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SHORTCOMINGS TO GLOBALIZATION: USING INTERNET TECHNOLOGY AND ELECTRONIC COMMERCE IN DEVELOPING COUNTRIES

Aurore J. Kamssu, Ph.D
Tennessee State University, USA
Jeffrey S. Siekpe, Ph.D
Tennessee State University, USA
James A. Ellzy, Ed.D
Tennessee State University, USA

ABSTRACT

Information and communications technology (ICT) has become an indispensable tool in the fight against world poverty. ICT provides developing nations with an unprecedented opportunity to meet vital development goals, such as poverty reduction, basic healthcare, and education, far more effectively than before (UNDP, 2000). Nations that succeed in harnessing the potential of ICT can look forward to greatly expanded economic growth, dramatically improved human welfare, and stronger forms of democratic government. The unequal access to technology between groups due to differences in demography , economic status, and locations, has been suggested to affect worldwide globalization through Internet connectivity. Other speculations in addition to these factors that are crucial to the adoption and use of ICTs include the number of ISPs (Internet Service Providers) and/or OSPs (Online Service Providers) in a given country. The present study investigates the impact of information technology (IT) infrastructure, ISPs, and socio-economic factors on ICT access and use. Statistical analyses show that there is an empirical relationship between these factors and the Internet adoption in different countries; which may help explain the gaps between groups with respect to Internet use.

JEL Classifications: F20
Keywords: Information Technology, Communications Technology, Development, Telecommunication

INTRODUCTION

From the US to Europe, and quickly spreading around the world, millions of people are finding their life styles changing through the use of the Internet. The Internet constitutes a potential resource for many stakeholders including investors. On the Internet, thousands of computer servers and databases around the world are connected, thus, investors can have lots of information at their fingertips (Kichen, 1994). Through this communication medium, businesses can reach customers, who, otherwise, would never have known about their products and/or services. The Internet is, therefore, a rich resource for information on the market for competitors, suppliers, and customers (Riddle, 1999). On the international market, the availability of information can help firms gain popularity and credibility; and therefore, help reduce travel, transaction, agency, and communication costs.

The Internet is described as "the most important innovation since the development of the printing press", with the potential to "radically transform not just the way individuals go about conducting their business with each other, but also the very essence of what it means to be a human being in society" (Hoffman, 2000). Since the Internet's inception, researchers and practitioners have suggested that investment in Internet technology will determine success in e-commerce between countries; and the capabilities to harness new technologies and new methods of doing business determine the economic success of countries in the current global marketplace (Bhatnagar, 1999). Not surprising therefore, global spending on information and communication technology topped $2.1 trillion in 1999 and is projected to surpass $3 trillion in 2003 (Brown, 2000). E-commerce has become the newest and most rapidly evolving areas of international trade (Abeyesekera, 1999). Organizations, such as the World Trade Organization (WTO), advocate that the world globalization would have real commercial benefits.

BENEFITS OF THE INTERNET AND PROBLEMS OF ITS ACCESS

[illegible] firms having access to information in almost every industry including business, health, education, sports, recreation, etc. From an economic perspective, Petrazzini and Kibati (1999) argued that the Internet is being developed in many countries around the world under the premise of interconnecting the resources of those countries. Information, together with capital and labor, is an essential factor for production. It is a major contributor to labor productivity. An increase in information content has significantly changed the concept of production, signifying the importance of timely information flows. Firms failing to incorporate new information can be left behind in gaining productivity and competitiveness. ICT has also significantly changed corporate behavior and organization structure in an effort to increase

productivity (Brynjolfsson and Hitt, 2000). The Internet allows big and small companies to easily engage in business transactions within the country and overseas. On a social note, during the 2000 Ebola virus outbreak in Zaire, a neighboring country, Zambia was able to use the Internet to check details about similar cases in the Zambian Copperbelt; and doctors working in rural hospitals could promptly access medical information on various diseases. However, the underdeveloped regions of the world continue to face obstacles in accessing the Internet (Petrazzini and Kibati, 1999).

Today, 96 percent of Internet host computers reside in the highest income nations with only 16 per cent of the world's population. For instance, there are more Internet hosts in Finland than the whole of Latin America and the Caribbean, more in New York City than on the entire continent of Africa (UNDP, 2000). This inequality (often referred to as the 'digital divide') in development among countries is growing and has greatly concerned many researchers including the United Nation (UN) about the imbalance of access to Internet facilities; and it raises questions about the perspective of e-commerce in these regions (Abeyesekera, 1999). From an academic perspective, Arunachalam observes that researchers in developing countries do not have the necessary electronic technology to access free information in cyberspace, as a result their performance and contribution to science can be very limited compared to their peers in developed countries.

Nonetheless, past experience has shown that unavailable, unreliable and/or outdated information is a major impediment to development (Blackman, 1998). "Countries that choose to invest in improving their telecommunications infrastructure are likely to outpace those that do not" (Blackman, 1998). But improving such infrastructure goes beyond simply adding more telephone lines or enhancing the capability of the local and international networks. More importantly, most countries will need to reform their regulations on telecommunications, reconfigure the tariff structure, allow competition from the private sector, and generally provide an enabling environment necessary to take advantage of the inevitable telecommunications boom.

