other firms in business to business, B2B, exchanges,

and subcontracting in the supply chain are related to ICT use and are positively related in the various studies of IT adoption of firms.

Network externalities effect on firm adoption of ICTs has been studied by various studies reviewed by Chris Forman and Avi Goldfarb (2005). When network externalities are present, the private benefits of adoption differ from the social benefits. This can lead to a variety of sub-optimal equilibrium outcomes. The probability of adopting by a given date is positive related to the proportion of firms in the peer group that have already adopted. However, most research has been unable to identify whether this empirical pattern is caused by network externalities, knowledge spill overs, or other "bandwagon effects". Larger network size increases the speed of adoption when there exists common standards, other things equal. When standards aren't set and can be used to differentiate, adoption may exhibit negative externalities.

Most of the studies reviewed above are done to explain technology adoption behavior for business organizations in the developed countries. Very limited studies are done in the least developed countries, which are mainly descriptive studies. Miria Pigato(2001) has studied SMEs information needs and access to ICTs by interviewing 100 SMEs in Tanzania and Botswana. Though the time of study in the two countries differs, the methodology and questionnaires used were the same. The main findings of the studies were similar except that ICT use is wide spread in Botswana than Tanzania. The studies indicated that computer-

based information systems (e-mail and Internet access) were used mainly in the tourism, services sectors and foreign owned enterprises. Those firms that are catering for the domestic market were found to utilize more basic ICTs. The study further indicated that most SMEs use networks of family, friends, the local business community and own knowledge and experience to satisfy their business information needs.

CHAPTER FOUR

METHODOLOGY AND SOURCE OF DATA OF THE STUDY

The study is conducted in the capital city of Ethiopia; Addis Ababa, which has an estimated population size of 2.8 million people (Central Statistical Authority, 2004). Addis Ababa has more than half of the total telephone line, Mobile and Internet subscribers, in the country. However, most of the businesses in Addis Ababa are not connected to the Internet. Therefore, the city is selected for the study because demand for Internet services is met only partly and most of the businesses are not connected to the Internet. Attempts are made to have a sample of businesses with different economic and firm graphic characteristics, ensuring representative-ness using a random sampling procedure.

4.1. Source of Data and Sampling Procedure

The information required to analyze for the Internet adoption (access) by firms will be gathered from field survey using questionnaires distributed to businesses in Addis Ababa. As a result, questionnaire, which is attached at the end of this study, has been prepared and distributed for a random sample of 250 businesses in the city to be filled by their respective managers or one of the top management of the organizations. In addition, secondary sources of data such as journals, ITU reports, statistical reports

from CSA and ETC will be used in the literature and analysis sections of the study.

4.2. Descriptions and Hypothesis of the Study Variables

This study employs a Logit regression model to examine the relationships between having or not having access to the Internet and the various independent variables of the study. The independent variables to be tested are average annual sales, education level, age (of the firm), size (number of permanent employees), sector of operation, competition level, import (openness to international trade), content relevance of Internet, perception of businesses to Internet service prices and Computer availability. The variable education level refers to the highest education status of the general manager of the business or a member of board of directors. The perception of businesses on Internet costs are based on one time connection fee (i.e. Birr 156), monthly fixed payment for 900 minutes (i.e. Birr 60), per minute call charge above the 900 minutes (i.e. 0.04 cents/min), charges for telephone calls made to connect the Internet (i.e. Br. 0.20/six min.).

For the purpose of descriptive analysis and estimation of the model, the variables are coded as follows.

The model explained variable is a binary choice Pr(Access=1) for basic access to the Internet service and Pr(Access=0) for no basic access to the Internet by an enterprise.

The description of the explanatory variables in the model of simple binary choice and the hypothesis of the study regarding the variables are presented as follows:

- Age (of the firm)- the number of years since the establishment of the firm (continuous variable). Age of a firm is supposed to be a significant positive factor to explain the probability of getting connected by a firm, as more years means more experience towards technology.

- Size – which is represented by the number of employees of the firm as a result a continuous variable has been used. Size of a firm is supposed to influence the likelihood of Internet access of by a business positively and significantly, as more workers mean more communication and information exchange.

- Sales- Average annual sales of the firm, which is represented using three dummy categorical variables to hold the various levels of sales of firms. See the detail variables and their description in Table 1 annexed. The variables for sales of the firm as established in the various studies in the area are supposed in this study as well to be related to Internet access positively and significantly.

- Education – The educational status of the top management, which has four categorical variables for Elementary, secondary, College Diploma and Degree and above level of education. The variables for educational status of the top management are believed to affect the probability of having Internet connection of by a business positively and significantly. See detail variables in Annexed Table 1.

- Sector1 - general retail trade -these are redistributors by buying in bulk from the wholesalers. As a result of less need for information of the businesses negative and significant relationship is expected between this sector and the dependent variable of the study.

- Sector2 – Hotel, tourism and food related sector -as most of production and distribution is local, it is supposed to be related negatively to the dependent variable of the study and it is also believed to be significant variable

- Sector3 - Publishing services, education and health - as information and knowledge is required from Internet in the production of publishing and educational items. This variable is believed to be positively related to the probability of connectivity but may not be a significant variable.

- Sector4 – Business services including IT related firms- these are services that give consultancy in construction or businesses and serve other businesses and sale or resale telecommunication services,

software and hardware. A positive and significant relationship is expected to exist between this sector and the probability of Internet Access.

- Sector5 – This variable is used to accommodate a sector of activity of a business that isn't specified in the four sector variables mentioned above.

- Branches- number of branches (continuous variable) of a firm is taken to see the structure of the company. Having multiple branches is believed to influence the probability of having Internet access by a firm positively and significantly as a business with more branches has to coordinate its activities using communications technologies like Internet.

- Competition- whether a firm faces domestic and/or international competition in the output market. Dichotomous variable that will have two values will be utilized i.e. high or low (reasonable) values. Competition variable is supposed to affect the likelihood of Internet connectively positively but may not be significant factor in the case of Ethiopia, as most of the businesses may not require technological sophistication to be competent.

- Openness to International trade (i.e. Import and/or export). Dichotomous variable that will have two values; 1 for Yes response and

0 for No response for International trade. As Internet enables firms to reach international markets the probability of having Internet access will increase when a firm has a regular International trade activity and it is expected to be significant factor in explaining the dependent variable of the study.

- Content- this variable is used to assess the relevance of the information in the Internet to the daily activity of the businesses. Dichotomous variable that will have two values will be used taking 1 for Relevant response and 0 for Not Relevant response for the contents available on the Internet. The relevance of the information and applications in the day-to-day activity of the businesses increases the probability of Internet access by a firm and it is expected to be significant factor to explain the decision of a firm to have or not to have basic access to the Internet.

- Prices- Evaluation of businesses on costs of dial up Internet service that includes Internet Subscription Fee (ISF), Internet Utilization Charges(IUC), and Telephone Utilization Charges(TUC) to make the connection. Dichotomous variable that will have two values will be utilized i.e. high or low (reasonable) values. Three dummy variables (i.e. ISF,IUC and TUC) are used for Internet subscription, utilization and telephone costs. These variables are supposed to be not significant factors which affect the probability of Internet access by a business, compared to Income of businesses prices of Internet will not

have that much influence. However, as expected from basic demand theory they are expected to be negatively related to Internet access demand.

- Computer – this variable is used for availability of computer, but since it will create estimation problem (endogenous with Internet Access) predicted values will be used in the estimation of the model.

4.3. The Sample Design and Sample Size Determination

Under the current administration of Addis Ababa there are ten sub cities. Three sub cities namely Ararda, Addis Ketema and Kirkose are main business centers as a result the study population will be business organizations in these areas. According to the Central Statistical Authority 2004 survey result, there are around 52,800 business entities registered in Addis Ababa out of which 40% are located in the study area. The sample framework has been the list of businesses in the three sub cities taken from the CSA database. Then using a random number generated using computer the sample businesses has been selected from the sample framework. The sample size has also been distributed across the sub cities using proportion percentages taken from the total population of the businesses.

A representative sample size was computed using the following general formula n> 30 for large population. Therefore, the sample size of the study

is 250 businesses in the city. A random sampling technique will be employed after stratification is done into three sub cities of the city to get a representative sample.

4.4. Data

A total of 250 businesses were approached to interview using the questionnaires prepared for the survey and 240 businesses responses have been collected, on which the final analysis of the study is carried out.

Due to the availability of Telephone for 95% of the businesses in the sample, we will take telephone variable as a control variable in the logit estimation of the model. Furthermore, since the number of observation for export variable is limited our analysis will depend on the import variable only to show how openness to international trade affects connectivity of a firm.

Finally, the collected data has missing values for variables of prices for Internet access and utilization. In order not to lose observations during estimation, as the Stata software will exclude those observations with the missing values, imputed values for the prices variables have been used in the estimation of the model.

