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Telecommunication, Regulation and Economic Development in Botswana.

A Quantitative Analysis.

A Thesis

Presented to the

School of Communication

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

University of Nebraska at Omaha

By

Thapedi Kgodungwe

December 2004

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THESIS ACCEPTANCE

Acceptance for the faculty of the Graduate College,
University of Nebraska, in partial fulfillment of the
requirements for the degree Master of Arts ,
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Telecommunication, Regulation and Economic Development in Botswana.

A Quantitative Analysis

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University of Nebraska, 2004

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This study is a quantitative analysis of the relationship between telecommunication infrastructure and economic development in Botswana from 1995 to 2003. The study used Gross Domestic Product (GDP) per capita as a measure for economic development and telephones per 100 people as a measure for telecommunications.

A statistical correlation test was used to analyze the relationship between telecommunications and economic growth. The results of the analysis found that the two are significantly related.

Looking at the results of this study, they reaffirmed the claim made by numerous previous researchers that indeed telecommunications is positively linked to economic development. However, it still remains to be seen how the relationship between telecommunication infrastructure and economic development occurs.

This study also looked at telecommunication regulation and liberalization. From the results of this study, it is concluded that regulation stimulates economic development through market access.

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Chapter 1

INTRODUCTION

“The communication technology of a society determines who can speak to whom, over what distances, with what time delays, and with what possibilities for feedback or return communication” (Hardy, 1980).

Every communication student understands the conceptual meaning of telecommunication. However, concepts of its functions vary significantly depending on ones geographic location and economic standard and exposure (Ngwainmbi, 1999). According to Read & Youtie (1996), the word “tele” is Greek, which means over a distance and “communication” is the conveyance, storing, and conceptualization of messages. Debates on the functions of telecommunications technologies have drawn conclusions that telecommunications plays an important role in economic, social, and more political transactions (Ngwainmbi, 1999).

This study will examine the relationships between investment in telecommunications and economic development. Dholakia and Harlam (1994) said that there is a strong positive relationship between telecommunications infrastructure and economic development, adding that venturing in telecommunications is even more attractive for countries that are economically growing.

The literature review will analyze the benefits of telecommunications, the relationship between telecommunications and economic development, rural telecommunications’ contribution to development, telecommunications regulation, liberalization, Botswana and its telecommunications system.

Read and Youtie (1996) found that telecommunication infrastructure investments could attract potential investors. Based on previous research, they concluded that telecommunication infrastructure is necessary, however they cautioned that it is not a sufficient cause to attract investors. Dholakia and Harlam (1994) added that it is only one of the numerous inputs necessary for economic development. Read et al. (1996) said that telecommunications could allow firms to be extra productive and to operate in a less costly way. Madden and Savage (as cited in Forestier, Grace, and Kenny 2002) found that telecommunication is a strong tool of information transfer for markets on information flows. Because of this, they concluded “telecommunications can improve the organizational efficiency of firms and the efficiency of transactions between firms and individuals” (p.625).

Riverson (1993) described telecommunications networks as the fundamental nervous structure of complex societies relaying information and commands among the numerous parts of such societies. He added that if these activities are lacking, then some of the tasks within various sectors of societies especially government and economic activities will malfunction.

With a different explanation, Koch (1991) described telecommunications infrastructure as the primary structure “of technical facilities and institutional arrangements that make the transmission of voice, data, and video information possible” (p.7). When economic development occurs, some type of communications increasingly becomes the most cost effective way of communicating for a growing part of the population (Saunders, Warford and Willenius, 1994).

According to Koch (1991), telecommunications has become more vital in economic, business and social transactions, which had led to some fierce competition among telecommunications providers and manufacturers in the United States of America. Koch (1991) found that when there is competition between telecommunications providers and manufacturers, more variety and better quality services and equipment such as telephones, fax machines, personal computers and printers would be provided. During the telecommunications revolution that began in the 1970's in the United States, competition increased in telecommunication markets. Companies such as AT&T experienced some decline in the places where they used to dominate because competition allowed other companies to penetrate and compete in the markets that used to be dominated by one company. This move improved the sector's performance as other telecommunications providers competed over the same products and services (Cave and Crandall, 2001).

Having provided the meaning of telecommunications, this study will look at its validity. To test the validity of this study, statistical test will be run to determine if telecommunications is related to economic development. Researchers have conducted studies like this one in developed countries and less developed countries. They have found that telecommunications is a driving force in many economies. Since Botswana has a vibrant economy, it would be determined if the correlation of telecommunications and economy follow the same pattern.

Cave and Crandall (2001) said the performance of the telecommunications industry was brought to where it is right now because of the sector's revolution in telecommunications policy in the early 1990's. According to Cave and Crandall (2001),

telecommunications liberalization was used by many states that realized that competition was impractical in various markets, without a vibrant competitive telecommunication sector. In the 1980's, technological improvement and desire to increase businesses were among the aspects that changed the way telecommunications were organized (Frempong and Atubra, 2001). Consequently, the European Union, Canada and the United States introduced major new policies that were intended to create competition in all telecommunications markets (Cave and Crandall, 2001). As many governments emulate the idea of telecommunication regulation, Ngwainmbi (1999) said implementation of such laws by governments should establish effective social measures for progress by creating appropriate policy frameworks to administer the telecommunications sector. He added that policy or regulation is the process by which a governing body creates rules or policies to shape conduct.

Diffusion of Innovations theory

A basic idea of diffusion of innovations theory is that a new idea is adopted slowly during the early period of its diffusion process. If the innovation is seen as helpful to the early users then it will make its way to others (Backer and Rogers, 1998). They added that “an adoption of the innovation over time is typically formed by the relatively slow initial diffusion, which then speeds up when a critical mass has occurred and, finally, levels off in the rate of adoption as fewer and fewer individuals remain to adopt”(p.17).

In Great Britain, the telephone was first adopted in the urban areas (Pool, 1977). City dwellers were identified as easier to adopt a new invention than rural dwellers. With

such a disparity in adoption, promoters of the telephone introduced it in cities than in rural areas. The early adopters of telephone in the Great Britain were business people who called telephone a business machine (Pool, 1977). These people (business people) as Backer and Rogers, (1998) and Wells and Anderson (1997) put it, were the first people to use this new invention, who then introduced it to rural dwellers.

It was recognized quite early that infrastructure concerns were pivotal for those interested in innovation (Madden and Macdonald, 1998). In addition, the telegraph, telephone, and steam locomotive significantly fueled innovation by opening markets and offering access to the resources needed to move inventions in to the mass production phases of innovation (Madden and Macdonald, 1998).

The diffusion process has been conceptualized as an interaction among a number of various elements. Korsching, Hipple, and Abbott (2000) traced the adoption and diffusion of innovative research to one of the first pioneers, Everett Rogers. Using Rogers's model, they defined diffusion as "a process by which an innovation is communicated through certain channels over time among the members of a social system" (p.149). Although adoption might have its own disadvantages in the society, Anokwa, Lin, and Salwen (2003) said technological innovations such as communication satellites have allowed people in different areas to simultaneously watch the same news, information and entertainment broadcasts. Madden and Macdonald (1998) argued that innovations are appearing more frequently today because of the assorted types of innovations facilitated by the use telecommunications technologies.

However, Korsching et al., (2000) cautioned that those participating in the adoption and diffusion process (those for whom the innovation is intended to) play a major role in the success or failure of the technological aspects of innovation. Participants in the adoption and diffusion process can have profound effects on how technological innovations are incorporated within a society (Korsching et al., 2000).

History of Telecommunications

The beginning of the telephone system in the United States can be traced back to the nineteenth century. Alexander Bell invented telephone in 1876. The American Bell Telephone Company was established four years later (Ngwainmbi 1999). According to McMaster (2002), the telephone is one of the telecommunications inventions that went through a number of changes and developments over the years. Since its invention and introduction to the public, the telephone has become an important part of every society. It has connected people all over the world, and provides information to others in a variety of ways (Mcmaster 2002).

Hudson (1984) points out that even though the telephone is important to everyday life today, during its invention, people took it for granted in industrialized nations like the U.S. where some towns would have more telephones than people, while in developing nations, that was not the case. Telecommunication has changed rapidly in recent years. Following World War II, numbers of telephone has grown quickly; in 1945 there were 41 million phones world wide, and by 1982 there were more than 494 million (Hudson 1984).