OBJECTIVES

The Internet and e-commerce pose unique challenges in the area of international trade because the practicality of a perfect globalized world using the Internet is far from reality. In order to achieve such a global marketplace, easier access to the Internet and better telecommunication (telecom) systems, should be implemented in all countries. The objective of the study is to explain why some countries have easily implemented e-commerce while others have yet to take the first step and why different paths should be taken to successfully develop and promote Internet use in developed and developing countries. The present study investigates the factors that may potentially prevent people in different regions around the world from fully taking advantage of the Internet benefits. In other words, the factors that contribute to unequal growth of the Internet in developed and developing countries, the quality of service offered by ISPs in relation to Internet adoption in different regions of the world, the relationships between socio-economic factors and Internet adoption are the concern of this study. The main goal of this paper is

to relate the resources of various regions around the world to Internet use and more importantly to identify any differences in the aforementioned factors.

RELATED RESEARCH

Though not all the evidence on technology diffusion is conclusive, there is broad agreement in the literature on two points. On the one hand, new technologies are usually not adopted by all users at the same time (Rogers, 1995). The widespread diffusion of new technologies can take anywhere from five to fifty years (Blackman, 1997). Rogers (1995) argues that the diffusion of new technologies follows a predictable intertemporal pattern. Many studies on adoption and diffusion of new technologies focus on such transition processes and try to explain why not all potential users move immediately to new (more profitable) technologies.

In explaining technology diffusion, Rogers (1995) proposed that the characteristics of a given technology innovation in terms of its *perceived relative advantage* (ie. the perceived ICT benefits and impact), *compatibility* (both technical and organizational), *trialability* (the degree to which ICT can be experimented), *complexity* (ease of use or learning ICT) and *observability* (the extent to which relative advantage or gains of Electronic Commerce are clear) determined adotption. These innovation factors have been the key features of several IT adoption studies including Iacovou, Benbasat and Dexter (1995); Kwon and Zmud (1987); Moore and Benbasat (1991); Ling (2001).

In another stream of research, it has been argued that positive organizational factors contribute to the success of technology diffusion (Bowonder, Miyake and Linstone, 1994). Some of the organizational factors that have been noted by scholars in diffusion studies include *organizational structure* (Ives, Hamilton and Davis, 1980); *size of firm* (Iacovou, Benbasat and Dexter, 1995; Igbaria, Zinatelli and Cragg, 1997), *organizational culture* (Fink and Kazakoff, 1997), *top management support* (Beatty, 1998; Cooper and Zmud, 1990), *organizational technology readiness* (Parasuraman, 2000). Ling (2001) categorizes these factors as internal environmental factors and added that external environmental factors such as industry factors (*competitive pressure, critical mass and externalities),* and national factors (*cultural differences, level of national infrastructure, and government's support).* While a nation's infrastructure is defined by its basic communication and transport capacity, many governmental have been the source of funding infrastructure projects (Kettinger, 1994).

At the nation level, the impact of government policies and initiatives has been shown to have a direct and an indirect stimulation to the supply of information, which produces faster technology diffusion (Stoneman and David, 1986). Bhatnagar (1999) studied the effect of telecom reforms in developing countries on the growth of e-commerce and his findings support the theory that cheap IT equipment (low custom duties on IT products) and cheap telecom services (low telephone service charges and low Internet service provider (ISP) charges) promote Internet use and thereby contribute to the growth of e-commerce. Peha (1999) expended the number of factors to include political stability, economic growth, policies on spectrum management, international

telephone services and accounting rates, ISP licensing, the resale of service and access to the Internet (Peha, 1999).

Herrera Ramos (2001) examined differences in access to basic infrastructure and capacity and ability to use information technology and telecommunications, at household, state, national and international levels. Graham (2002) discusses the effects of ICT development on social and geographical unevenness within and between cities in the global North and South; some focus on the role of innovative initiatives combining technology and urban policy to ameliorate the division. Horvath (2000) discusses conflicting views about the existence in Europe of a separation between those who are online and multimedia-literate and those who are not, based on socioeconomic factors; public and private warnings of and strategies to prevent a "two-tier" information society. Parker (2000) covers the importance of advanced telecommunication services, competitive policies, needed rural services, community action options, examples of rural initiatives, and federal policy options.

These studies have underscored the need to understand country-level diffusion metrics. The recent proliferation of various e-readiness and similar indexes, and a recently announced initiative by the World Bank's Information for Development Program to fund such studies [Infodev, 2001], point to a strong interest of national policy makers and business people. Though several studies have contributed to this effort, lacking, however, is a theoretical framework that incorporates these factors in a parsimonious and coherent structure. This paper does not try to set forth a general theory of why the ICTs diffuse. Such an attempt in a single study may undermine critical factors of technology adoption/diffusion that are otherwise significant in different situations. Rather, this paper attempts to empirically examine the effect of external variables on Internet adoption and use and demarcate which variables may be considered a necessary precursor to the development of such a theory.