4.5. Model Specification

Several models exist to investigate technology diffusion process in the literatures such as epidemic model, rank effect (probit or logit) model; stock effects; order effects, legitimating and competition and Information cascades model. The main assumption of the epidemic model is that lack of information for potential users lead to slow diffusion of innovation. Information diffusion process doesn't flow smoothly as it is affected by "word of mouth" thus creating asymmetric S-curve. Epidemic models take a Macro-view of innovation diffusion process (Philipp Kollinger, 2005).

The probit model assumes that individuals/firms have different goals and capabilities and as a result, are more likely to adopt the technology at different point in time (Viktoria Menkove, 2004). The basic idea of this model is that firms differ from each other in at least in one relevant dimension such that the net present value of a technology is higher for some firms than others(Philipp Kollinger, 2005). The main purpose of this model is to identify relevant characteristics of individuals /firms that affect the probability of technology adoption. Firm size has been the main determinant used in this model. In addition, the probit model includes such factors as technological expectations, learning, search costs, switching costs, and opportunity costs. According to Pilipp Kollinger(2005), the strength of this model is its flexibility to incorporate any of firm heterogeneity into the modeling approach.

Stock effect models emphasis the strategic aspect of adopting a technology. And use a game-theoretic approach that focuses on the interdependence of payoffs between firms that compete on the same output market. These models assume that firms are identical and compete on some given output market (Philipp Kollinger, 2005).

Order effect models are extensions of stock effects approach. This model relaxes the assumption of the stock effect, which is the annual profits of all users of the new technology are the same irrespective of the time of adoption and the number of firms adopted the technology. However, the order effect assumes the timing of investment decision creates different benefits to early and later adopters- being an early adopter yields much higher returns which can be sustained even if other firms adopt later (Philipp Kollinger, 2005).

In the legitimating and competition model, the two forces help in the creation of new technology and ultimately limit its take up in the market. Information cascade models explore the fact that initial choice between different variants of new technology affects the speed of subsequent diffusion. According to the author, network externalities may strengthen the diffusion process. Furthermore, diffusion processes driven by information cascades consists of three stages. These are the initial choice, the lock-in, and the bandwagon (Viktoria Menkove, 2004).

In this study, however, probit or logit framework will be used to model Internet Adoption of firms in Addis Ababa. As indicated above, the probit model presumes that firms have different goals and abilities and as a result, are more likely to adopt the technology at different point in time. The probability that firm i has the Internet adopted is assumed to be a function of vector of its characteristics (X_i) that includes firm characteristics (size, age etc), availability of relevant content, prices for Internet connection, etc.

The general representation of a model used to describe the diffusion process is as follows.

$$\text{Prob (Internet adoption)} = (\alpha + \beta X_i)$$

Where X_i s are the independent variables of firm characteristics and is a cumulative distribution function (cdf). The type of cdf depends upon the assumption imposed on the distribution of the error term. In this case it is assumed to have a logistic distribution that is the logit model is estimated.

Individuals (firms) adopt the technology when the net benefit of adopting is positive. In general under the probit or logit model an establishment i will adopt a new ICT at time t if the following conditions hold.

$$NB(x_i, t) = B(x_i, t) - C(X_i, t) > 0 \qquad (1)$$

$$NB(x_i, t) > NB(x_i, t')/(1+r)^{t'-1} \qquad t' \neq t \qquad (2)$$

Where NB is the net benefit of adoption, B is the gross benefit of adoption and C is the cost of adoption. All functions represent the present value of profits discounted to time t. we let x_i be a vector of firm characteristics that influence the value of adopting the new technology. These equations say that a firm will adopt ICT first, when the expected benefits less expected costs (or net benefits) are positive, and second when the net benefits of adopting at time t are greater than the net benefits of adopting any other time t'≠t. A technology diffuses throughout the population either because the benefits of adopting are increasing over time or because the costs of adoption are declining. (ICT diffusion in business, 2005)

Therefore, using logit model the study tries to estimate the various independent variable that affect the dependent variable of the study that is Internet adoption in business.

CHAPTER FIVE

DESCRIPTIVE ANALYSIS AND ESTIMATION RESULT OF THE INTERNET ACCESS DEMAND MODEL

In this chapter, the descriptive statistical analysis and the result of the estimation of the model will be presented. As stated in the previous chapter, the representative-ness and the response rate of the sample has been satisfactory on which the following statistical analysis and regression results depend very much. In the description part, the sample statistics for the various explanatory variables and the explained variable of the study are presented. In the estimation part, the dependent variable of the study degree of association to the various main independent variables has been analyzed using cross tabulation analysis and then the regression result of the estimated model will be discussed as contrasted with other empirical results in the area.

5.1. Descriptive Statistics

In this section, socio-economic and firm graphics of the businesses, the business mangers perceptions of Internet benefit, with their assessment of the content relevance to their businesses are described using statistics. In addition, ICT access status of the businesses with the cost of access and

usage, price awareness and quality of the service are described in terms of sample statistics. A total of 240 businesses responses have been collected, on which the following final analysis of the study is carried out.

5.1.1. Firm characteristics

Firm characteristics such as type and form of ownership, management type, sector of activity, age(number of years since establishment), size (number of employees), number of branches, education, average annual sales, and openness to international trade are described in this section.

In terms of the type and form of ownership of the businesses, the sample result shows that around 98 percent of the businesses in the sample were private owned and only 2% were government owned (see Annex Table 16). And the form of ownership is mostly sole proprietor (around 67.5%), private limited companies (24.6 %) and the rest 6.8% are share companies, joint venture and associations (Refer to Annex Table 17). The management type of the businesses have been 70.8% owner manager, 15.4 % managed by family/relatives and 13.8 % are managed by hired managers and only 17.9 % had board of directors.(see Annex Table 20)

Sector of activity of the businesses has been assessed as an explanatory variable of the study. The result of the survey revels that large number of businesses (29.2%) are in general retailing activity of clothes, food items, etc. Electronics trade has been the second sector to have more proportion

of the sample businesses, which is 13.8%. Though this category can be considered as retailing but the nature of the products are quite different from the general retailing activity, as they are more related to technologies products sales which are mainly imported. Business services such as secretarial services, consultancy are 11.7% of businesses in the sample.

Table 5.1. Numerical and Percentage Distributions of the Businesses by Various Sectors of Activities

No.	Sector	Frequency	Percent	Cumulative Percent
1	Food related	20	8.3	8.5
2	Publishing	10	4.2	12.8
3	Manufacturing	8	3.3	16.2
4	Electronics retail	33	13.8	30.2
5	Transport	2	.8	31.1
6	General retail	70	29.2	60.9
7	Tourism	5	2.1	63.0
8	Finance	4	1.7	64.7
9	Telecos& IT	23	9.6	74.5
10	Business services	28	11.7	86.4
11	Health	13	5.4	91.9
12	Education	7	2.9	94.9
13	Others	17	7.1	100.0
	Total	240	100.0	

Businesses that are in the IT and Tele centers constitute 9.6% of the sample. This sector uses Internet both for input and output in the case of resale as a result more access to ICT will be the case as production necessarily requires the availability of technologies. The higher percentage exhibited to this sector compared to its age could be attributed to the flourishing of Tele centers and IT related firms in the city. Food related businesses such as hotels and bakery are 8.3% in the sample while Health related businesses are 5.4%. Businesses in the publishing of photo, magazines etc are 4.2 % in the sample. Such businesses as in the IT and Tele center businesses will have especially computers as the

production of their services necessary requires it. Other businesses in the sample were manufacturing (3.3%), education (2.9%), tourism (2.1%), finance (1.7%) and Transport (0.8%). Other than the sectors identified in this study we have the remaining 7.1% businesses in the sample that operate in other sectors not specified in the questionnaire.

As indicated in the literature part, most literatures related to technology diffusion to businesses put size of a firm as the most important explanatory factor. The data for size of the firm in the sample ranges from 1 employee to maximum 1380 employees and the average number of employees is 29, with standard deviation 130.76. And the distribution of the businesses in relation to the mean firm size shows that 87.49% are under the mean firm size computed for the sample.

Age of a firm was also one of the explanatory variables assessed during the survey. The data for age in the sample ranges from 1 year to maximum 44 years with the average age of the businesses being around 8.3 years, with standard deviation 8.77. Out of the total responded businesses 67.6 % are below the mean age 8.3 year.

Whether a firm has branch (es) has also been taken as an explanatory variable to Internet Access demand. Number of branches of a firm indicates as to the company structure. The company structure is supposed to affect the decision to have Internet access by the firm. The result of the survey indicates that 30% of the businesses in the sample have branch

(es). The number of branches ranges from 1 to 35 branches and the mean number of branches is around 1 branch. The percentages of businesses that are above the mean number of branches were 16.3%. Regarding branches out side Addis Ababa, only 7.7 % of the total businesses of the sample have branches outside Addis Ababa.