Research on telephone density among developed and developing nations by Saunders, Warford, and Willenius (1983), found that there are broad variations among developing countries in telephone density. For example, in the early 1980's a ratio of ten telephones per 100 people existed in both Costa Rica and Argentina. Saunders et al., (1983) also found that telephone density in Africa (excluding South Africa) was just 0.8 telephones per 100 people in 1981, which was very low at the time.

Riverson (1993) found that the number of telephones in service in developing countries is very low as compared to some of the more developed nations. Nevertheless, previous studies by Saunders et al., (1994) indicate that in recent years, the gap is narrowing between developed and developing countries in basic telephone service. Riverson (1993) added that developing countries have shown extensive rates of growth as shown in Table 1.

Table 1: Distribution of the World's Telephone Main Lines per 100 Population

Region	1995	2000
Africa	1.80	2.53
Americas	28.71	34.25
Asia	5.47	9.76
Europe	33.28	39.88
Oceania	38.41	41.01

Source: International Telecommunication Union

Telecommunications is a major player in the social, political and economic development of every country (Hudson 1997). Although telecommunications technology has grown so fast in the past decade, there are still regions where access is limited. The majority of telecommunications amenities are found in eight countries with Africa

accounting for only 1.8 percent of the world's main lines (Hudson 1997). However, Kiplagat & Werner (1994) illustrated that despite Africa's low rank in telecommunications, a number of countries in Africa have shown satisfactory results over the decade as revealed in Table 2 below. Kiplagat & Werner (1994) found that six of the 17 fastest growing networks are African.

Table 2: African economies with annual growth rate in main lines of over 15 percent per year, 1983-92

	<i>Annual Growth</i>	<i>Teledensity (x 100)</i>
Cape Verde	22.7%	3.4
Burundi	20.6%	0.23
Gambia	19.9%	1.33
Botswana	16.1%	2.62
Egypt	15.7%	3.94
Chad	15.4%	0.07

Source: Kiplagat and Werner (1994) derived from *ITU/BDT Telecommunications Indicator Database*.

The reason telephone density varies between developed nations and developing regions such as Africa is because during the time when organization for Economic cooperation and Development (OECD) countries were developing their infrastructure, their income were much higher than present levels for most African countries (Kiplagat et al., 1994).

Having explained some of the concepts in telecommunications history and differences among nations, the literature below will give an in depth explanation of the benefits of telecommunications and how is regulated.

LITERATURE REVIEW

Many researchers and writers have acknowledged the general socioeconomic value of telecommunications. Dickenson (as cited in Hudson 1984) said, “ if trade is the lifeblood of the economy, then telecommunications can truly be regarded as the nervous system of both the economy and society” (p.18). According to Read and Youtie (1996) previous research has established a link between telecommunications infrastructure and economy. They said that advanced telecommunications infrastructure is very helpful on the economy.

One of the earliest studies on telecommunications was by Ithiel De Sola Pool (1977) who studied the social impact of the telephone. In his study he found that the telephone serves economically productive functions, giving as an example professionals who operate from their homes. Being such a valuable tool to professionals, Hudson (1997) said that residential telephones appear to contribute more to economic development than business telephones because residential phones are often times used for business purposes whereas business phones are only used for business and they are available for certain work hours. He added that a residential phone that is used as a business and a private line contribute immensely because they are available 24 hours a day and services could always be provided irregardless of the time.

Scmandt, Williams, and Wilson (1989) concluded that as much as railroads were necessary to connect the large markets that made mass production possible in the past, communications network have taken a leading role to support the production process between segmented markets in today's life.

Many telecommunication researchers such as Dholakia and Harlam (1994) and Saunders et al, (1994) said that telecommunication infrastructure facilitates economic growth. While this study is analyzing the relationship between telecommunications and economic development, telecommunications is one of the other developmental inputs necessary for economic development such as physical infrastructures (Dholakia and Harlam, 1994).

Telecommunications and Physical Infrastructure on Economic Development

Physical infrastructures such as roads, power or electricity, bridges, human capital through education and energy have a positive impact in economic development (Dholakia et al, 1994). To realize the benefits of telecommunications infrastructure, basic physical infrastructures should also be available (Andrew and Petkov, 2003). To attain the contributions of telecommunication in economic development, benefits of telecommunications are to be recognized in combination with other infrastructure inputs such as electricity and roads. It is unlikely that telecommunications can have a positive impact in an area where there is no power or roads to stimulate economic growth (Andrew and Petkov, 2003).

The Benefits of Telecommunications

Information is a significant social resource. Along with materials and energy, it is one of the three mainstays of social resources. Information is a positive and effective element in connecting the social productive forces. “ When information is free to flow in large quantities and at high speed, it can effectively promote the development of production” (Zhao and Junjia, 1994, p.213).

Telecommunications services can substitute for other types of communication such as postal service and personal travel (Saunders, Warford, and Willenius 1994). According to Koch (1991) and Saunders et al., (1994), telecommunication services are a lot more efficient and effective than these forms. Hudson (1984) said that telecommunications could help promote social changes by promoting mobility for the population. He argued that the telephone works as a means of mobility in the sense that one can coordinate his or her work around the country while remaining in the same area.

Research has shown that the economic benefits of telecommunications are related to distance and density. The benefits of telecommunications are relatively greater where telephone density is low and communication alternatives are expensive or time consuming (Hudson 1997).

Saunders, et al., (1994) concluded that telecommunications could promote development even in remote areas. They wrote that telecommunications could facilitate social, political, cultural, and economic integration. Telecommunications is a potential factor in economic development by providing access to human capital such as telework. A concrete telecom network is a key to economic development in education, health, transportation and other fundamental elements that make up a nations' economy (Hackler 2003).

Increasingly, the telecommunications sector is being promoted as a foundation in the industry, determining the economic development prospects of regions, cities and rural areas (Lentz and Oden, 2001). Rapid expansion of telecommunication technology is changing many aspects of social and economic life. Lentz and Oden (2001) added that

telecommunications technology advances the way business is conducted. For instance, one can shop online, take courses facilitated by distance learning technologies and deliver services to remote areas. In addition, telecommunications can play a vital role in government administration because much of the government work is related to the dissemination of information (Korsching, Hipple & Abbott 2000). Furthermore, Hudson (1984) explained that telecommunications services may facilitate political development adding that telecommunications can increase participation within a nation. It can also promote civic involvement and civic pride.

Similarly Jonscher (as cited in Hills, 1990) wrote:

Improved communications promises more effective implementation of the participation model' of development in which the involvement of a country's people—their individual and collective contribution to the solution of their own problems—is considered the key to successful well developed communications infrastructure (p.78).

Markets gain in effectiveness due to improved communication because farmers can command prices from another location (Saunders, et al., 1983). Further, rapid responses to market signals become likely and access to information is expanded at villages, towns, cities, regional, national and worldwide. Saunders, et al., (1983) argued that the direct contribution of telecommunications to the welfare of an individual and family is not only limited to “social purposes” for instance, (making telephone calls) but rather the well being of the family is supported by telecommunications to meet their daily services that preserve life, health and property.

Development Theory and Telecommunications

Development is a change toward pattern of society that permits "better realization of human values that allow a society greater control over its environment and political entity, and that enables its individuals to gain increased control over themselves" (Rogers, 1976, p.225).

Rogers (1976) outlined the elements of what he perceived as new trends in development. He said that development entails fair distribution of socioeconomic benefits. For development, planning and execution of projects should be decentralized both at district and village level (Rogers, 1976).

The development theory was grounded on what has been called "modernization". The industrial revolution in the U.S.A. and U.K in the 1950s and 1960s was used to reinforce the theory that modernization is tied to economic growth. (Hills, 1998).

Conception of development theories in the 1960's was ruled by the "dominant paradigm". Many nations have used this theory to guide their national programs. (Rogers, 1976).

Rogers, (1976) said that the dominant paradigm was based on assumptions that development was centered in the rate of economic growth. Gross national product and gross domestic products per capita were used as economic indicators to measure level of national development. According to this theory, if the economic indicators were high, they showed a positive sign of development. The theory stresses that once industrialization takes places, then technology would be available, hence, social structures would develop (Hill, 1998). Economic success exhibited in Europe and North

America was a dominant paradigm pattern that other underdeveloped nations should formulate as a key to development (Rogers, 1976) However, he noted that the role of telecommunication within the dominant paradigm framework is uncertain in developing nations because it is based on the western development patterns which basically is not necessary suitable for other countries especially African nations.