THEORY FOUNDATIONS AND RESEARCH MODEL

Information systems researchers have employed various models such as Rogers' (1995) Innovation Diffusion Theory (IDT), Fishbein and Ajzen's (1975) Theory of Reasoned Action (TRA), Ajzen's (1985) Theory Planned Behavior (TPB), Davis' (1989) Technology Acceptance Model (TAM) in an attempt to explain technology adoption and use behaviors. Many of these adoption models looked at the relationships between behavioral characteristics like perception or belief, attitude, behavioral intentions, and actual behavior in technology adoption. For example, the TAM put forward by Davis (1989) addresses IT adoption, implementation and diffusion in terms of perceived ease of use and perceived usefulness. TAM suggests that belief about the system, perceived use and perceived ease of use, directly affects attitudes toward use, which in turn affects intention to use the IT, a direct antecedent of actual technology use (cf. Rogers 1995 IDT; see literature review in previous section). However, a limitation of these earlier models is that they exclude the influence of external environmental factors such as economic or infrastructure variables. Furthermore, Larsen (1997) questioned whether ICT can clearly be defined in relation to the innovation and diffusion process alone. Larsen explained

that hybrid corn and medical products were at the core of Rogers' IDT development which salient characteristics did not change during the diffusion process. That is, the adopters could not change or make modifications to the innovation during the diffusion process. This is in direct contrast with IT innovations such as the Internet. It is not easy to describe the Internet as distinct, separate, and unchangeable entity.

This study acknowledges that although these earlier models discussed above make important contributions to a growing body of knowledge, it is critical to consider the influence of country specific environment factors, such as socioeconomic, infrastructure and human capital, which may act as precursors to technology awareness and adoption. In the context of Internet adoption, Wolcott et al (2001) noted that researchers who are studying how the Internet is influencing and changing the economic, political, and social systems of various countries have been limited by the absence of models that are more accurate, descriptive, and sophisticated than the simple number of Internet hosts in a country.

Based on the literature, this study organizes these various environment factors in three groups. These groups are: socio-economy of the region, telecom systems and IT infrastructures, and the different telecom and ISPs service charges. Since socio-economic factors have an impact on a region's telecommunication system and IT infrastructure, which in turn will determine telephone and Internet service charges; therefore, to ensure a successful installation and a steady growth of the Internet in a given region, researchers must first analyze the socio-economy of the region, then, determine how advanced the region is in technology and telecommunication, and finally, identify the elements that contribute in setting the different service charges.

Socio-Economy

Socio-economic factors represent the root of IT development. The role of socio-economic factors was confirmed by Peha (1999), who argued that a country like Haiti faces Internet growth problems because 65 percent of the population lives in rural areas (which increases interconnection costs) and more than 60 percent of the population is illiterate (which limits the number of people who could navigate the Internet). Socio-economic factors include, among others, the level of education, the purchasing power of the population, economic growth, language skills, etc. Most developing countries have low literacy rates, which explains why there is a slow personal computer penetration (Anwar, 1996). Socio-economic factors are often correlated. For example, in countries where a high percentage of the population lives in rural areas, the rate of illiteracy will be high; therefore, limiting not only the purchasing power of individuals, but also the reading and writing skills required to effectively use the Internet.

In order to develop the need to access the Internet, users must have the basic knowledge of computer, which can be acquired by frequently using computers. Having access to computers can increase an individual's curiosity and develop the need to connect to the Internet. Abeyesekera (1999) also suggested that education and practical training are needed to put together and maintain suitable e-commerce web sites. The more comfortable an individual is with computers the higher is his incentive to access the

Internet. Apart from being educated, people should have the money to purchase the required technology. For example, in the US, the average monthly salary of a professional is the equivalent of three computers; whereas in Tanzania, a computer costs three times as much as a professional average monthly salary (Petrazzini and Kibati, 1999). Thus, socio-economic factors are expected to positively affect Internet use, which may help explain why technology is concentrated in few countries. We therefore hypothesized that:

> **Hypothesis 1:** The higher the purchasing power of individuals, the higher will be their Internet use.

IT and Telecom Infrastructures

The availability of technology and telecom infrastructures is one of the most important factors for Internet growth. Connecting to the Internet requires a computer and other components such as software, modem, network cards and cables, the backbone infrastructure, and ISPs.

Access to Computers: In order to connect to the Internet, a user must have access to a computer. Access to a computer represents a problem in developing countries and the consequent problems of Internet availability (Abeyesekera, 1999). Owning a computer requires investing a large amount of money, relatively, that many people around the world, epecially in developing countries, cannot afford. In some countries, the costs of computer infrastructures can considerably increase with the custom duty charges imposed. Those custom duties constitute a critical source of tax revenue in developing countries especially in Africa and Arab States (Bhatnagar, 1999). In addition, poor countries do not have the necessary infrastructure, adequate communication channel and bandwidth. This lack of infrastructure affects many other areas in those countries. As Arunachalam (1999) noted, even with the willingness to acquire computers and other components, individuals in certain parts of the world will not be able to connect to the Internet because of the poor handling of telephone infrastructures and ISPs. Generally, it is expected that the high costs of IT infrastructures and equipments will slow the growth of Internet use. Promotion of low-cost technology and access without having to use a personal computer might increase Internet use. Based on this preceding discussion we hypothesized the following:

> **Hypothesis 2:** The availability of IT will be positively related to Internet Use. In other words, a higher IT investment will lead to more Internet use.