Education status of the management of a company has been a positive factor in the firm's decision to have access to the Internet. In this regard, the statistics on educational status of the business manger or board of the businesses indicate that 9.6% are elementary level, 31.4 percent are secondary level, 33.1 % have college Diploma, and the remaining 25.9% have Degree and above education.

Table 5.2. Numerical and Percentage Distributions of Business by Mangers Educational Status

No.	Education Level	Frequency	Percent	Cumulative Percent
2	Elementary	23	9.6	9.6
3	Secondary	75	31.4	41.0
4	College Diploma	79	33.1	74.1
5	Degree and Above	62	25.9	100.0
	Total	239	100.0	

However, managers could also rely on their staff that have IT education or computer training to use Internet for their businesses. So whether the businesses have IT graduate (Degree or Diploma) employee or not has been assessed and the result shows that 45.8% of the sample businesses have responded positively (Refer to Annex Table 5).

The availability of the computer training for employees of the organizations in the sample was seen as a factor that affects the use of Internet by the businesses. And 47.9% of the total 240 businesses responded positively reporting that they have provided/planned for training (see Annex Table 6). With regard to the usefulness of training for use of the Internet 95% of the businesses believe that training as to how to use the Internet is important (see Annexed Table 7). This might show that use of Internet requires substantive learning for employees to have access to it and exploit the opportunities and cost advantage a technology like Internet to offer. In addition, this might show that the higher level of awareness about ICT among the businesses and their preparation level to adapt the technology in their businesses.

The economic variables of a firm that are gathered during the survey were annual sales and asset of the firm. The result, as indicated in Table 5.3 below, shows that 64.3% of the businesses have average annual sales less than Birr 100,000, while the remaining 35.7% businesses have annual sales greater than Birr 100,000. Regarding current asset of the sample businesses, the result shows that 45.5% of the businesses have asset level less than Birr 100,000 Birr while 54.4% have asset level more than Birr 100,000(Refer to Annex Table 4).

Table 5.3. Numerical and Percentage Distributions of the Businesses by Annual Sales

No.	Annual sales	Frequency	Percent	Cum. Percent
1	Less than 50,000 Birr	128	54.5	54.5
2	Between 50,001-100,000 Birr	23	9.8	64.3
3	Between 100,001-150,000 Birr	17	7.2	71.5
4	Between 150,001-200,000 Birr	15	6.4	77.9
5	Between 200,001-250,000 Birr	5	2.1	80.0
6	Above 250,000 Birr	47	20.0	100.0
	Total	235	100.0	

Regarding to openness for international trade, that is import and export activities of the businesses were assessed. The result indicates that 26.7% of the sample businesses have regular import activities and only 4.2% of the businesses have regular export activities(see Annex Table 23). In addition to this the competition level the firm faces domestically or international has also been assessed and the result indicates that 41% of the businesses have reposted that they face high competition in the output market (Refer to Annex Table 23).

5.1.2. Internet Perceived Benefits, Uses, Language and Service Quality

Perception of the business mangers as to the usefulness of Internet to business, its content relevance, the language difficulty faced, and in general the quality of the service were assessed during the survey and the results are presented in this section.

Perception of businesses as to the usefulness of Internet to their business was interviewed during the survey. The result indicates that out of the total 224 businesses responded to the question, 175(78.1%) stated that Internet is useful for their business activity (see Annex Table 8). In addition, various uses of the Internet were specified on the questionnaire so that respondents would indicate which service they use and not to use. Among the enlisted uses some of them were email, browsing, procurement, government websites, marketing and market monitoring. The result shows email and browsing are the dominant uses of Internet by the businesses (Refer to Annex Table 21). In addition, the purpose of use of the Internet was assessed and the result shows that among 121 businesses responded 26(21.5%) indicated that they use Internet for business related activities only, 6(5.9%) use Internet for business and resale purposes and 4(3.3%) of them use Internet for personal use only. But most of them 66.9% (81 businesses) use Internet both for business and personal activities (Refer to Annex Table 9).

The relevance of contents available on the Internet to the businesses activities was one factor investigated in the study. Content includes information and applications on the Internet and which is mostly developed in the context of the developed countries. The measurement of Internet content relevance to businesses will be more meaningful if it is assessed among the connected businesses as they have the exposure to test the service. Hence, as indicated in the table below, among connected businesses, 75.5% have reported positive response and the remaining

24.5% have stated that Internet doesn't have that much relevance to their businesses.

Table 5.4:- Numerical and Percentage Distribution of the Businesses Cross Tabulation Using Internet Access and Content

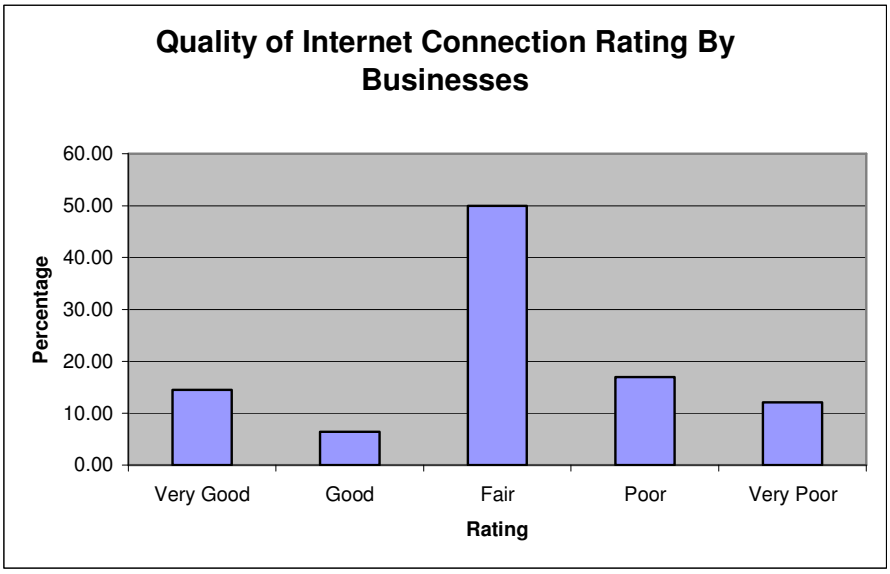
			Content		Total
	Responses		NO	YES	
Internet Access	No	Count	37	34	71
		%	52.1%	47.9%	100.0%
	YES	Count	26	80	106
		%	24.5%	75.5%	100.0%
	Total	Count	63	114	177
		%	35.6%	64.4%	100.0%

However, if penetration is concerned, the assessment of relevance will be important also among those not connected businesses. Because these businesses are assumed to be aware to the Internet and will be potential market to increase penetration as attractive contents are available on the Internet. In this regard, Table 5.4 above shows that among the businesses that aren't connected and have responded, only 47.9% have reported Internet is relevant to their businesses. The percentage for relevance of Internet content decreases in the businesses that aren't connected to the Internet. Hence, the need to improve content relevance is more important to businesses that aren't yet connected.

Question to assess whether language of the Internet is a problem for the businesses in using the Internet have been included in the questionnaire. Out of the total businesses responded 14.4% have stated that they face difficulty in using Internet as its contents are in English other than the local languages. However, it is clear from the result that this problem could

affect usage to some extent but not access to the Internet to significance level (Refer to Annex Table 10).

For those connected businesses or have access to the Internet, a question to evaluate the quality of the dialup Internet service was posed. Among 124 businesses responded, 14.5% have rated it to be very good, 6.5% rated it good, 50% rated it fair, 16.5% rated it poor, and 12.1% rated it very poor. In general, 78.1 % of the respondents have stated that the quality of the service to be fair, poor or very poor.



Furthermore, rating of the specified problems in using the Internet was given to users of Internet and the result indicated that data communication speed is the main problem. That is 85.2 % of the 108 businesses responded to the question has expressed the speed of the Internet to be very low. The second main problem the result of the survey shows is that

of the risk of viruses. Out of the total 109 businesses responded 60.6 % state that the virus problem to have much importance in using the Internet (Refer to Annex Table 11).

5.1.3. ICT Access Status, Costs of Access& Use of the Internet

Access of the sample businesses to the various ICTs (Fixed telephone, mobile, Fax, personal computer and Internet) and the businesses perceptions of the Internet access and usage charges of the ISP Company are surveyed and presented as follows.

Data for Internet access, which is the dependent variable of this study, among businesses in the sample was collected and the result shows that out of the total businesses 45 percent of them have access while the remaining 55 percent have no access. Table 5.5 presents the number and percentage of businesses in the sample that are connected and aren't connected.

Table 5.5:- Numerical and Percentage Distributions of Businesses by their responses to Internet Access

No.	Responses	Frequency	Percent
1	Yes	108	45.0
2	No	132	55.0
	Total	240	100.0

The type of Internet access the businesses have is dominantly dialup connection (93.5%) and leased line connection is only 3.8% (see Annex Table 12). The ADSL and wireless options of connection are not chosen at all. This could be due to the recent introduction of the technologies in the market. But the ADSL connection which is faster and flat rated than the dialup seems expensive to businesses, as most of the responded businesses rated it to be high. Those businesses that don't have access were asked further whether they have access plan in the near future. The assessment shows that 69.5% of the businesses have access plan to the Internet (Refer to Annex Table 25).