Failure of development in some countries in Africa was believed to have caused by lack of industrialization. Proponents of this theory said that industrialization caused modernization, which most underdeveloped countries haven't reached (Hill, 1998). Many scholars criticized this theory because it was seen as ethnocentric in a cultural sense because it implied that poverty was the same as underdevelopment (Rogers, 1976).

Telecommunications and Economic Development

Beyond providing one of the social mainstays of a society, the German Gemeinwirtschaftslehre School of Economics has pointed out that the telecommunications infrastructure is a kind of basic input for an entire national economy, adding that, since it facilitates all economic transactions, it must be made available and accessible for everybody (Pfeiffer & Wieland, 1990).

According to Cronin, McGovern, Miller and Parker (1995), telecommunications has been known as a significant element of economic development. The authors showed that the World Bank spent 3.0 % of its loans from 1960 to 1982 in telecommunications projects as a way to enhance telecommunications in developing countries. Saunders et al., (1994) observed that if telecommunications investments are carried out, the returns are likely to generate internal financial rates of approximately 20 percent in profits.

Furthermore, many of the telecommunications units will make considerable net contributions to the government, which will ultimately be used in other sectors that are less able to mobilize domestic resources (Saunders, et al., 1983)

Saunders et al., (1994) further noted that once-developing nations such as Hong Kong, Korea, Singapore and Taiwan have utilized telecommunication as a key element of their overall economic strategy to boost what today is a highly competitive position in the world market for high technologies and services. According to Riaz (1997) Singapore's economy was more reliant on producing goods for export, Singapore then realized that for the economy to grow fast, there should be some information interchange to maintain and accomplish growth. He added that Singapore's upgrade of its telecommunications infrastructure facilitated information to substitute the product as a commodity.

Tyler (as cited in Hudson, 1984) conducted a study in 1981 for International Telecommunications Union (I.T.U) to determine limitations in telecommunications services on the performance of Kenya's certain businesses such as banking. The study was to measure how lack of telecommunications services hindered Kenya's businesses' performance and how they would benefit if telecommunications services were improved. The Kenya study found that the losses incurred as a result of poor telecommunications were on the average 110 times higher than the total cost of providing sufficient telephone service and amounted to an average of 5 percent of total income.

Firms used for the study were assessed to identify numerous ways in which the efficiency of the business was affected by the quality of telecommunications services. Among the cost benefits expected to be obtained from better telecommunications were

savings in managerial time and labor time, lower production costs, improved vehicle utilization and more economical sales decisions. By and large, Tyler's study presents a strong indication that economic benefits resulting from improved telecommunications services greatly surpass the costs.

There seems to be a general consent that telecommunication, in combination with other factors, can help make organizations more effective in their internal operations. Secondly it can make transactions between organizations more effective (Koch 1991). Norton (1992) stated that telecommunications infrastructure decreases the costs of transaction in many markets and leads to higher aggregate output. Leff (1984) argued that telecommunications could lower both the fixed costs of obtaining information and the variable costs of participating in markets. In addition to lowering transaction costs, telecommunications could influence other economic institutions to be more efficient because firms can lower their costs and expand their output, which ultimately can contribute to the economy (Leff, 1984). Read et al. (1996) added that the United States saved about \$36 billion between 1963 and 1982 by using telecommunications in capital and labor inputs. In his study to test the transaction cost, Norton (1992) found that telecommunications lowered transaction costs that otherwise could have hindered economic growth.

Forestier, Grace, and Kenny (2002) in their study to test the impact of telecommunications on income groups in developing groups, found that there is evidence that telecommunications can increase the income of the poor. They looked at income per

capita, number of telephones per capita, literacy rate, and Internet access. From their study, Forestier et al (2002) found that telephones and income were highly correlated.

However, they said that high teledensity could also increase inequality between the rich and poor with the rich getting more of the benefits of telecommunications than the poor. Although that might be case, Forestier et al., (2002) acknowledged that there is strong substantial evidence at the micro-economic level that telephone access can considerably boost the ability to benefit from services that can have an impact on quality of life.

Another linkage between telecommunications and economic development is that firms tend to relocate to areas where there is proper telecommunications infrastructure (Borg, 1988). He observed that telecommunication should be recognized as an engine of economic growth in the sense that it can increase employment and revenue to pay for other development needs such as extension of universal services, including health care and education. Borg (1988) added that telecommunications infrastructure could lure foreign investors to countries with advances telecommunications networks.

According to Read et al., (1996), telecommunications can also improve the productivity of labor due to better education and health care services facilitated by advanced telecommunications infrastructure.

Although many studies have looked at correlation between telecommunications and economic development, Hudson (1984) claimed that all of the studies failed to establish the direction of causality once a positive relationship in telecommunications and economic growth has been found.

Both Hardy (1980) and Riaz (1994) took a causal analysis approach to establish correlations that other researchers missed. In both studies, they developed hypotheses to answer various important recurring questions. Hardy's (1980) study shed significant light on questions of causality in telecommunications and economic development. He said that the contribution of telecommunications to economic development seems to be greater in developing countries than in industrialized nations. From his study, Hardy (1980) analyzed telephones and radios with GDP per capita to see how they contribute to economic developments. From his results Hardy (1980) said that from a causality point of view, telephones contribute to economic growth, while the relationship does not seem to exist in the case of radios. Hardy (1980) said it appears that two way telecommunications facilities such as telephone have a much greater effect on economic development than a one way medium such as radio broadcasting. Hudson (1984) said that, contrary to developed nations; residential telephone is a very considerable factor of development in developing countries. He added that a large percentage of residential phones are used for businesses communications, which in turn promotes economic growth with limited capital investment.

Building on the study conducted by Hardy to measure the effect of telephones on economic development, Hudson (1984) found that Hardy's study revealed that the contribution of the telephone to economic development is higher in areas or countries with lower telephone density. Therefore, "the lower the telephone density, the greater the potential contribution of telephone investment to economic development measured in increase in GDP per telephone" (p.43).

To add on the correlation between telephone investment and economic development, the state of New Jersey telecommunications infrastructure study examined this link by drawing upon two models called “supply push” and “demand pull”. The supply push model assumes that the use of a new technology will cause a market for services to occur. On the other hand the demand-pull postulate that investment in technology should follow the use markets that request services. Under the supply push model, Read & Youtie (1996) said that telecommunications infrastructure has a significant stimulative effect on economic development. However, supporters of the demand-pull model said that economic benefits of telecommunications could only arise if telecommunications capabilities are extended to accommodate growth instead of stimulating it. All in all, these two models appear to benefit an increasing number of firms that rely on telecommunications technology for their business functions (Read et al., 1996).

Telecommunications and Rural Economic Development

In the environment of growing global interdependence, telecommunications infrastructures are coming to be an increasingly significant element of international, regional, and local economies (Schmandt, Williams, Wilson, and Strover, 1991). For the past 20 years many studies have shown that telecommunications plays an important in the economic capability of nations, as global information transfer becomes the main component of economic viability (Schmandt et al., 1991).

The word “rural” according to Merriam Webster’s Dictionary means linking to the country or agriculture. Definitions formulated by researchers such as Koch (1991) did

not give a specific definition of rural but described “rural” by looking at population density, total population and distance to major cities.

Telecommunications make companies more footloose, more capable to scatter and locate even in remote areas, but this is possible only if an advanced telecommunications infrastructure is available (Read and Youtie, 1996).

Telecommunications researchers have argued that there is a disparity between telecommunications technologies deployment in rural and urban areas (Korsching, Hipple and Abbott, 2000).

Rural areas always lag behind in telecommunications infrastructure that is required for development than their urban counterparts, and more advanced telecommunications are largely unavailable to rural residents (Korsching, Hipple and Abbott, 2000). Koch (1991) found that rural and urban disparity is influenced by the fact that there are fewer educated people in rural areas and more prospective customers in urban areas. Although rural areas might be lagging behind in telecommunications infrastructure, the provision of that infrastructure in rural areas is hindered by planners who normally ignore the societal benefits, which are necessary for development (Andrew and Petkov, 2003).