Telephone Infrastructures: Internet services are based on either the dial-up access over national telephone systems, direct access through wired cables, or wireless links using antennas and receivers. Developed areas have a comparative advantage because they have most of the telephone lines and they can afford the high cost of wireless infrastructure such as satellites. In most developed countries, especially the U.S., the

Internet was easily accessible using the dial-up system because most homes and businesses have one or more telephone lines. However, because most homes in the US are equipped with cable televisions, many people are switching to broad band connections such as cable-modem. The ease of telephone access may explain why the Internet began in the U.S. where 95 percent of homes had telephone lines, which are dependable, noise free and cheap relative to income (Peha, 1999). In developing countries, on the other hand, dial-up access is available only in big cities. Petrazzini and Kibati (1999) argue that in 1997, over 80 percent of developing countries' main telephone lines were in urban centers even though 60 percent of the population lived in rural areas. In Kenya for example, 85 percent of Internet users are in Nairobi, the capital (Petrazzini and Kibati, 1999). In Haiti, phones are concentrated in the capital city, Port-au-Prince, and it takes more than a year to get a phone line (with the waiting list of about 10,000), and about one third of the country's phone lines are out of service (Peha, 1999).

Arguably, because of the competition and the infrastructures, most rich regions can expand and easily obtain telephone lines at relatively low prices, which give them a comparative advantage with respect to Internet growth. Furthermore, there is a disparity between high and low-income regions in terms of both Internet hosts and users (Petrazzini and Kibati, 1999). Though developed countries represent a small fraction of the world population, 16 percent, and have three quarter of the world's telephone lines (Arunachalam, 1999), their share of Internet hosts is more than 97 percent (Petrazzini and Kibati, 1999). We therefore hypothesize the following:

> **Hypothesis 3:** The existence of reliable telephone infrastructures will have a positive effect on Internet use.

Telecom and ISP Service Charges

ISPs include large commercial services such as America Online, small commercial companies, universities, government agencies, and non-profit agencies. ISPs play an important role in corporate communications networks (Rockwell and Fontana, 1996). However, as new market entrants, they must make a significant leap in infrastructure and service capabilities to build credibility (Smetannikov, 2000). To attract users, a number of ISPs offer free access, (for example NetZero) funded by advertising or sponsorship, and in return acquire users' personal information given to the service provider. In any case the free access to the Internet is either conditional to agreeing to be a paying subscriber for a certain length of time, or subject to restrictions such as the limited duration of each on-line session, or the display of advertisements on the browser.

It is becoming current for telephone and cable companies to provide Internet services because companies that choose to avoid the Internet business are being shortsighted and are missing a major opportunity. For example, QWEST, formerly US WEST Inc., competed for Internet access business, Internet firewall management and electronic data interchange support markets (Greene, 1997). Similarly, BellSouth, Southern New England Telecommunications, and other Telecommunication companies offer Internet access to their local residential and business customers (Davis, 1997).

Whether the offering is dial-up or dedicated access, browsers or home installation, hosting or consulting, customers have new choices from their local exchange carriers when connecting their PCs to the Internet. However, the delivery method is a key factor that ISPs have to consider in service quality.

Despite the attention given to the US, very little is known about the deployment and provisioning of the Internet in other countries, especially those in the developing regions. According to Shankar (1997), the market focus within the Internet varies from carrier to carrier and is defined, first, by the carrier's strengths and weaknesses, and secondly, by the process of market segmentation. The distribution of rural Internet providers across the US shows that over time, network growth has clustered from one state or region to the next (Garcia, 1996). Most telecommunication companies in those areas provide Internet services either as sole service providers or as Internet resellers operating in conjunction with consortia (Garcia, 1996).

The differences in Internet services among countries may be linked to the type of telecommunication systems they have. In developed regions there is a tight competition in the telecom market, where as, most developing countries are disadvantaged by telecom monopolies. In Haiti, for example, telephone services are provided by a government-owned monopoly and Internet connections to a single computer cost approximately $2000 (Peha, 1999). The lack of competition makes access to international network and Internet access expensive (Petrazzini and Kibati, 1999). Abeyesekera (1999) and Bhatnagar (1999) indicate that liberal telecom systems may have lower costs of leased lines for Internet service providers in developed countries compared to developing countries.

Furthermore, the existing data are generally not interconnected as to help decision makers or even misleading in many cases. To overcome the difficulty of connecting locations with poor quality telephone infrastructure, some regions such as Eastern European countries have provided high-speed Internet access using wireless technology (Tully and Riekstins, 1999). Those wireless Internet connections are mainly used to link non-profit organizations such as universities, schools, and government agencies. Individuals are usually not able to acquire the technology because of the high access fees and maintenance costs. Beside the quality of the telecom systems and IT equipments, service charges of Internet use constitute an important element for the successful adoption of the Internet and e-commerce (Bhatnagar, 1999).

The service charges can be broken into two: setup costs and operating costs. The setup costs are very high and include the costs of acquiring IT equipments and installation costs. In developing countries, those set up costs are relatively higher when they are compared to the per capita income (Petrazzini and Kibati, 1999). For instance, leasing a line costs about US$ 11,000 in Kenya compared to only US$ 300 in the United States (Abeyesekera, 1999); and lower costs of leasing a line leads to lower local call charges and lower ISP charges. Setup costs therefore, contributes to promoting the Internet and e-commerce. Operation costs constitute local telephone charges and Internet service provider charges. These costs are extremely expensive and increase even more in developing countries relative to the low income of the population. In Ghana, for Instance, an Internet account costs US$50 per month, the equivalent of two-month salary

for most Ghanaians; whereas in the industrialized world, services of better quality cost less than $25 (Petrazzini and Kibati, 1999). International leased-line charges are the main factor contributing to high Internet service charges; therefore, the high prices of international telephone services create difficulty for Internet growth (Peha, 1999). Cheap IT and telecom equipments and cheap service charges (telecom and Internet charges) will encourage the use of the Internet and, therefore, stimulate the practice of doing business electronically. Competition among ISPs will lead to better service quality, lower service charges and connection costs, and consequently higher Internet use. From the preceding discussion, we hypothesized the following:

> **Hypothesis 4:** Internet use is expected to be positively impacted by the increase in competition in ISPs.