Tele center are also source of access for Internet due to their low cost of access and a number of Internet cafes are opened in the city. In this regard, the public Internet access use by the businesses was assessed and the result is only 15.5% of the responded businesses uses Tele center to access Internet(see Annex Table 26). This seems logical as the businesses are capable of subscribing the Internet, as revealed in the coming paragraphs, because they have the required infrastructure already available for Internet connection. The public access will be more relevant for individuals and residences as for these customers access costs could be expensive.

The availability of other Information and communication technologies such as telephone (fixed and mobile), fax, computer (with modem), and local area network (LAN) in businesses was assessed in the survey. Out of the

240 responded businesses 229(95.4%) have fixed telephone. Due to high number of businesses which have telephone lines we can say that one of the infrastructure required (i.e. telephone) for connectivity is already available among our sample businesses (refer to Annex Table 13).

Personal computer (PC) is also one of the most important infrastructures for Internet connectivity. Data regarding PC availability among businesses reveal that 62.1 percent of the businesses have computer. This shows that PCs are adopted by businesses for other purposes as the number of businesses, which have PC are greater than the number of businesses connected to the Internet (see Annex Table 13). Further assessment as to the cost of PC as barrier reveals that out of 130 businesses responded to the question 52(21%) businesses responded positively, while the remaining 188(79%) responded negatively. This is also supported by the data of availability of computers in the businesses offices for other purposes than connecting to the Internet (Refer to Annex Table 15).

Annexed Table 13 also indicates that the result for mobile access among businesses is also high. Among the total sample businesses 221(92.1%) businesses have mobile access. Data communication service such as fax access among the businesses shows that 132(55.6%) of the sample firms have fax services.

In general, as ranked by the businesses, the type of use between communication and information reveal that Internet is primarily used by the businesses for communication purpose (see Annex Table 22). Availability of local Area network (LAN),which could be used to share resources such as printer and Internet among the business offices was assessed during the survey. The data shows that 26.5% of the businesses in the sample have LAN.

Before the respondents were asked to evaluate prices, there were questions to measure the level of price awareness of the businesses. As indicated by Annex Table18 and Table 19, the statistics to measure Internet subscription and use prices awareness of the respondents indicate that 49.6% and 45.5% respectively were not aware during the Interview.

The costs of accessing and using the Internet include subscription fee, utilization costs for Internet and telephone usage costs during Internet connection and cost of computer. The cost of telephone subscription is excluded since 95.4% of the sample businesses have fixed telephone this variable will be used as a control variable in this study.

Regarding to perception of respondents to cost of Internet subscription (Birr 156), among responded businesses, the data indicate that 81.8% rated it to be medium, low (reasonable) or very low, while 18.2% rated it to be high or very high. For usage price (Birr 60 for 900 minutes and 0.07

cents/min for additional minute during daytime or 0.04 cents/minute for nighttime) evaluation, 80.7% of the responded businesses stated it to be medium, low (reasonable) or very low and 19.3% responded as high or very high (Refer to Annex Table 14).

Evaluating the telephone use charges (Birr 30 for 900 minutes and 0.033cents/min for additional minute), during Internet connection, the same table 14(annexed) indicates that 75.5% of the sample businesses rated it to be medium, low (reasonable) or very low, 24.5% stated it to be very high or high. However, for a customer use cost of Internet includes payment both to the telephone and Internet usage charges at the same time and in this regard the question posed to assess Internet use charges (Internet plus Telephone use charges) combined. The result shows that out of 235 businesses responded 42.1 % stated the general use costs to be medium, low (reasonable) or very low, while 24.7% stated it to be very high or high. The remaining 33.2% put no opinion(see Annex Table 14)

Therefore, it can be seen that in general the supply factors that are investigated in this section seems to be less important to affect Internet access as the majority of the businesses have the required infrastructures needed for connectivity and also the majority businesses have expressed the prices of access and use for Internet to be low (reasonable). Furthermore, close to half of the businesses aren't aware about prices, which might indicate the limited work to promote the service by the ISP Company. And finally it is indicated that the use of Internet is limited to

basic service that is communication compared to advanced information services.

5.2 Results of the Estimation of the Model for Internet Access

In this section, estimation results of the logistic model for the probability of Internet access by businesses are presented. The dependent and explanatory variables used in the regression are described and annexed in Table 1. To have Internet access computer is a precondition as it is the only access device possible in Ethiopia. When the occurrence of the explanatory variable is a precondition to the dependent variable such models are called sequential models –Amemiya (1975) as quoted by Maddala(1983). If an explanatory variable which is a precondition to the dependent variable in our case Internet access, is included in the regression then it will arise estimation problem (Maddala, 1983). Endogenous problem due to simultaneity might result in inconsistent and biased estimates (see Wooldridge, 2002).

According to Maddala(1983) the problem will be the coefficient of the explanatory variable will be infinite estimate. As a result, controlling for PC to avoid endogenous problem and then regressing, Full Information Maximum Likelihood (FIML) estimation by using bivariate logit or two-stage estimations are recommended. However, the method of controlling for the endogenous variable (PC) will not enable as to see the effect of

computer availability on Internet access and exclude significant number of observations from the regression. FIML estimation using bivariate logit taking Internet access and Computer availability as dependent variable at the same time will make estimation and interpretation of the results difficult. As a result, to allow computer as explanatory variable and find easily interpretable estimation results two-stage binary regression model was utilized in which first computer availability was regressed on exogenous variables and second, the predicted value of the model was used in the Internet access equation that includes computer as an explanatory variable. This technique enables us to use the predicted values of computer as an instrument to computer availability. However, to find a consistent estimation, the error terms of the two models (Internet and Computer adoption) should not be correlated (Wooldridge, 2002).

In this study, therefore, two-stage estimation method was employed and Internet access dummy variable was regressed on the socio-economic, firm graphics, perceptions of costs of the service and Computer availability variables, using predicted values for Computer adoption. The estimation results for Computer adoption model among businesses is annexed to Table 27.

The hypothesis of the study will be tested against the result using a Z test with a 95% level of confidence. If the ratio of the estimate to its standard error (Z statistics) greater than 1.96, then the estimate for an individual variable is different from zero, otherwise it is not. Having a variable

significant the next step is to examine its impact on access to the Internet, which can be done using marginal effect reports of the logit estimation. The logit regression has taken the dummy explanatory variables as described in Table 1 annexed at the back of this paper except for Age of the firm, Size (Number of employees) and Number of branches which are continuous in the regression. The results of the regression are presented in Table 5.8.

Before proceeding directly into the estimation of the logistic model of the study, simple cross tabulations of the individual explanatory variables with the dependent variable were analyzed to see the distribution of the explanatory variables in relation to the Internet access which is the dependent variable of the study. The cross tabulation results for all variables of the study are annexed in Table 2, but sector cross tabulation with Internet access is presented in the table followed.

Table5.6. Sector and Internet Access Cross Tabulation

No.	SECTOR	INTERNET ACCESS		TOTAL
		NO	YES	
1	Retail	69(67.0%)	34(33.0%)	103(100.0%)
2	Hotel, Tourism& Food	18(72.0%)	7(28%)	25(100.0%)
3	Publishing, Education & Health	16(55.3%)	14(46.7%)	30(100.0%)
4	Business service including IT	15(29.4%)	36(70.6%)	51(100.0%)
5	Other	14(45.2%)	17(54.8%)	31(100.0%)
Total				240(100.0%

The number of observations for some sectors such as finance, manufacturing, and transport are small and are include in the Other

category. In general, individual sector association with Internet access reveal that business services including IT(sector), has higher percentage of having Internet access reported. Hence, the cross tabulation method already indicates in what sectors Internet access is positively distributed. In this regard, sector for business services including IT is positively related to Internet access, while the distribution for retail, hotel and tourism sectors are in large number negatively related to Internet connectivity.

A better method to see the association of the dependent variable to the explanatory variables is Mantel-Haenszel Common odds Ratio Estimate. The correlations of the main individual explanatory variables of the study to Internet access are presented in Table 5.7 below. Age, Size and Import variables are individually correlated to Internet access. The result shows that Age and Size variables aren't significantly correlated to the Internet access, while Import found to be significantly correlated to Internet access.

Table 5.7 Mantel-Haenszel Common Odds Ratio Estimate

			Import	**Age of the Firm**	**Size**
Estimate			12.2	.625	3.278
ln(Estimate)			2.501	-.467	1.187
Std. Error of ln(Estimate)			.381	.283	.646
Asymp. Sig. (2-sided)			.000	.099	.066
Asymp. 95% Confidence Interval	Common Odds Ratio	Lower Bound	5.781	.360	.925
		Upper Bound	25.748	1.092	11.621
	ln(Common Odds Ratio)	Lower Bound	1.755	-1.022	-0.78
		Upper Bound	3.248	.088	2.453

However, a decision to have access or not by a firm is a combined effect of various factors of socio-economic and firm characteristics. Hence, a binary logit regression including all explanatory variables of the study is run on the survey data to estimate the demand model specified.