Riverson (1993) found that not only does Africa have fewer phones but it also has inequities in service that favor urban over rural areas. Riverson’s (1993) study, conducted in 27 African countries, found that 53% of the phones in those countries were in capital cities despite the fact that more than 80% of the African population lives in rural areas.

According to Koch (1991), economic developers come across numerous obstacles in rural areas. She outlined four barriers that hinder the progress of telecommunications in rural areas. First, she noticed that there is often an insufficient supply of planners and leaders who have the skills and time to deal with economic development problems. Second, it is hard to deploy telecommunications infrastructure in rural areas because rural communities are dispersed from each other. Hudson (1984) adds that costs of installing and sustaining rural services are likely to be higher than costs of urban systems. Third, in the absence of a good telecommunications infrastructure, professional advice may be ineffective because information originating from cities is hard to get due to high transaction costs. Fourth, inadequate local capital resources hinder the progress of telecommunications in rural areas.

Hudson (1997) said that inadequate telecommunications could hamper the growth and efficiency of industries in developing nations. However, several researchers have pointed out that with improved telecommunications infrastructure, rural areas can overcome some of their economic disadvantages.

The communication Effects Gap

As the infusion of technology grows, so as the segments of the population with the "haves" and "have not" widens up (Donohue, Tichenor and Olien, 1986). Relative to urban areas, rural areas are at an information disadvantage because of lack of telecommunications infrastructure (Hudson, 1984). The segment of the population with higher socio-economic status are always found in cities and tend to acquire new technology than those with lower socio-economic status which majority of them are

concentrated in rural areas. According to Donohue et al (1986), the disparity between the groups is reflected in the knowledge gap between these segments.

The communication Effects gap also known as the knowledge gap hypothesis contends that not only lower status group stays "information poor" but the rural and urban disparity in information escalate as information flow increases (Donohue et al 1986). Hindman (2000) said that the widening gaps between society's information rich and poor are expected to grow, ultimately contributing to an imbalance in the use of information technologies. A longitudinal study conducted by the United States department of Commerce Census Bureau from 1994 to 1998 found that minority, low income, residents of rural areas did not have access to information resources such as computers and telephones (Hindman, 2000).

The widening gaps between higher and lower status group in information technologies is influenced by the fact that technologies are designed for higher status group and city dwellers. As noted earlier in diffusion theory, earlier adopters tend to be city dwellers who adopt a new idea faster than rural people (Hindman, 2000).

Rural Telecommunications Contribution to Development

Just as knowledge gap is predicted to widen up in the rural areas, there are many ways in which telecommunications can facilitate rural development processes.

Telecommunications experts have realized that telecommunications development in rural areas could help alleviate the movement of people from rural areas to the towns, which is common in Africa. "Rural telecommunications development may allow a more balanced development of a nation by allowing business and government to operate outside the

large urban areas” (Riverson, 1993, p.16). Calabrese and Jung (1992) added that companies could diversify rural economies by operating from rural areas because rural areas have low real estate and construction costs. Compared with urban centers, rural areas have relatively low cost of labor due to unemployment. When companies operate from rural areas they can help accelerate telecommunications systems (Calabrese and Jung, 1992).

Availability of telecommunications system in rural areas can allow rural populations to have access to other information such as market prices because with access to market information, efficiency in production could be promoted (Riverson, 1993).

The timely access to important information such as weather and availability of essential input (seeds, fertilizers, tools, personnel) should make rural agricultural enterprise more effective; moreover, rural telecommunications can help reduce costs in all sectors (Riverson, 1991).

Many researchers have concurred that telecommunications can draw business to rural areas. In accord with other researchers, Koch (1991) offered several factors that influence rural competitiveness. He found that small numbers of students in remote areas can improve their educational opportunities through distance learning which is made possible by a wide variety of telecommunications applications at low cost and high benefits. In addition, Hudson (1984) wrote that two-way communication has been used in developed countries like Australia, United Kingdom and the United States to support correspondence studies.

Rural communities could also gain from changes that telecommunications is bringing to the health care field. Koch (1991) said that improved telecommunications services could help health care institutions in rural areas because many small hospitals in rural areas are forced to close due to lack of funds, leaving rural residents to drive long distances to get medical assistance in town. She said that telecommunications application can help make administrative operations of these hospitals more efficient and more financially sound.

Telecommunication plays a very important role in promoting economy. Rural telecommunications can foster higher employment and foreign exchange earnings (in export sectors) by facilitating a higher use of resources (Riverson, 1993). Telecommunications, in combination with postal services and transportation facilities, may also facilitate rural areas to surmount their relatively low levels of customer aggregation (Koch, 1991). Telecommunications can overcome some aspects of the distance obstacle by advancing or increasing the number of communication channels that link urban and rural areas and making it easier for rural areas to pond their resources to supply communication dependent services. This, as Koch (1991) puts it, “allows existing businesses, government organizations, and social services in rural areas to operate and provide services more efficiently (p.39).

On the other note, Hudson (1997) found that the availability of telecommunications services enables rural people to use them more heavily and spend more of their income on telephone calls than their city counterparts. Hudson (1997) said that in northern Canada, Indians and Inuit were spending more times making long

distance telephone calls despite the fact that they were earning less than urban Canadians. They spent more time on distance calls because they were isolated from other areas. Therefore telephones became an alternative means of getting messages through quickly (Hudson 1997).

Regulation and Liberalization

Just as telecommunications infrastructure facilitate economic growth; a regulatory framework is also needed to enhance economic objectives. Until the 1970's, the telecommunications industry was straightforward with one single technical purpose of supplying a two-way, narrow bandwidth communications link that connected everyone in the country (Noam, 1984). Before the turn of the 1980's, global telecommunications services were supplied mostly on a monopolistic basis (Frempong and Atubra, 2001). Monopoly in most of the developed countries was mainly run by an administration or state-owned enterprise. In developing countries like those in Africa, governments created state monopolies without competition in the provision of services (Frempong and Atubra, 2001).

The separation of telecommunication operators from postal services in many countries, as Bertolini (2002) analyzed, served as one of the first steps toward telecommunications reform. According to Xavier (1997), as telecommunication competition intensified, many people recognized that there was a need for a regulatory principle that should provide a level playing field, which was "technological and competitively neutral" (p.533). These regulatory principles in conjunction with

telecommunication liberalization were believed to enable customers to get the best possible deal in choice, quality and value for money (Yan and Thong, 2003).

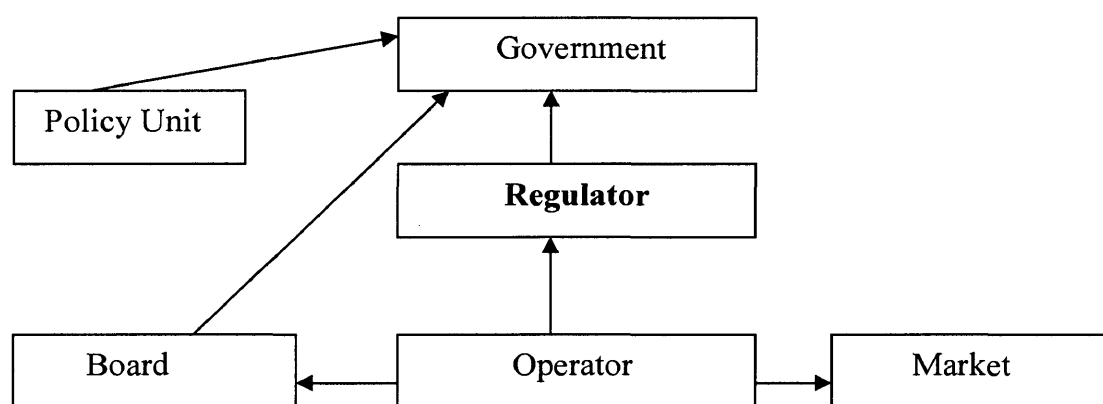
Regulation

As part of a process of major economic reform, the telecommunication industry is being reorganized in most countries as a solution to the problems of inefficiency, investment, technological upgrading and new service development (Mody, Bauer, and Straubhaar, 1995). They said that a process of telecommunication reform would mainly be effective if close attention is paid to the sequence in which structural changes transpire.