RESEARCH DESIGN AND EMPIRICAL RESULTS

A list of 196 countries from all five continents (Africa, America, Asia, Europe and Oceania) was identified from the International Telecommunication Union (ITU) World Telecommunication Indicators Database. The number of countries was reduced to 146 because of missing data for some factors considered. The factors considered for each country include indicators on basic economy, telephone lines, and information technology for the year 2001.

Ordinary least squares regression models were used in the analysis and the results are summarized in Table 1. The first regression considers all selected countries from the five continents. The other four regressions group countries by continents to better understand how factors may vary by environments. However, Oceania had only a few countries and was associated with America due to their many similarities. For example, an international initiative between New Zealand and Canada compared user education objectives and practices, and the relationship between user instruction and information literacy in academic libraries. It was found that there were far more similarities than differences in the attitudes and practices of librarians responsible for user education in New Zealand and Canada (Rader, 2002).

The statistical model used for analysis can be represented as follows:

$$\text{Internet Use} = \beta_0 + \beta_1 \text{Economy} + \beta_2 \text{Computers} + \beta_3 \text{PhoneLines} + \beta_4 \text{InternetHosts} + \varepsilon$$

Where:

Internet Use: the number of Internet users per 10,000 inhabitants for 2001.
Economy: represented by the Gross Domestic Product (GDP) per Capita for 2001.
Computers: the number of personal computers per 100 inhabitants for 2001.
Phone Lines: the number of main phone lines per 100 inhabitants for 2001.
Internet Hosts: the number of Internet hosts per 10,000 inhabitants for 2001.

RESULTS

Economy: The economy factor bears mixed results. Contrary to the prediction by hypothesis 1, the parameter estimate for the economy proxy (GDP) is negative (β= -0.00006) in the first regression where countries of all continents are considered. But, when the countries are separated by continent, the sign of the parameter is negative for Africa, Asia and Europe; and positive for America/Oceania. These results are not statistically significant. Therefore, it is not possible to conclude with certainty that the purchasing power of the population has an impact on Internet use.

Table 1: Ordinary Least Squares Estimates of Internet Use for 146 Countries Grouped by Continents and (t-statistic)

	Dependent Variable: Internet Users/10,000 for 2001				
Regressions	All Countries	Africa	America & Oceania	Asia	Europe
Number of Observations	146	37	38	34	37
Economy (GDP/Capita)	-0.00006 (-0.00462)	-0.034 (-1.193)	0.041 (1.567)	-0.029 (-1.307)	-0.026 (-0.755)
Computers/100	33.743 (3.391)***	87.213 (3.355)**	35.084 (2.212)**	51.35 (2.544)**	38.769 (1.671)*
Main phone Lines/100	15.831 (7.232)***	2.521 (0.457)	7.570 (1.318)	24.815 (4.382)***	18.412 (2.739)***
Internet Hosts/10000	0.589 (3.653)***	1.590 (0.674)	0.216 (0.981)	-0.512 (-0.558)	1.189 (3.311)***
F-Ratio	241.538***	79.081***	72.547***	53.423***	38.578***
R-Squared	0.873	0.908	0.898	0.881	0.828

* Statistically significant at 10% confidence level.
** Statistically significant at 5% confidence level.
*** Statistically significant at 1% confidence level.

Computer Infrastructures: As predicted by hypothesis 2, the parameter estimates for computer use is positive and significant at the 1% level for all the countries together (β=33.743, t=3.391), 1% for Africa (β=87.213, t=3.355), 5% for America & Oceania (β=35.084, t=2.212), 5% for Asia (β=51.35, t=2.544) and 10% for Europe (β=38.769, t=1.671). These positive and significant relations between the percentage of computer and Internet use suggest that the more people have access to computer, the more likely they are to connect to and use the Internet. These results also show that access to computers is a big problem in Africa as compared to other continents.

Telecom Infrastructures: As predicted in hypothesis 3, the coefficient of telephone lines is positive for all five regressions. With all countries analyzed together, the percentage of main telephone lines per inhabitant is positive (β=15.831, t=7.232) and significant at the 1%. This means that, the availability of telephone lines increases the probability of people to connect to the Internet. When continents are considered separately, the coefficient of telephone lines per inhabitant increases for Asia (β=24.815, t=4.382) and Europe (β=18.412, t=2.739) and the level of significance remains at 1%. However, the coefficient decreases for Africa (β=2.521, t=0.457) and America/Oceania (β=7.570, t=1.318) and the level of significance deteriorates. The telecom infrastructure variable may not be significant for Africa not only because most people do not have a personal computer creating no need for them to connect to the Internet using their phone line; but also because, in many countries there are high telephone service charges apply to long distance and local calls discouraging people from dial up. In America on other hand, where countries are so diverse, the poor countries outnumber big ones leading to inaccessibility to computer as in Africa and the difficulty to conclude with certainty on the variable. In Europe and Asia on the other hand, where the countries are more homogeneous and access to telephone and computers are more affordable, most connection are done in the privacy of individual's home using private phone lines.