In the regression of computer on exogenous variables such as education categories, sales levels import and sector categories the result indicated that education category (EDUIII), Sale3, Import, and Sector4 variables are positive and significant in explaining the adoption of Computer by business organizations. The other variables such as Age of the firm and Size were not significant in explaining computer adoption with negative and positive signs of their coefficients respectively. As mentioned above the purpose of this estimation is to found predicted values for Computer availability variable and use it in the logistic estimation of Internet access (Refer to Annex Table 27).

Having the predicted values, not the actual computer availability values, the logistic model of Internet access probability of businesses that include the soicio-economic, computer availability and firm characteristics was run. The result of the model estimation can be seen as follows

Table:- 5.8. Logistic regression Internet access on the socio-economic and firm graphics factors

A) Regression result of the constant Term

Logistic regression				Number of obs =	240
				LR chi2(0) =	0.00
				Prob > chi2 =	.
Log likelihood = -165.15332				Pseudo R2 =	0.0000
Access |	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
Constant |	-.2006707	.1297498	-1.55	0.122	-.4549757 .0536343

B) Results of the logit regression on socio-economic and firm graphics

Logistic regression				Number of obs =	226
				LR chi2(18) =	162.85
				Prob > chi2 =	0.0000
Log likelihood = -74.661024				Pseudo R2 =	0.5217
Access |	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]
Age (of the Firm) |	-.0806872	.0336267	-1.40	0.016	-.1465942 -.0147801
Size |	.0060451	.008336	0.73	0.468	-.0102931 .0223833
EDUII |	.3256682	.9071097	0.36	0.720	-1.452234 2.10357
EDUIII |	2.706085	1.093893	2.47	0.013	.5620951 4.850076
EDUIV |	3.105472	1.258242	2.47	0.014	.6393623 5.571582
Sale2 |	1.067609	.6308851	1.69	0.091	-.168903 2.304121
Sale3 |	3.937339	1.519161	2.59	0.010	.9598383 6.914839
Import |	4.457912	1.739441	2.56	0.010	1.04867 7.867154
Sector2 |	1.665743	.8353077	1.99	0.046	.02857 3.302916
Sector3 |	1.550253	.9894735	1.57	0.117	-.389079 3.489586
Sector4 |	2.977082	1.267761	2.35	0.019	.492317 5.461847
Sector5 |	.0793106	1.06199	0.07	0.940	-2.002151 2.160772
ISF |	-.2005625	1.095086	-0.18	0.855	-2.346892 1.945767
IUC |	- 1.221714	1.060394	-1.15	0.249	-.8566204 3.300049
TUC |	- .8072071	.7157967	-1.13	0.259	-.5957286 2.210143
Content |	.6267013	.5256543	1.19	0.233	-.4035621 1.656965
Competition |	.6708913	.3050045	2.20	0.028	.0730935 1.268689
Computer |	2.355414	2.958332	0.80	0.426	.153639 3.44281
Constant |	- 4.558876	1.511159	-3.02	0.003	-7.520694 -1.597057

As indicated in the above table, Age (of a firm) is found to be insignificant and negative in estimated model, as the z value is –1.40 which is less than the critical value. Size is positive as expected but it is also insignificant. Since size variable showed multi-colinearity problem with branch variable, Branch variable was dropped out of the regression and the decrease in the LR ratio for this variable was found to be insignificant.

Among sector variables in the model Sector2 and Sector4 are found to be positive and significant compared to the reference sector Sector1. The sign of the coefficients for the sector variables are found as expected in the hypothesis, except for Sector2, which is positive in the estimated model.

All variables for education found to be positively related to the dependent variable. Compared to the reference variable EDUI, coefficients for variable EDUIII (College Diploma), EDUIV (Degree and above) have been significant and positive with the Z values 2.47, while variable EDUII has been insignificant. Compared to the variable Sale1, the coefficients for all annual sales level are positive and only variable Sale3 (Above Birr 250,000) is significant with z values 2.59. Import is also significant and positive with z value 2.56 compared to the critical value of Z 1.96 with 95% confidence interval.

The coefficients for the variables ISF, IUC and TUC are all insignificant and negative which is consistent to the basic theory of demand that establish a negative relationship between demand and prices.

Content variable is also insignificant but as expected positively related to the logit of the Internet Access, while variable for Competition is significant at z=2.20 at 95 % confidence level and positively related to the dependent variable. The variable for computer availability (i.e. Computer) has been positively related to Internet access but it is insignificant to affect the probability of Internet access by a business organization.

Finally, the degree to which the logistic model used in this study predicts the observed data is tested using Hoser and Lemshow test for logistic regressions. Here follows the tables that show the goodness of fit of the model of this study.

Table 5.9 Hoser and Lemshow Goodness of fit test and contingency table

A)Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	5.587	8	.693

B) Contingency Table for Hosmer and Lemeshow Test

	INTERNET = No access		INTERNET = Have access		Total
	Observed	Expected	Observed	Expected	
1	21	21.392	2	1.608	23
2	22	19.806	1	3.194	23
3	21	19.699	3	4.301	24
4	15	17.453	8	5.547	23
5	14	12.552	9	10.448	23
6	10	11.601	13	11.399	23
7	9	9.668	14	13.332	23
8	7	6.619	16	16.381	23
9	3	2.467	20	20.533	23
10	0	.744	20	19.256	20

The Hosmer and Lemeshow Googness-of-Fit test statistic shows that the model that is fitted for the data on the various socio-economic, firm graphics and costs and content of the service has chi-square 5.587 for 8 degree of freedom with p=0.693. This result shows that we should accept the null hypothesis that there is no difference between the observed and the predicted values of Internet access, in other words this means the model has good fit to the data

5.3 Discussion of Results

The logistic regression models estimation for the probability of Internet access by a business organization has been done using STAT V9 procedures. Internet access was regressed on demand factors i.e. socio-economic, firm characteristics, predicted values for personal computer and supply factors i.e. perception of respondents regarding costs of access and usage of Internet

Firm characteristics such as Age of a firm, is found to be insignificant and negatively related to the likelihood of Internet adoption by a firm. Existing empirical works have mixed result on the sign of Age of a firm on the probability of adopting a technology such as the Internet. In our case, age variable is negatively related to the likelihood of having access to the Internet. This result might show that in Ethiopia younger firms are more likely to embrace technological changes than older firms. However, age is

not statistically significant explanatory variable in Internet access likelihood of a business organization.

Regarding to size (the number of employees) of the firm, the result found in this study is consistent to empirical works in the area that is it is positively related to the probability of Internet access. As the size of the firm increases, the likelihood of the firm getting connected increases. However, size is also insignificant explanatory variable statistically in the adoption of Internet by a firm.

As expected the level of education of the business mangers, are positively related to Internet access and are significant except secondary level of education. The significance level for education increases as the level of education the business managers have specifically from college diploma to degree or above. Hence, compared to those who have elementary level of education, the business mangers that have Diploma or Degree and above are more likely to have Internet to their businesses.

The estimation result also shows that level of the average annual sales of a firm affects positively the likelihood of the firm to be connected to the Internet. Among the levels of sales included in the regression Sale3 has been significant. This might show that compared to those businesses which have annual sales less than Birr 50,000(Sale1), those with sales above Birr 250,000 have high probability of having access to the Internet. In this regard, the marginal effect analysis (Table 3 in Annexes) indicates

that a unit change in this level of annual sales increases the likelihood of having access by 61%.

Import, which is an indicator for degree of openness to International trade, has been significant factor in explaining the likelihood of a firm to have Internet access. As Internet is a communication and information medium businesses could use it to explore new market opportunities, price search and communicate with their suppliers abroad cost effectively. Hence, the estimation result for import variable is as expected in the hypothesis of the study.

Sector of activity of the firm influences the likelihood of a firm to adopt Internet, as some of the variables are statistically significant. According to the result of the logit estimation, compared to businesses in retail being in hotel, food related and tourism sector is positively and significantly related with the logit of Internet access of a firm. The same result is found for sectors such as business services including IT, which increases the logit of adopting Internet by a firm positively and significantly. In general the result shows and confirms that Internet is a general purpose technology as the observations of the sample indicate various firms from different sectors have Internet access and there exists difference in the benefit gains across industries which will be significant explanatory factor in the decision to have access to the Internet.

The regression result on supply factors that is costs of Internet subscription and utilization, telephone utilization cost during Internet connection indicates that Internet access are not significantly influenced by Internet access and utilization charges and telephone utilization charges during Internet connectivity. This seems logical especially for subscription fee for the Internet, as this payment is one time payment and is small compared to the businesses levels of sales. In addition, the comparison for Internet tariff in African countries reveals that Ethiopia's tariff for Internet is lower than most African countries in the sample of the study (ResearchICTafrica.net, 2004). Hence, in general price factors are not significant explanatory variables in affecting the likelihood of Internet access by business organizations.