Based on Melody's structural reform, Mody, Bauer and Straubhaar, (1995) said for structural reform to take place there should be clear and distinct roles for policymaking, regulation, and management. Management should be separate from the government so that neither government bureaucrats nor politicians can interfere in decision-making. Management of a regulator body should comprise of a board of directors that is insulated from government interference. For example, Botswana Telecommunication Authority is composed of a board of directors who are insulated from day to day interference (Schorr and Sunberg, 2001). According to Mody, Bauer and Straubhaar (1995), regulation should be independent from the telecommunication operator and similarly independent from the government. The regulator should be in a position to implement government policies, make sure the telecommunication operator performs according to the standards to meet the economic and social policy objectives set.

Additionally, Mody, Bauer and Straubhaar, (1995) said that to strengthen the function of the regulatory body and policy development, there should be an independent policy unit that consult with the government to ensure that policy makers are informed and competent to address the changes if so required. Figure 1 below shows a structural reform and how policies are carried out.

Figure 1: Dimensions of Structural Reform.



Source: Mody, Bauer and Straubhaar, (1995)

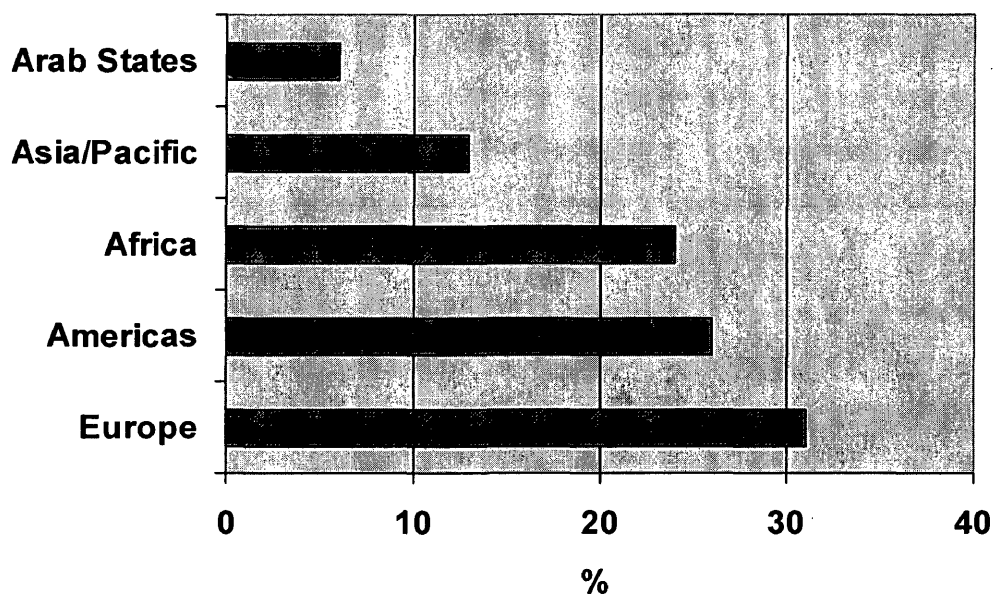
Regulation is an essential part of any reform program due to the persistence of faulty competition in some markets segments and the existence of market failures. Bertolini (2002) stressed that regulation is regarded as an important and inevitable political task that every independent government authority should pursue.

Governments introduce regulatory reform to ensure that some developments in the telecommunications sector can be executed and the shift from the state monopoly to competition can be implemented. Regulatory framework is used to facilitate and manage interconnection agreements and fair access of the new entrants to compete with the former monopolist (Bertolini, 2002, Makhaya and Roberts, 2003).

Economic regulation of telecommunications is to set prices, which ultimately can stimulate competition in the market and protects user interests. Independent regulators' objectives are to stimulate innovation of IT technologies, change the structure of the industry and ensure technical preconditions for efficient operation such as the interconnection and numbering plan (Xavier 1997). Regulatory bodies often follow this as part of their implementation task, encouraging imperfect markets to simulate the success of those that are perfect (Wheatley 1999).

The International Telecommunications Union (ITU) reports that in the past ten years, the reform of the information and Communication Technologies (ICT) sector has resulted in big changes at the regulatory and institutional levels (ITU, 2003). Berg and Foreman (1996) realized that the reason national policies were drafted in many countries affecting the telecommunications industry was because the sector has changed, therefore there was a need to oversee or administer new technological developments, new commercial opportunities, and problems with cost based regulation.

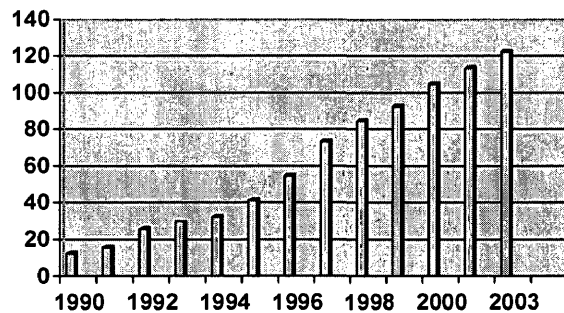
13 countries had separate telecommunications regulator agencies that operated separately from the government or government ministries in 1990, solely responsible for providing telecommunication services (ITU).

Figure 2: Separate Regulators by Region (1999)

Source: International Telecommunication Union

According to the ITU report of 2003, there are now 123 independent telecommunications regulatory agencies worldwide as compared to only 13 in 1990, with many of them created in the past seven years. According to Samarajiva (2000), most of these regulatory agencies are in the developing world. The boom in numbers has been stimulated, for the most part, by the fact that many countries worldwide have reformed, or are in the process of reforming their telecommunication sectors through the review and creation of new legislation to adjust to the fast changing communication environment.

Figure 3: Increase in Regulatory Agencies from 1990-2003 (World cumulative).



Source: ITU world Telecommunication Regulatory Database

Besides the issue of technological changes in telecommunications, the developing world received a lot of pressure and influence from the World Bank and other international organizations to open up the sector to liberalization (Frempong et al., 2001). Restructuring the sector is critical because a single operator is unable to meet the demands and challenges of all types of users.

Regulatory Design

Regulatory agencies are being legislatively given the power of policing monopoly/oligopoly, regulating for the introduction of competition and applying social objectives such as universal access (Samarajiva, 2000) Trends in Telecommunication Reform of 2002 states:

The means by which each country creates, structures and implements its regulatory body is one of the most important factors in the success of its reform process. It is one thing for countries to make a policy decision to create a regulatory agency, and quite another to empower the agency to act independently and effectively. Regulatory agencies are not created in vacuums; inevitably they are the products of political, social, legal and economic conditions that exist at fixed points in time in each country (p. 1).

The survival of regulatory agencies depends on their success in winning legitimacy in the eyes of the public and the stakeholders (Samarajiva 2000). If regulatory agencies could not maintain their legitimacy, they are likely to lose their independence as well as their ability to execute their main functions effectively (Samarajiva 2000).

Abdala (2000) recognized that for reform to be maintained, regulatory agencies have to be very strong to balance the demands of various groups engaged and simultaneously to be able to adjust to changing circumstances. Regulatory agency's weakness could cause imbalances that could result in government taking advantage of through opportunism, and by facilitating decisions that favor "short-run interests (of different kinds) at the expense of the interest of society" (Abdala, 2000, p 647). Bertolini (2002) points out that despite the fact that regulatory institutions were formed as a way to regulate the sector, it is still greatly a political issue. Taking the Argentina case for example, Abdala (2000) said that regulatory governance has been a tough task because a group of visible and political influential urban intensive users has pressured the agency to keep prices low, which has resulted in some government sectors to behave opportunistically, refusing a needed price rebalancing.

China took different trends to reform its telecommunications sector. According to Gao and Lyytinen (2000), restructuring was a very slow process because the government as a socialist movement played a dominant role in large scale state owned enterprises hence limiting competition and controlling the sector. In 1994, China's regulatory regime underwent some changes as it separated enterprise management functions from

government. However, this failed until 1998 when China realized that the best way to do it was to eliminate monopoly and increase competition (Gao and Lyytinen, 2000).

Makhaya and Roberts (2003) offered two approaches that can be taken towards regulatory discretion. The first one is for the government to devise broad policy objectives that the regulator has to follow when it plans its own regulatory system. In addition, the regulator's discretion will be monitored all the time. They added that this approach calls for transparency and accountability.