ISP Services: As hypothesis 4 predicts, the coefficients for the ratio of Internet host per 10,000 inhabitants are positive. This result is significant at the 1% level for all the countries combined. However when the countries are grouped by continents, only Europe remains significant at the 1% level; Africa, America/Oceania, and Asia are not significant. This shows that in Europe, as the number of ISPs increases, the number of Internet users increases. It may be due to the fact that, the connection cost decreases with competition, leading to more Internet use.

In general, the F-statistic of all the regressions is significant at the 1 percent level and R-squared are all above 80%. These high R-squared suggest that the independent variables (purchasing power of Individuals, percentage of computers, percentage of telephone lines, Internet hosts per 10,000 inhabitants) explain at more than 80% the changes in variation in Internet use of individuals. In other words, the model used in the present study is a good fit.

The mixed results obtained for the economy factor (level of GDP) requires further investigation. Such a situation may occur because some variables may have lost their level of significance due to the diversity of countries in continents both economic

and social, specially the American continent. Therefore, an analysis of the countries based on their level of development may present better insights into the data. Thus, the next group of regressions divides countries in low purchasing power, mid-purchasing power, and high purchasing power of populations (PPP) regardless of the continent.

The criteria to divide the countries were the economy. All the countries were ranked based on the purchasing power of the population and divided in three groups. The first observations go from 1 to 46; the second set goes from 51 to 96 and the third group ranges from 101 to 146. Omitting observations from 47 to 50 and from 97 to 100 creates a more independent estimator, which increases the power of the test. The results of the analysis are summarized in Table 2. When the countries are divided according to the PPP, the economy variable is positive for the groups of countries with low and average PPP and negative for those with high PPP, however, these results remain not significant. Tables 2 shows that all three groups of countries behave differently from one another. Taking all countries together, all the variables, except the economy variables, are positive and significant at the 1 percent level. The economy variable is negative but not significant.

The variable for computer infrastructure, is positive for all the groups; however, it is not significant for countries with high PPP, while it is significant at 5% and 1% level for countries with low and those with average PPP respectively. The telephone

Table 2: Ordinary Least Squares Estimates of Internet Use for 146 Countries Grouped by Purchasing Power of the Population (PPP) and (t-statistic)

	Dependent Variable: Internet Users/10,000 for 2001			
Regressions	**All Countries**	**Low PPP**	**Average PPP**	**High PPP**
Number of Observations	146	46	46	46
Economy (GDP/Capita)	-0.00006 (-0.00462)	0.164 (1.581)	0.071 (0.984)	-0.004 (-0.179)
Computers/100	33.743 (3.391)***	48.828 (2.554)**	50.600 (3.054)**	27.260 (1.481)

Main phone Lines/100	15.831 (7.232)***	8.990 (2.371)**	6.807 (1.531)	20.388 (3.920)***
Internet Hosts/10000	0.589 (3.653)***	-13.202 (-1.921)*	2.183 (2.347)**	0.614 (2.245)**
F-Ratio	241.538***	6.787***	18.533**	26.057***
R-Squared	0.873	0.398	0.644	0.718

* Statistically significant at 10% confidence level.
** Statistically significant at 5% confidence level.
*** Statistically significant at 1% confidence level.

infrastructure variable is not significant for countries with average PPP, while is significant at 5% and 1% level for countries with low and those with high PPP respectively. Finally, the ratio of Internet host per 10,000 inhabitants has an unexpected negative sign for low PPP countries; however, this variable is only significant at the 10% level.

The same variable is positive and significant at the at 5% level for both countries with average and those with high PPP. These results suggest that different variables must be considered when trying to promote Internet use and E-commerce in developed, developing and undeveloped regions.

Rich countries: Internet use is most influenced by telephone connectivity and competition among ISPs. The variables that represent the economy and computer infrastructures are both not significant; mainly because in those countries, the economy has reached a level where, investing in computer infrastructures requires a very small portion of an individual's earnings. Which explains the argument by Arunachalam (1999) that developed countries, which account for only 20% of the world population, have 95% of all computers. Given that most people in developed countries can afford a computer without stretching their budgets, most households will be equipped with at least one computer. Consequently, in the need to access the Internet, individual will refer to the dial up system, which uses phone lines. Therefore, the percentage of main phone lines is the most significant variable at the 1%; meaning that most connection in developed countries are done using the dial up system especially when using their private computers. Those private connections also require the use of ISPs; therefore, the Internet host variable is positive and significant at the 5% level. In other words, when there is competition in ISPs, the connection costs decrease leading to more Internet use.

Countries with mid-level economy: It appears that owning a computer is the most important factor (positive and significant at 1% level); followed by competition among ISPs (positive and significant at 5% level). The economy and telecom infrastructure variables are not significant. Therefore, in developing countries, it can be expected that an increase in the number of computers and Internet hosts would lead to more people connecting and using the Internet. However, most connections are done

using means other than the dial-up system through private phone lines. The fact that the variable for phone line is not significant indicates that most Internet users rely on public places such as "cyber-café"; which explained the rapid grow of these businesses in developing and underdeveloped countries.