Among other factors, Internet contents relevance variable was hypothesized in the study to explain the likelihood of Internet access by businesses however, the estimation result indicate that it is positively related to Internet access but insignificant statistically to explain Internet adoption by businesses. But the descriptive statistical analysis of the variable shows that among businesses that aren't connected and have responded, only 47% have reported that Internet is relevant to their businesses. Given the large proportion of businesses that are not connected, this result might suggest that more has to be done in terms of local content development to attract businesses that aren't connected and to retain the existing ones.

In other words, the use of Internet should develop from the existing status or basic email (communication) use to more advanced services such as browsing (information), applications (B2B, B2C, market monitoring etc.). In order this to happen contents need to be developed which enable to increase the value of the network to customers. In fact, local content development requires allowing the private sector to participate in the Internet market so that these actors will identify the needs of customers and develop the required contents. Probably content could be more important to explain utilization demand of Internet access, which is not addressed in this study.

Competition level found to be significant explanatory variable for the likelihood of a firm to have access for Internet. The evaluation has been carried out by the business managers to rate the level of competition their respective firms face as high or low (reasonable). And the result shows that competition is positively and significantly related to the likelihood of a firm to have Internet access. This means the higher the level of competition the business managers face the more likely the firm to have Internet access. Finally, Computer availability among businesses have found to be not a significant factor to affect the likelihood of Internet access by a business organization. This is supported by the descriptive analysis that shows Computer availability is already high among businesses that are not connected to the Internet.

CHAPTER SIX

CONCLUSION and RECOMMENDATIONS

Internet access is considered as the main indicator of a country's penetration level of ICT, which has significant impact for socio-economic and political developments of a given country. Ethiopia being the least developed and the second populace nation in Africa has the lowest Internet connectivity even compared to the Sub-Saharan countries excluding South Africa. Among the possible contributors to the underdevelopment of Internet and all telecommunication services in Ethiopia, the monopoly of the market structure could be considered as one cause. This has paralyzed the participation of the private sector, which is a vibrant actor in most parts of the world by becoming also competitors to incumbents.

In preparation to the market reform supposed to be undertaken long ago, the Ethiopian government formed the Ethiopian Telecommunication Agency (ETA) to regulate the sector and the Ethiopian Telecommunication Corporation (ETC) as operator. The main objective of establishing ETA was to draw regulations to allow competition in the sector by issuing license to operators in the sector. However, the agency couldn't come up with substantial measures to promote the development of the ICT sector in Ethiopia, due to lack of enforcing power, low administrative capacity and heavy dependence on the political structure.

Historically, the development of Internet has passed through certain stages before it is commercialized and it has engaged various groups of the society and required coordination and working collectively. As a result Internet was not developed by a single institute or commercial body rather the involvement of the various institutions, government policy makers, and private commercial entities have made a realization of Internet successful.

The same is reflected in the Internet network development in Ethiopia, which has also involved various institutions such as the UN ECA, and ESTC. After receiving the initial projects, the Ethiopian Telecommunication Corporation is the only Internet service provider (ISP) in the country. To keep up with the increasing demand for the Internet the operator has gone through expanding the network three times and currently the total capacity of the network can accommodate 116,500 dial up and 3300 leased line customers. However, the number of subscribers couldn't increase as expected and currently the corporation has around 26,000 dial up and 300 leased line customers. Thus, there is unutilized capacity of the network that could have been used to increase the Internet penetration level in the country.

To tackle shortage of demand recently the operator has come up with the idea of Virtual Internet service providers (VISP) to participate the private sector in the marketing and distribution of Internet connections based on commission payment system. This could be seen as a positive move in the

part of the government to allow the participation of the private sector in the development of the sector. However, compared to what VISPs do in other countries the participation level has been vary restrictive, which will not enable the VISP to play their roles in the local content development for the Internet.

To stimulate demand, parallel to the network expansion works, the operator has been revising tariff downwardly so that to increase the take up of the service in the society. After two price regimes the current price structure seems cheaper to customers at least for business customers as it is also evidenced in the survey carried out to this study, in which around 81.8 %of 176 businesses reported it to be medium, low(reasonable) or very low both for subscription and utilization charges. Thus, this might suggest that price isn't a factor to affect demand at least in the business community

The demand for Internet can be categorized into three. These are subscribers of dial up and leased line customers, those who access Internet through public access points that is Tele centers and those that access Internet using government networks for schools, woredas and universities. The first category of Internet users refers mostly individuals, households and business organizations. With regard to this segment of Internet subscribers, the demand for Internet has been growing on the average 44% annually for the last eight years. However, currently there is shortage of demand for Internet access as the take up of the services is

lower. Moreover, taking this segment of customers to show Internet level of demand in a country could understate the level of penetration in the country, as the measurement doesn't include those who have access through public access areas.

The main objective of this study has been to determine the factors that affect Business organizations demand for Internet access in Addis Ababa. The study result from the cross section data of 240 businesses in Addis Ababa indicates that tariff factors have minimum significance to explain the probability of Internet access by a business. Rather firm socio-economic factors such as education, sales, openness to international trade, competition and sector of activity of the firm are the main determinants of access to Internet connectivity. Factors like firm size (number of employees), age and computer availability have less importance in influencing the probability of a firm having Internet connection.

Content variable of the logistic model estimated that is content relevance was not significant factor to explain probability of connectivity. Though the factor is positively related to the dependent variable of the study, it was found to be insignificant. Due to the local nature of businesses most firms have and the preference for informal communication means such as friends and families might be the explanation for the insignificance of content in the model.

Therefore, the overall review of the Internet sector in Ethiopia, the descriptive statistics of the survey and the results of the logistic models estimations done in this study suggests the following points for the promotion of the Information and Communication technology in general and Internet service in particular in the business organizations in Ethiopia.

1) the market structure of the Internet service in Ethiopia should allow competition and the participation of the private sector so that the private sector will play vibrant role in the development and hence in the increasing of Internet penetration among businesses. In addition, the recent move in the part of the operator should be strengthen by allowing the private sector to have its own access server to provide various local contents rather than mere connection sales aimed at present. The Increase in the local content (applications and information) will increase the value of Internet in the day-to-day activities of businesses, which will in turn bring more demand for Internet services. Furthermore, in order to identify local needs of the business community in Ethiopia studies should be carried out.

2) in addition, as described and indicated in the history of the Internet in Ethiopia, the involvement of various institutions is critical to increase penetration level in the country. In this regard, government catalyst role should be strengthen.

3) to strengthen the regulatory agency i.e. Ethiopian Telecommunication Agency(ETA) by solving its problems of manpower, finance etc. is crucial

since this will help the agency to take strong measures that will promote the ICT development in Ethiopia. In addition, to avoid unutilized network capacity and hence increase the efficiency of the sole ISP Company (ETC), network expansions need to be carried out followed by demand studies for the service.

4) in addition, as indicated in the statistical description part of this study, close to half of the businesses are not aware the prices of Internet access and utilization and this could be due to lack of aggressive promotion in the part of ETC. Hence, ETC should increase its promotion through ways that will enable to get the attention of the business community. ETC should also facilitate to give training to potential as well as existing customers as to how to use the Internet. The result from the survey showed that most businesses have stated the need for training as important factor to affect use of Internet by the businesses.

5) education level is significant in increasing Internet penetration level, in this regard policies that will help in upgrading business managers educational level seems important factor in order, among other things, to increase the use of Internet in the business community.

6) sector of activity of a firm is important factor in the probability of Internet access. As a result, ICT policies need to consult businesses in those sectors that are more connected to drive lessons to use in encouraging those businesses in less connected sectors. Specifically retail sector of

activity has the highest proportion of businesses and most of the businesses have no access, Internet access should be facilitated to these businesses through at least their trade associations centers so that theses businesses will be benefiting from Internet.

7) this study doesn't look deeply the use of the Internet, as access doesn't necessarily mean utilization, in this regard future studies should look at usage of Internet access among business or

ganizations as well.