The second approach that they offered is for the government to explain the necessary regulatory methods of possible legislation for them, ahead of time. They cautioned that the options that policy makers choose regarding regulatory discretion should reflect the conditions in the country (Makhaya and Roberts, 2003).

Makhaya and Roberts (2003) praised the Chilean regulatory framework because of its telecommunications law that limits the discretion of the authority. Another model that is praised is that of Botswana, which created an incentive-driven and lean regulatory regime (McCormick, 2001). McCormick, (2001) argued that Botswana has employed measures that are simple and easy to supervise which in turn reduce the workload and political burden of the regulatory agency.

Licensing

There are no rules about entry in perfect markets, and any plan for limiting it needs explanation in terms of potential customer benefits (Wheatley, 1999). Xavier (1998) recognized that not only licensing procedures and conditions influence market entry but also the post-entry competitiveness of markets. Extra care must be undertaken

to examine that a licensing regime does not limit market entry. Open market access is a vital aspect of maintaining the benefits of competitive and contestable markets (Xavier, 1997) According to Wheatley (1999) the establishment of a licensing regime is a significant move in regulation. In addition, it provides a clear account of the rights and obligation of the operator.

However, licenses do not necessarily control market entry because a new competitor may still be free to supply one service. For instance, the competitor can provide mobile services while being barred from providing other services such as long distance telephony and telecommunication equipment (Wheatley 1999). Xavier (1998) outlined four uses of licensing telecommunications operators. First, the license provides a formal contract between telecommunications operator and the government, which explains the rights of both parties, hence reducing uncertainty and insecurity. Second, licensing of telecommunications has been used to enforce competition by monitoring anti-competitive conduct (such as predatory pricing and cross-subsidization of competitive services) through license conditions. Third, government raises funds through licenses fees through auction. These auctions are supposed to be transparent and fair and reveal the firms estimates of licenses values and can be designed to integrate a variety of public policy goals (Xavier, 1997). Fourth, licenses act as a regulatory tool that prescribes to operators what they can do and what they cannot do (Xavier, 1998).

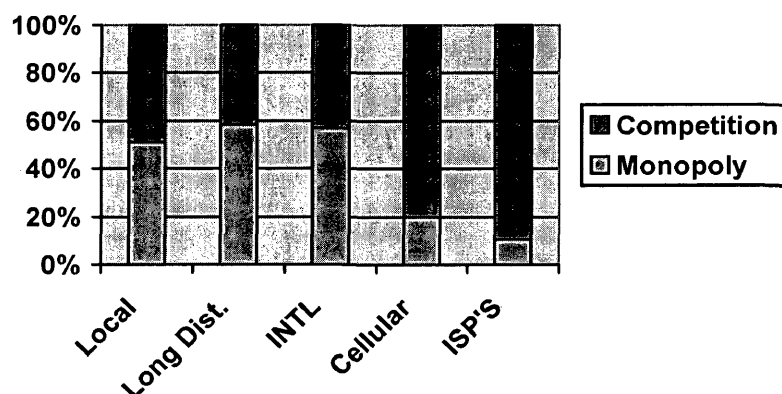
Liberalization

To make telecommunications markets more appealing to investors, some type of liberalization of the network is recommended (Hills, 1990). According to Frempong and

Atubra (2001), there is a great amount of evidence that liberalization of telecommunications can have a positive effect on network penetration.

Ghana is one of the few countries that liberalized its telecommunications sector in the early 90's. (Frempong and Atubra, 2001). This was a way to promote better provision of services through competition. By so doing, Ghana introduced duopoly into the fixed network by licensing more cellular telephone operators, which has resulted in high penetration of the service (Frempong and Atubra, 2001).

Figure 4: The Status of Liberalization in 2003 (Worldwide).

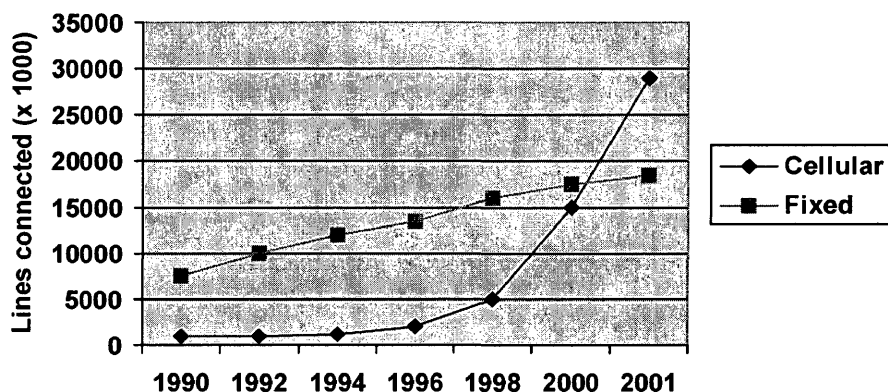


Source: ITU World Telecommunication Regulatory Database.

In Hungary, liberalization has facilitated mobile cellular entrance making it one of the first countries in Central and Eastern Europe to introduce mobile cellular service. (Xavier, 2000). Penetration of mobile cellular service due to liberalization has grown tremendously especially in Africa, because of restructuring of the sector to allow competition (Frempong and Atubra, 2001).

As many governments in Africa liberalized telecommunications, penetration of cellular phones in the market grew so much surpassing fixed line service as shown in figure 5 (Mureithi, 2003).

Figure 5: Growth of Cellular Phones versus Fixed lines in Africa.



Source: Mureithi, (2003) derived from ITU.EMC

It is clear that cellular operations as predicted have grown larger than fixed line operators in Africa. For instance 104 cellular networks were reported in Africa by the end of 2001 (Mureithi, 2003).

The 2004 ITU report on African telecommunication indicators, states that 70% of African telephone subscribers use mobile telephones. Mobile surpassed fixed telephones in 2001. While it is still unknown whether the growth of mobile telephony could be sustained, the report estimated that the annual growth rate of mobile subscribers in Africa is about 107% (ITU, 2004).

Liberalization of the sector takes some time to yield results. The World Bank suggested four major options that countries should consider in liberating

telecommunications market to attract investors (Hill, 1990). The first entails diversification and separation of the supply of customer's equipment from network operation. When China moved from its monopoly style to liberalization, it allowed equipment market to exchange technologies to assure telecommunications network development with advanced technologies (Gao and Lyytinen, 2000). The advantage of this option is that customers get an array of choices. The second option is that separate business networks could be accepted on the basis that they will be able to supply telecommunication equipment. The third option involves selling facilities to third parties, (companies that were not involved in the supply of telecommunication network or equipment). A fourth option is that a provision of value added services should be supplied by numbers of suppliers instead of one telecommunications operator or company.

Competition

Competition is regarded as one of the outcomes of liberalization. It is noted that companies that engage in intense competition with each other in one area are likely to cooperate in another (Knauer, Machtley and Lynch 1996). They said that access to networks could be maximized if telecommunications companies work together.

The benefits of introducing competition are evident in all sectors of the telecommunications markets. According to McMaster (2002), the introduction of competition in the United States resulted in the elimination of AT & T's monopoly of the long distance industry. A competitive telecommunications industry brings competitive benefits to consumers. A competitive market also supports innovation by compensating

those who invent, develop and introduce new network technologies (Bourreau and Dogan, 2001).

Many researchers in the telecommunication field have found that there are three common methods typically used to bring competition in to the sector (Xavier, 2000, (Xavier, 1999, (Hill, 1990, Lapuerta and Tye, 1999). The first one is facilities- based competition, which involves the ability of a new competitor to build a network using its own facilities to reach its customers without having to rely on the incumbent's carriers network. As a result the new entrant is able to provide new or more services to its customers, which in turn puts pressure on the incumbent to upgrade its network. The second method is resale, which may permit small competitors, who may not be in a position to build their own facilities, to enter the market by leasing services from the incumbent. Third, while some new competitors might be allowed to construct their own network, it is not always practical to build an entire network. Thus, a new competitor would be allowed to construct part of the network and buy access to the relevant essential facilities provided by the incumbent such as the local loop (Xavier, 2000). The local loop, according to Michalis (2001), refers to the "access network connection between the customer's premises and the telecommunications operator's local switch" (p.760).