Countries with poor economy, the number of computers and telephone infrastructures positively affect Internet use. The variables for percentage of computers and main phone lines are both significant at the 5% level. Therefore, the more computers and telephone lines that are available, the more people will connect to the Internet. However, the variable for Internet host is negative and significant at only 10%. This result is ambiguous and suggests that in underdeveloped countries there are some other variables to be considered in predicting Internet use. This suggestion is also in line with the value of the coefficient of determination R-squared which is less than 40% for countries with poor economy, whereas it is 64% for those with average economy and 72% for countries with advanced economy. Therefore, the model used in this research is a better fit when assessing the variables that impact Internet use in developed countries than it is for underdeveloped countries.

SUMMARY AND CONCLUSION

This study analyzed the factors that affect Internet use in order to determine the future of e-commerce and international globalization. All the factors considered seem to be consistent with the hypotheses and significant; with the exception of the economy variable, which has mixed results and is not significant. Because of technology inequality, there is an increasing gap between rich and poor countries when it comes to having access to the Internet. The need of a computer is proven to be a necessary but not sufficient condition for Internet use. This statement is supported by the fact that without a computer it is not possible to use the Internet. Furthermore, the latest computer does not automatically give access to the Internet without the proper telecom system or telephone infrastructure. In other word, in addition to having a computer, a user should insure that the proper telecom system and Internet service are available for connection. The number of computers is meaningless unless there are interconnected with each other. Moreover, insufficient information regarding the Internet in many areas can itself present a barrier to network deployment.

Telephone companies are more likely to offer new services to the extent that they know about, and can draw upon, the positive experiences of others. Similarly, policy-makers concerned with universal service must have an accurate picture of any deployment problems before they can act to resolve them. Since the telecommunication system in many countries are locally regulated and access to a telephone line is either very costly or slow to implement, international globalization can be accelerated or achieved through the use of other infrastructures such as cable modem instead of telephone lines especially in underdeveloped countries. Some fear that while the Internet has profound implications for many countries, it will only accelerate the marginalization of others, especially the poor countries; and as the digital divide widens, the gap between those who are connected and those who are not deepened. Brown (2000) stated that

North America continues to lead the globe with spending of $796 billion in 1999, while Eastern Europe trail with $30 billion information and communication technology (ICT). The Middle East and Africa saw spending growth of 26 percent between 1997 and 1999, whereas ICT spending in the Asia-Pacific Region grew 18 percent between 1997 and 1999.

This research presents some limitations that must be addressed. For Instance, the analysis does not take into account the level of education, native language, religion and culture of the popuiation. These characteristics may help explain the adoption of the Internet, especially in poor countries. This limitation presents possibilities for new research that will hopefully be explored next.

REFERENCES

Abeyesekera, Anton. 1999. "Partners Speak-out: Views on E-commerce." *International Trade Forum*, No. 2, pp. 23-25.

Ajzen, I. 1985. "From intentions to actions: A theory of planning behavior." In J. Kuhl and J. Beckman (Eds.), Action, control: From Cognition to Behavior. Berlin: Springer Verlag, pp. 11-39.

Anwar, Imram. 1996. "Internet is Rough for Small Player." *Far Eastern Economic Review*, V. 159, No. 39, pp. 36.

Arunachalam, Subbiah. 1999. "Information Technology: What Does It Mean for Scientists and Scholars in the Developing World?" *Bulletin of the American Society for Information Science*, V. 25, No. 4, pp. 21-24.

Beatty, R. 1998. "An empirical investigation into the salient factors used by organizations in the adoption of Web site technology." Mississippi State University, DBA.

Bhatnagar, Pradip. 1999. "Telecom Reforms in Developing Countries and the Outlook for Electronic Commerce." *Journal of World Trade*, V. 33, No. 4, pp. 143-158.

Blackman, A. 1997. "Economic Research on Technology Diffusion: Implications for Developing Country Climate Change Policy." Mimeo, Resources for the Future: Washington, DC.

[illegible] 1999. "[illegible] African information society *Initiative* seeks information technology access for every African." *Africa Recovery,* V.11, No. 4, p. 22

Bowonder, B., T. Miyake, and H. Linstone. 1994. "The Japanese institutional mechanisms for industrial growth: A systems perspective - Part II." *Technological Forecasting and Social Change*, V. 47, pp. 309-344.

Brown, D. 2000. Study: "Gobal IT Spending Tops $2 Trillion." http://www.zdnet.com/intweek/stories/news/

Brynjolfsson, E. and L.M. Hitt. 2000. "Beyond Computation: Information Technology, Organizational Transformation and Business Performance", *Journal of Economic Perspectives*, V. 14, No.4.

Conroy, L. 1997. "Telcos and ISPs: Poles apart yet pulled together." *Telecommunication,s* International Edition, V. 31, No. 3 pp. 96-97.

Cooper, M., and G. Kimmelman .1999, February. "*The digital divide confronts the Telecommunications Act of 1996:* Economic reality versus public policy." Yonkers, NY: Consumers Union. Available: http://www.consunion.org/other/telecom4-0299.htm

Cooper, R. and R. Zmud. 1990. "Information Technology Implementation Research: A Technology Diffusion Approach." *Management Science*, V. 36, No. 2, pp. 123-139.

Davis, F.D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology." *MIS Quarterly*, V. 13, No.3, pp. 319- 340.

Davis, S. H. 1997. "Expanded Portfolios." *Telephony*, V. 232, No. 4, p. 40.