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Annexes

Table 1:- Description of Dependent and Explanatory variables

Variables	Description	Type
Access	Internet access or connected	Dummy (1 if connected, otherwise 0)
Age (of the firm)	Number of years since establishment	Continuous
Size	Number of permanent employees	Continuous
EDUI	Primary education	Dummy(1 if primary, otherwise 0)
EDUII	Secondary education	Dummy(1 if secondary, otherwise 0)
EDUIII	Diploma	Dummy(1 if Diploma, otherwise 0)
EDUIV	Degree and Above	Dummy(1 if Degree&above, otherwise 0)
Sale1	Average annual sales less than Birr 50,000	Dummy(1 if sales less than Birr 50,000, otherwise 0)
Sale2	Average annual sales between Birr 50,001-250,000	Dummy(1 if sales between Birr 50,001-250,000, otherwise 0)
Sale3	Average annual sales above Birr 250,001	Dummy(1 if sales above Birr 250,001, otherwise 0)
Import	Regular import activity	Dummy(1 if Yes, otherwise 0)
Sector1	Retail	Dummy(1if Retail,otherwise 0)
Sector2	Hotel, tourism and food related	Dummy(1 if Hotel, otherwise 0)
Sector3	Publishing, Education and Health	Dummy(1 if Publishing, otherwise 0)
Sector4	Business services including IT	Dummy(1if Business service, otherwise 0)
Sector5	Other sectors not in the above list	Dummy(1 if Otherthan listed, otherwise 0)
ISF	Internet Subscription Fee	Dummy(1 if High, or 0 for Low(reasonable))
IUC	Internet Utilization charge	Dummy(1 if High or 0 for Low(reasonable))
TUC	Telephone Utilization charge	Dummy(1 if High or 0 if Low(reasonable))
Content	Internet content relevance to business activities	Dummy(1 if Relevant or 0 if Irrelevant))
Competition	Level of competition	Dummy(1 if High or 0 if Low(reasonable))
Computer	Availability of Computer(Ownership)	Dummy(1 if Yes, otherwise 0)
Constant	Constant term	Continuous

Table 2:- Cross Tabulation of the Socio-Economic and Firm graphics Variables with Dependent Variable Internet Access

Name of Explanatory Variables		Access =No	Access =Yes	Total
Age	Age <8.3	82(50.9%)	79(49.1%)	161(100%)
	Age >8.3	48(62.3%)	29(37.7%)	77(100%)
Size	Size<29	123(58.9%)	86(41.1%)	209(100%)
	Size>29	8(26.7%)	22(73.3%)	30(100%)
Education	EDUI=0	107(51.2%)	102(48.8%)	209(100%)
	EDUI=1	18(81.8%)	4(18.2%)	22(100%)
	EDUII=0	63(44.3%)	79(55.6%)	142(100%)
	EDUII=1	62(69.7%)	27(30.3%)	89(100%)
	EDUIII=0	91(61.1%)	58(38.9%)	149(100%)
	EDUIII=1	34(41.5%)	48(58.5%)	82(100%)
	EDUIV=0	114(59.1%)	79(40.9%)	193(100%)
	EDUIV=1	11(28.9%)	27(71.1%)	38(100%)
Sales	Sale1=0	31(29%)	76(71%)	107(100%)
	Sale1=1	96(75%)	32(25%)	128(100%)
	Sale2=0	100(57.5%)	74(42.5%)	174(100%)
	Sale2=1	26(43.3%)	34(56.7%)	60(100%)
	Sale3=0	122(64.9%)	66(35.1%)	188(100%)
	Sale3=1	5(10.6%)	42(89.4%)	47(100%)
Branch	Branch=0	112(66.7%)	56(33.3%)	168(100%)
	Branch=>1	20(27.8%)	52(72.2%)	72(100%)
Import	No	34(39.1%)	53(60.9%)	87(100%)
	Yes	8(12.9%)	54(87.1%)	62(100%)
Competition	Low	69(48.9%)	72(51.1%)	141(100%)
	High	62(63.3%)	36(36.7%)	98(100%)
Content	Irrelevant	37(58.7%)	26(41.3%)	63(100%)
	Relevant	34(29.8%)	80(70.2%)	114(100%)
Subscription Charge	Low	56(38.9%)	88(61.1%)	144(100%)
	High	12(37.5%)	20(62.5%)	32(100%)
Utilization Charge	Low	58(40.8%)	84(59.2%)	142(100%)
	High	10(29.4%)	24(70.6%)	34(100%)
Utilization Charge for Telephone	Low	51(42.5%)	69(57.5%)	120(100%)
	High	7(17.9%)	32(82.1%)	39(100%)

Table 3:- Marginal effects after logit

y = Pr(Access) (predict)
= .54747619

Variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Age of firm	-.0199899	.00804	-1.49	0.013	-.035742	-.004238	8.20354
Size	.0014976	.00204	0.73	0.464	-.002507	.005502	30.4867
EDUII*	.0801321	.22186	0.36	0.718	-.354699	.514963	.362832
EDUIII*	.554571	.15307	3.62	0.000	.254563	.854579	.345133
EDUIV*	.5182131	.10678	4.85	0.000	.308937	.72749	.159292
Sale2*	.2492683	.12845	1.94	0.052	-.002481	.501017	.265487
Sale3*	.6100712	.08767	6.96	0.000	.438249	.781893	.199115
Import*	.7026467	.10092	6.96	0.000	.504854	.900439	.269912
Sector2*	.3402829	.12407	2.74	0.006	.097107	.583459	.110619
Sector3*	.3251179	.14598	2.23	0.026	.038999	.611237	.123894
Sector4*	.5419072	.11366	4.77	0.000	.319147	.764667	.225664
Sector5*	.019585	.26152	0.07	0.940	-.492986	.532156	.115044
Content	.1552627	.13025	1.19	0.233	-.100032	.410557	.654069
Competition	.1662106	.07626	2.18	0.029	.016739	.315682	1.69469
ISF	-.0496885	.27119	-0.18	0.855	-.581218	.481841	.175721
IUC	-.3026749	.26169	-1.16	0.247	-.210219	.815568	.183377
TUC*	-.1881807	.15141	-1.24	0.214	-.108568	.48493	.132743
Computer	.5835445	.71908	0.81	0.417	-1.99292	.825829	.632821

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 4:- Numerical and Percentage Distribution of the Sample businesses by Current Asset Levels

No.	Current Assets	Frequency	Percent	Cumulative Percent
1	Less than 100,000 Birr	106	45.5	45.5
2	Between 100,001-200,000 Birr	48	20.6	66.1
3	Between 200,001-300,000 Birr	16	6.9	73.0
4	Between 300,001-400,000 Birr	14	6.0	79.0
5	Between 400,001-500,000 Birr	5	2.1	81.0
6	Above 500,000 Birr	44	18.9	100.0
	Total	233	100.0	

Table 5:- :- Numerical and Percentage Distribution of Businesses by

Responses for IT Staff Availability

No.	Responses	Frequency	Percent	Cumulative Percent

1	Yes	110	45.8	54.2
2	No	130	54.2	100.0
	Total	240	100.0	

Table 6:- :- Numerical and Percentage Distribution of Businesses by Responses for Provided/Planned Computer Training for their Staff

No.	Responses	Frequency	Percent	Cumulative Percent
1	Yes	115	47.9	47.9
2	No	125	52.1	100.0
	Total	240	100.0	

Table 7:- :- Numerical and Percentage Distribution of Businesses by Responses for Training Usefulness for Using the Internet

No.	Responses	Frequency	Percent	* Valid Percent	Cumulative Percent
1	Yes	192	80.0	95.0	95.0
2	No	10	4.2	5.0	100.0
	Total	202	84.2	100.0	
	Missing	38	15.8		
	Total	240	100.0		

Table 8:- :- Numerical and Percentage Distribution of Businesses by Responses for Internet Usefulness for their Business Activities

No.	Responses	Frequency	Percent	* Valid Percent	Cumulative Percent
1	Yes	175	72.9	78.1	78.1
2	No	49	20.4	21.9	100.0
	Total	224	93.3	100.0	
	Missing	16	6.7		
	Total	240	100.0		

Table 9:- :- Numerical and Percentage Distribution of Businesses by Purpose of Internet Use

No.	Purpose of use	Frequency	Percent	* Valid Percent	Cumulative Percent
1	For Business Use	26	10.8	21.5	21.5
2	For Personal Use	4	1.7	3.3	24.8
3	For (1) and (2)	81	33.8	66.9	91.7
4	For Business use and resale	6	2.5	5.0	96.7

5	For Business, Personal and resale uses	4	1.7	3.3	100.0
	Total	121	50.4	100.0	
	Not Access	119	49.6		
	Total	240	100.0		

*Valid percent shows that those businesses responded the Question

Table 10:- :- Numerical and Percentage Distribution of Businesses by Responses of Language Difficulty in using the Internet

No.	Responses	Frequency	Percent	Cumulative Percent
1	No	218	85.6	85.6
2	Yes	22	14.4	100.0
	Total	240	100.0	

Table 11:- :- Numerical and Percentage Distribution of Businesses by their Responses for the various problems Significant in using the Internet

Problems	No Importance=1	Some Importance =2	Much Importance =3	Don't Know=4	Total
1. Data communication is too slow or unstable	3(2.8%)	12(11.1%)	**92(85.2%)**	1(0.9%)	108(100%)
2. Risk of Viruses or hackers	11(10.1%)	28(25.7%)	**66(60.6%)**	4(3.7%)	109(100%)
3. Lack of Perceived benefit	25(24%)	41(39.4%)	**31(29.8%)**	7(6.7%)	104(100%)
5. Misuse or theft of a Password	25(23.8%)	22(21%)	**37(35.2%)**	21(20%)	105(100%)
6. Poor customer handling by Tele (ETC)	9(8.4%)	27(25.2%)	**67(62.6%)**	4(3.7%)	105(100%)