The third method according to Xavier (2000) is also called unbundling, which requires the incumbent to unbundle its network and to charge the remaining elements at a reasonable price. This enables the incumbent to share its network or rent it out to a competitor. However, Michalis (2001) argued that unbundling is not a fair deal because it allows potential competitors to enter the market fairly quick by purchasing or leasing the

local loop and permitting them to gain from the incumbent's economies of scale.

Michalis (2001) added that once new entrants lease out the local loop, they become too dependent on the incumbent's network, ultimately ignoring to invest in their own network. Additionally, incumbents have claimed that unbundling makes them reluctant to invest or improve their network because new entrants would also benefit (Michalis, 2001).

Although unbundling has been regarded as an unfair game, in Hungary competition has shown that entrance of new competitors has increased the range of customer choice leading to reduction from monopoly status of Matav. In response to the challenge, Matav has increased its service, offering customers discounts such as prepaid cards, price discounts, three way calling and call forwarding (Xavier, 2000).

However, Xavier (2000) cautioned that although competition is a necessary step in the telecommunications industry, it will improve only if the appropriate legislation and rules are implemented and followed effectively, adding that as competition grows, there will be a constant need to guarantee that promised benefits of competition to consumers do materialize.

BOTSWANA

The Republic of Botswana is situated in Southern Africa bounded on the north and west by Namibia, on the northeast by Zimbabwe and Zambia. In the South and Southeast it shares the border with South Africa (Picard, 1985). Centrally located between these four countries, it does not have access to the sea making it landlocked. (Picard, 1985).

The capital and the largest city is Gaborone, with an estimated population of 186,000 in 2001. The majority of the population of Botswana is concentrated in the eastern part along the railway line that streams from the South to North. Gaborone is Botswana's main business center. Other business centers include Francistown, Jwaneng, Selebi Phikwe, Kanye and Serowe (Schorr and Sunberg, 2001).

Botswana is comprised of a number of tribes, among them Bakgatla, Bangwaketse, Batlokwa, Bangwato, Batawana, Bakalanga, Basarwa, Bakgalagadi and Bakwena. Citizens of Botswana are Batswana, and an individual citizen is a Motswana. The national language is Setswana, with English as an official language. English is also widely spoken in business and government institutions. Higher education is conducted entirely in English. (Picard 1987). The currency of Botswana is called pula (BWP 1.00=US\$ 0.20). One hundred Thebe equal one BWP. According to Schorr and Sunberg (2001), the population of Botswana in 2001 was estimated at about 1.68 million.

Figure 6: Map of Botswana



Source: C.I.A. World Fact Book, 2003

Botswana is about 582,000 square kilometers a little larger than France and a little smaller than Texas State in the United States with a vast amount of land taken up by the Kalahari Desert (Picard, 1985)

Botswana has implemented four national principles: democracy; unity; development; self-reliance; and botho, which is a Setswana word for good manners or respect; to maintain a positive economic growth (Townsend, 1994). Okavango, which is Southern Africa's longest river, flows through Botswana forming a huge delta in the northern part of the country (Townsend, 1994).

Political Environment

Botswana was known as Bechuanaland before it gained independence from Britain in 1966 (Picard 1987). Prior to Independence, Botswana was ruled by chiefs who

ruled their territories until Botswana was declared independent (Schorr and Sunberg 2001).

Botswana is a democratic country holding free elections every five years. All changes in power have been peaceful and democratic and have followed the guiding principles of the Botswana constitution (The government of Botswana website, 2004).

Botswana has a bicameral parliament made up of the House of Chiefs and the National Assembly, with the president performing the duties of head of state and head of government (Picard, 1985). Chiefs in Botswana don't play a political role in the running of the country but act as an advisory body to the National Assembly when it comes to tribal matters (Schorr and Sunberg, 2001).

Botswana is one of the few countries in Africa, which continues to have free-multi party elections on a universal franchise.

Economy

Botswana was regarded as one of the ten poorest countries in the world when it attained independence in 1966 (Danevad, 1995). The low level of economic development was apparent in an insufficient physical infrastructure and weak administrative capacity (Danevad, 1995). When Botswana became independent, it boasted just three and half miles of paved roads and only three high schools. Today, Botswana is regarded as one of Africa's success stories (Koppisch, 2002). Botswana has transformed herself from one of the poorest countries in the world to a middle-income country with a per capita GDP of \$4,277 in 2003 (IMF, 2003). With a growing economy and a stable political environment,

Botswana is the largest exporter of diamonds in the world and also the largest exporter of beef to the European Economic Community (EEC) (Picard, 1985).

Botswana enjoys a relatively enlightened government, and its health, educational and economic standards are rival on the African continent only by South Africa's.

According to Schorr and Sunberg (2001), Botswana has a vibrant economy based on free market principles. Most income is from diamonds, vehicle manufacturing, beef exports, tourism, and other forms of manufacturing, income and customs taxes.

Two major investment services ranked Botswana as the best credit risk in Africa. According to Standard and Poor's credit rating of 2002, Botswana earned an A rating while Moody's Investors Service rated Botswana A1. These ratings are a reflection of external debt and liquidity positions far better than those of comparably rated sovereigns. (Bank of Botswana, 2004). In addition, the Index of World Freedom released by the United States, Heritage Foundation has placed Botswana as Africa's freest economy (Gazette, 2004).

The World Bank report of 2004 has also placed Botswana as one of the best countries in the world with better economy conducive for doing business. According to the World Bank global top 20 economies, Botswana was ranked 19 followed by Thailand placing it as the only African country in the world to have a better business climate. The top three countries are New Zealand, United States, and Singapore. These rankings were based on variables such as getting credit, protection of investors, starting a business, enforcing contracts, hiring and firing workers, closing a business and registering property

(World Bank, 2004). In this analysis, most African countries performed badly because of poor administrative procedures and investment regulations (World Bank, 2004).

The Carnegie Endowment for International peace has also ranked Botswana as Africa's most globalized country. From its 2004 report, the Carnegie report states that Botswana came 30th after Japan (Mmegi Business Week, 2004). Rankings on the index were based on variables including economic, personal, technological and political. In the economic variables, Botswana was ranked seventeen (17). For personal variables, the Carnegie Endowment looked at strong increase in trans-border telephone use. They looked at the time spent on international phone calls (Mmegi Business Week, 2004).

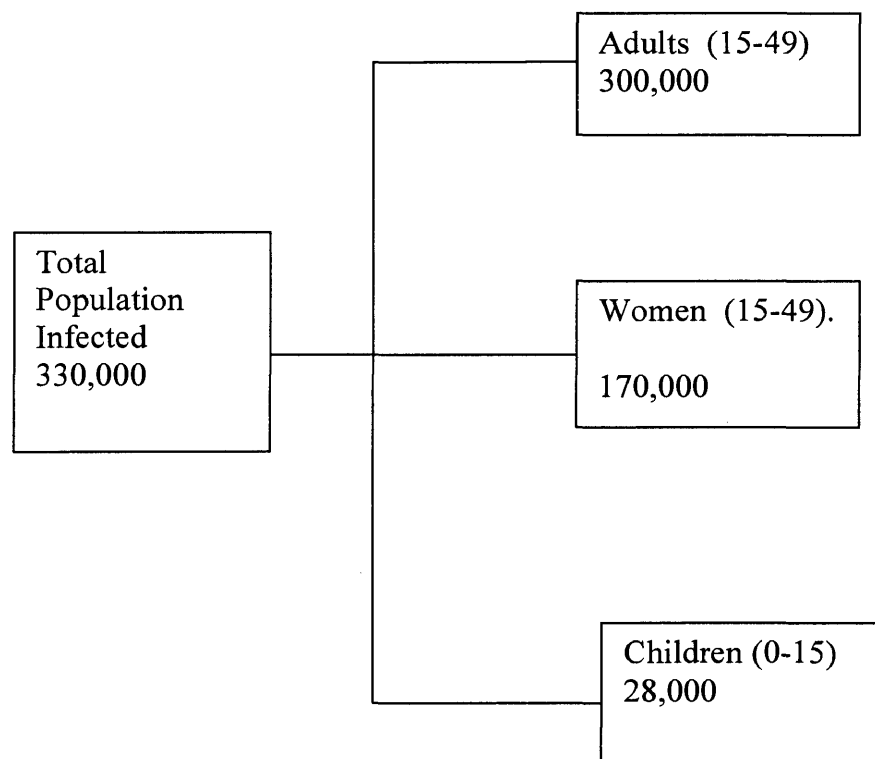
The Milken Institute in conjunction with Forbes Global has ranked Botswana's stock exchange as one of the best, coming fourth in Africa after South Africa, Egypt and Mauritius (Hermans, 1999). Rankings were based on qualitative, quantitative and risk factors of global capital markets (Hermans, 1999).