Donna L. Hoffman, Thomas P. Novak, Ann E. Schlosser. 2000. "The Evolution of the Digital Divide: How Gaps in Internet Access May Impact Electronic Commerce." *Journal of Computer Mediated Communications*, Online: http://www.ascusc.org/jcmc/vol5/issue3/index.html

Fink, D. and K. Kazakoff. 1997. "Getting IT right", *Australian Accountant*, V. 67, No. 10, 50 52.

Fishbein, M. and I Ajzen. 1975. Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research. Reading, MA: Addison-Wesley.

Garcia, L. D. 1996. "Who? What? Where? A look at Internet deployment in rural America." *Rural Telecommunications,* V. 15, No. 6, pp. 24-29.

Graham, Stephen. 2002. "Bridging urban digital divides? Urban polarisation and information and communications technologies (ICTs)." *Urban Studies (University of Glasgow)*, Vol. 39, No. 1, pp. 33-56.

Greene, T. 1997. "RBOC or ISP?" *Network World*, V. 14, No. 11, p. 10

Herrera Ramos, J. Mario. 2001. "La segmentación digital en México." *Perfiles Latinoamericanos*, V. 10, No. 18, pp. 29-58.

Hoffman, D. L. 2000. "The Revolution Will Not Be Televised: Introduction to the Special Issue on Marketing Science and the Internet." Marketing Science, V. 19, No. 1, pp. 1-3.

Horvath, John. 2000. "The European Divide." *Telepolis*, Online: http://www.heise.de/tp/english/inhalt/te/8461/1.html

Iacovou, C., I. Benbasat, and A. Dexter. 1995. "Electronic data interchange and small organizations: adoption and impact of technology." *MIS Quarterly,* V. 19, No. 4, pp. 465-485.

Igbaria, M., N. Zinatelli, and P. Cragg. 1997. "Personal computing acceptance factors in small firms: A structural equation." *MIS Quarterly*, September.

Ives, B., S. Hamilton, and G. Davis. 1980. "A Framework for Research in Computer-based Management Information Systems." *Management Science*, V. 26, No. 9, p. 910.

Kettinger, J. 1994. "National infrastructure diffusion and the U.S. information super highway", Information and Management, Amsterdam, Dec. 27(6), 357-369.

Kichen, Steve. 1994. "Time to Get Hooked." *Forbes*, V. 154, No. 7, pp.158-161.

Kwon, T. and R. Zmud. 1987. "Unifying the fragmented models of information system implementation." In Critical issues in information system research, Boland, R. and Hirschheim, R. (eds.), John Wiley, New York.

Lawton, G. 1995. "The Internet is Here." *Telephony,* V. 229, No. 4, pp. 42-45.

Ling, Chong Yee. 2001. "A Model for EC Adoption and Diffusion in SMEs: A Cross-country Study between Singapore and Australia." ECIS Doctoral Consortium, 24-26 June, Bled, Slovenia.

Moore, G. and I. Benbasat. 1991. "Development of an instrument to measure the perception of adopting an information technology innovation." *Information Systems Research,* V. 2, No. 3, pp. 192-222.

NTIA. 2000. "Falling through the Net: toward digital inclusion: a report on Americans' access to technology tools." Online: http://www.ntia.doc.gov/reports.html

Nua. 2003. "How many online?" Online: http://www.nua.ie/ surveys/how_ many_ online/

Parasuraman, A. 2000. "Technology Readiness Index [TRI]: A Multiple-Item Scale to Measure Readiness to Embrace New Technologies." *Journal of Service Research*, V. 2, No. 4, pp. 307-320.

Parker, Edwin B. 2000, May. "Policy forum: closing the digital divide in rural America." *Telecommunications Policy*, Vol. 24, No. 4.

Peha, Jon M. 1999. "Lessons from Haiti's Internet Development." *Communication of the ACM*, V. 42, No. 6, pp. 67-72.

Petrazzini, Ben and Kibati Mugo. 1999. "The Internet in Developing Countries." Communications of the ACM, V. 42, No. 6, pp. 31-36.

Radcliff, D. 1997. "ISPs Find Salvation in Value-added Services." *Software Magazine,* V. 17 No. 2, pp. 85-88.

Rader, Hannelore B. 2002. " Information Literacy – An Emerging Global Priority." White Paper prepared for UNESCO, the U.S. National Commission on Libraries and Information Science, and the National Forum on Information Literacy, Available: http://www.nclis.gov/libinter/infolitconf&meet/papers/rader-fullpaper.pdf

Riddle, Dorothy. 1999. "Using The Internet for Service Exporting: Tips for [illegible]

Rockwell, M., and Fontana, J. 1996. "ISPs Jump to the Majors." *Communicationsweek,* V. 635, p. 111.

Rogers, E.M. 1995. Diffusion of Innovations, 4th ed. The Free Press, New York, NY.

Shankar, B. 1997. "Getting Wired for Multimedia." *Telecommunications, International Edition*, V. 31, No. 9, pp. 41-45.

Wolcott, Peter; Larry Press, William McHenry, Seymour Goodman, William Foster. 2001. "A Framework for Assessing the Global Diffusion of the Internet." *Journal of the Association of Information Systems*. 2, No. 6, November.

Tully, John and Riekstins Arnis. 1999. "Licence-Free Wireless Internet Access Technologies." *Computer Networks*, No. 31, pp. 2205-2213.

UNDP. 2000. "Agenda for Action 2000-2001." Online: (http://www. undp. org/info21)