Table 12:- :- Numerical and Percentage Distribution of Businesses by Access type for the Internet

No.	Access Type	Frequency	Percent	* Valid Percent	Cumulative Percent
1	Dial Up	100	41.7	93.5	93.5
2	ADSL	1	.4	.9	94.4
3	Wireless	-	-	-	-
4	Leased Line	2	.8	1.9	96.3
5	Satellite	-	-	-	-
6	(1) and (2)	1	.4	.9	97.2
7	(1) and (3)	1	.4	.9	98.1
8	(1)and (4)	2	.8	1.9	100.0
	Total	107	44.6	100.0	
	Missing	133	55.4		
	Total	240	100.0		

*Valid percent shows that those businesses responded the Question

Table 13:- :- Numerical and Percentage Distribution of Businesses by their Responses for ICT Status

No.	Responses	Fixed Telephone	Mobile	Fax	Computer (with Modem)	LAN
1	Yes	229(95.4%)	221(92.1%)	108(45%)	149(62.1%)	63(26.5%)
2	No	11(4.6%)	19(7.9%)	132(55%)	91(37.9%)	175(73.5%)
	Total	240(100%)	240(100%)	240(100%)	240(100%)	238(100%)

Table 14:- :- Numerical and Percentage Distribution of Businesses by their Evaluations of Access and Utilization Prices

Prices	Evaluations	Frequency	Percent	* Valid Percent	Cumulative Percent
Internet Subscription Fee	Low	144	60.0	81.8	81.8
	High	32	13.3	18.2	100.0
	Total	176	73.3	100.0	
	No Opinion	64	26.7		
	Total	240	100.0		
Internet Utilizat	Low	142	59.2	80.7	80.7
	High	34	14.2	19.3	100.0
	Total	176	73.3	100.0	

ion charge	No opinion	64	26.7		
	Total	240	100.0		
Telephone charge	Low	120	50.0	75.5	75.5
	High	39	16.3	24.5	100.0
	Total	159	66.3	100.0	
	No opinion	81	33.8		
	Total	240	100.0		

Table 15:- :- Numerical and Percentage Distribution of Businesses by their Responses for Computer Cost Barrier ness (For Internet Access)

No.	Responses	Frequency	Percent	Cumulative Percent
1	No	188	79.0	60.0
2	Yes	52	21.0	100.0
	Total	240		

Table 16:- :- Numerical and Percentage Distribution of Businesses by Type of Ownership

	Ownership Type	Frequency	Percent	Cumulative Percent
1	Private	236	98.3	98.3
2	Public	4	1.7	100.0
	Total	240	100.0	

*Valid percent shows that those businesses responded the Question

Table 17:- :- Numerical and Percentage Distribution of Businesses by Form of Ownership

No.	Form of Ownership	Frequency	Percent	Cumulative Percent
1	Sole Proprietor	162	67.5	68.4
2	Private Limited Co,	59	24.6	93.2
3	Share Company	14	5.8	99.2
4	Joint Venture & Association	2	.8	100.0
	Total	237	98.8	
	Missing	3	1.3	
	Total	240	100.0	

Table 18:-Numerical and Percentage Distribution of Businesses by their Responses for Awareness of Internet Subscription Fee

No.	Responses	Frequency	Percent	Cumulative Percent

1	Yes	121	50.4	50.4
2	No	119	49.6	100.0
	Total	240	100.0	

Table 19:-Numerical and Percentage Distribution of Businesses by their Responses for Awareness of Internet Use charge

No.	Responses	Frequency	Percent	Cumulative Percent
1	Yes	131	54.5	80.7
2	No	109	45.5	100.0
	Total	240	100.0	

Table 20:-Numerical and Percentage Distribution of Businesses by Manager Type

	Management Type	Frequency	Percent	Cumulative Percent
1	Owner Manager	170	70.8	70.8
2	Hired Manager	37	15.4	86.3
3	Managed by Family	33	13.8	100.0
	Total	240	100.0	

Table 21:-Numerical and Percentage Distribution of Businesses by

Various Uses of Internet

No.	Uses of Internet	Yes	No	Total
1	E-mail	114(47.5%)	126(52.5%)	240(100%)
2	Browsing	111(46.25%)	129(53.75%)	240(100%)
3	Procurement	34(14.2%)	206(85.8%)	240(100%)
4	Business to Business (B2B)	64(26.7%)	176(73.3%)	240(100%)
5	Business to Customer (B2C)	42(17.5%)	198(82.5%)	240(100%)
6	Government Website	54(22.5%)	186(77.5%)	240(100%)
7	Market Monitoring	42(17.5%)	198(82.5%)	240(100%)
8	Marketing	46(19.2%)	194(80.8%)	240(100%)
9	Price Search	19(7.9%)	221(92.1%)	240(100%)

Table 22:-Numerical and Percentage Distribution of Businesses by Use of Information and Communication(Ranking)

No.	Use Ranking	Frequency	Number Responded	Percent
1	Information	37	78	47.4%
2	Communication	42	81	51.9%

Table 23:-Numerical and Percentage Distribution of Businesses by Responses Import and Export

No.	International Trade	Responses		Total
		Yes	No	
1	Import	64(26.7%)	176(73.3%)	240(100%)
2	Export	10(4.2%)	230(95.8%)	240(100%)

Table 24:-Numerical and Percentage Distribution of Businesses by Responses

Competition Level

No.	Competition	Frequency	Percent	Valid Percent	Cumulative Percent
1	High	98	40.8	41.0	41.0
2	Medium	114	47.5	47.7	88.7
3	Low	18	7.5	7.5	96.2
4	No Competition	9	3.8	3.8	100.0
5	Total	239	99.6	100.0	
	Missing	1	.4		
	Total	240	100.0		

Table 25:-Numerical and Percentage Distribution of Businesses by their Responses for Internet Access Plan

No.	Responses	Frequency	Percent	Valid Percent	Cumulative Percent
1	Yes	91	37.9	69.5	69.5
2	No	41	16.7	30.5	100.0
	Total	131	54.6	100.0	
	Connected	108	45.4		
Total		240	100.0		

Table 26:-Numerical and Percentage Distribution of Businesses by their Responses for Internet Public Access

No.	Responses	Frequency	Percent	Valid Percent	Cumulative Percent

1	Yes	35	14.6	15.5	15.5
2	No	191	79.6	84.5	100.0
3	Total	226	94.2	100.0	
	Missing	14	5.8		
Total		240	100.0		

Table 27:- Regression Result of Computer Ownership on the various Firm graphics and Socio-economic variables

Logistic regression — Number of obs = 227
LR chi2(12) = 141.10
Prob > chi2 = 0.0000
Log likelihood = -78.497647 — Pseudo R2 = 0.4733

Computer	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Age	-.0406399	.0270608	-1.50	0.133	-.0936781	.0123984
Size	.0295518	.0216434	1.37	0.172	-.0128686	.0719722
Import	3.964656	1.08983	3.64	0.000	1.828628	6.100683
EDUII	-.3573743	.6637189	-0.54	0.590	-1.65824	.9434909
EDUIII	1.324304	.66155	2.00	0.045	.0276897	2.620918
EDUIV	1.637479	.8733705	1.87	0.061	-.0742961	3.349253
Sale2	.7311706	.4917245	1.49	0.137	-.2325917	1.694933
Sale3	2.780225	1.244694	2.23	0.026	.3406686	5.219781
Sector2	.4029472	.6186637	0.65	0.515	-.8096114	1.615506
Sector3	.9498579	.6491189	1.46	0.143	-.3223917	2.222108
Sector5	-1.035727	.9505518	-1.09	0.276	-2.898774	.8273205
Sector4	2.076439	.5918562	3.51	0.000	.916422	3.236456
Constant	-1.349621	.67637	-2.00	0.046	-2.675282	-.0239605

GLOSSARY

ICT- Information Communication Technology

ETC-Ethiopian Telecommunication Corporation

ETA- Ethiopia Telecommunication Agency

ESTC- Ethiopia Science and Technology Commission

UN ECA – United Nation Economic Commission for Africa

ITU –International Telecommunication Union

CSA- Central Statistics Authority

TCP/IP- Transmission Control Protocol/ Internet Protocol

LAN – Local Area Network

WAN- Wide Area Network

VISP- Virtual Internet Service Provider

POP- Point of Presence

E-commerce- Electronics commerce

E-governance- Electronics governance (includes voting)

ISP- Internet Service Provider

PTO- Public Telecommunication Operator

PSTN- Public Switched Telephone Network

DDN- Dedicated Digital Network

SMEs- Small and Medium Enterprises

ADSL- Asynchronous Digital Subscriber Line

USD- United States Dollar

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