The discovery of diamonds right after Botswana's independence has fueled much of the expansion and currently accounts for more than one-third of GDP and for nine-tenths of export earnings (CIA World Fact Book, 2003). Moreover, cattle industry is the preferred investment for most Botswana (Picard, 1985). The real GDP economic growth rate is at 7 % while per capita income is stable at 4.3% annual growth.

In per capita terms, Botswana's foreign exchange reserves are among the highest in the world making it one of the wealthiest non producing oil-producing country in Africa (McCormick (2001). However, Botswana is affected by high AIDS (Acquired Immune Deficiency Syndrome) infection rate, which is crippling the economy. Moody's

reports states that the HIV/AIDS epidemic could affect the robust economy that Botswana is enjoying by losing skilled manpower, which may have a negative impact on production, and labor costs, adversely affecting the profitability of investment and shrinking the country's long-term economic growth chances (Bank of Botswana, 2004). Botswana is thought to have the highest number of HIV/AIDS cases in Africa. In 2003, The United States Census Bureau projected that Botswana would experience a negative growth in population as a result of HIV/AIDS (United Nations, 2001).

Figure 7: Botswana's estimated HIV/AIDS Statistics (2001).



Source: World Health Organization, 2002.

Sexually active population of Botswana, which is the country's workforce, is heavily affected by HIV/AIDS (National AIDS Co-ordinating Agency, 2003). According

to the agency, the number of active workforce in Botswana will decline by 35% over the next 5-10 years. Ultimately, the government of Botswana will have to divert some of its efforts to AIDS. Botswana has been promoting foreign direct investment to diversify her economy in its mission to create more jobs, but the impact of the disease is slowly draining the economy (National AIDS Co-ordinating Agency, 2003).

STATEMENT OF PURPOSE

Since the beginning of the 1980's, attempts to comprehend the relationship between telecommunications and economic growth have increased resulting in a number of studies being conducted, by among others, Hardy (1980), Hudson (1984,1988,1997), Saunders et al., (1983,1994), Riverson (1993) and Koch (1991). These studies have been significant in establishing the link between telecommunications infrastructure and economic development.

Many countries around the world, especially low-income countries have established information and communication technologies (ICT) policies and liberalized their telecommunication markets for foreign investment which in turn have resulted in a significant rise of fixed main lines, decreasing telecommunication prices and rising markets for mobile telecommunications (Bertolini, 2002).

The objective of this study is to look at the relationship between economic development and telecommunications in Botswana. Richardson (1991) has indicated that telecommunications benefits are prevalent in developing countries. This study will use Gross Domestic Product (GDP) as a measure for economic growth and telephone variable as the proxy for telecommunications.

The aim is to establish a statistical relationship of whether telecommunications is valuable to the growth of economy. Telecommunications plays a tremendous role in business. Wellenius (as cited in Hardy, 1980) said that with telecommunications, some of the physical limitation on organizational communication can be eliminated in all sectors of the economy allowing increased productivity through better management and

administration “making it possible to adopt different structures and locations and contributing to the evolution of increasingly complex and large corporations” (p.279).

This study will also try to look at how liberalization would have impacted the relationship between economic growth and the growth of telephones in the country. Hence the following research question was developed.

R.Q. 1: Is there a relationship between the telecommunications sector and the national economy?

Chapter 2

METHODOLOGY

This study is a quantitative analysis of telecommunications and economic development in Botswana. In this study, aggregate variables will be used to explore the relationship between economic development and the telephone. To date, many studies have been carried out to determine whether there is a causal relationship between the economic development and telecommunications. However, results of such studies have not established any direction of causation. Cronin, McGovern, Miller and Parker (1995) said that a causal relationship is found in both directions, adding that telecommunications could be both a cause and a consequence of economic growth.

This study is not trying to establish causation either, but to assess the relationship between two factors—telecommunications and economic development. It is important to note that a single correlation does not necessarily capture causal vibrant feedback processes that are dependent on time.

Variables

Data on economic development will be measured in terms of gross domestic product per capita while telecommunications infrastructure is measured in terms of telephone access per 100 people.

Aggregate variables show the characteristics of a country at a given time. For example, the country can be taken as a unit of analysis; therefore, measures of interest such as GDP per capita and telephones per 100 people are two examples of aggregate variables. Data will be analyzed based on teledensity and GDP for the period 1995 through 2003. GDP's will be converted to 2003 U.S. dollars (USD).

Since cell phones in Botswana were introduced in 1998, this study will try to determine if there was any change in growth for both teledensity and GDP three years before 1998 and five years after. That is why the period for analysis run from 1995 through 2003.

Research Design

Using time series correlation analysis to answer the research question, the study will try to establish if indeed telecommunications play a role in economic development by tracing the values of the variables over time. First, statistical correlation analysis will be applied between telephones per 100 persons and GDP per capita to provide evidence between the two variables. Therefore, for correlation tests, teledensity and GDP per capita are two traits that will be looked at over time.

The study will establish a correlation coefficient, which is assessed on how closely the two variables vary together or inversely (when one increases, the other decreases); thus, if teledensity grows over a specified period of time, similarly GDP will be expected to grow. Therefore, in this case the two tests would be showing positive correlation meaning that the measures vary together or are interlinked. However, if the same test yields opposite results, for instance, if teledensity increases while GDP per capita decreases or vice versa over the same specified period of time, then the measures would be varied inversely or the two measures would be showing a negative correlation.

To calculate the number of telephones per 100 persons, the formula below will be used. Number of subscribers will be multiplied by 100 then divided by the total population.

Formula

$$\frac{(\text{Number of subscribers}) \times (100)}{\text{total population}} = d \text{ (teledensity)}$$

Data Collection

Data for teledensity were obtained from Botswana Telecommunication Authority (BTA) while data for GDP were obtained from the United Nations (U.N) and International Monetary Fund (I.M.F). The data for the two variables will be analyzed simultaneously in a paired form (X, Y), which will be plotted in a two-dimensional space called a scatterplot. The GDP variable will be plotted on the X-axis and the telephone variable will be plotted on the Y-axis.

Data will be analyzed or interpreted using SPSS computer model, which is a software package, used for conducting statistical assessment, manipulating data and creating graphs and tables that summarizes data. The value of correlation coefficients ranges from -1 to $+1$, therefore the strength of the values will be determined by the magnitude of the correlation coefficient. If the correlation coefficient of both GDP per capita and teledensity tend to move away from zero, relationship between the two variables will be strong or positive, if they are otherwise, the relationship will be negative.

Chapter 3**BOTSWANA'S TELECOMMUNICATIONS SYSTEM**

Countries like Singapore started by investing more in telecommunications to jump-start their economies. Today, Singapore is one of the few countries in the world with advanced telecommunication infrastructure (Riaz 1997). Botswana is trying to follow Singapore's case by diversifying its economy through the use of telecommunications. In his 2004 state of the nation address, the president of Botswana, Mr. Festus Mogae, said that Botswana should embark on knowledge intensive schemes such as financial services and other information and communication technology so it could sustain a competitive environment for attracting both domestic and international investment (The government of Botswana website, 2004).

McCormick (2001) points out that Botswana to this end has taken initiatives to promote economic diversification by following Singapore's steps. As the president of Botswana said in his 2003 budget speech, the government of Botswana has so far committed millions of Pula to improve the quality of telecommunication infrastructure to compete in global markets (The Government of Botswana website, 2004).

Botswana Telecommunications Corporation (BTC)

Botswana Telecommunications Corporation was established in 1980 with two basic purposes of supplying telecommunications service to all of Botswana and also to operate on a profitable basis (Kiplagat and Werner, 1994).

BTC is a government owned corporation with a separate board established to monitor the administration and objectives of the corporation. (Kigplat and Werner, 1994).

BTC falls under the government wing of the Ministry of Communications, Science, and Technology.

BTC was operated as a monopoly basis 1996 when the government of Botswana passed the Botswana Telecommunications Corporation Act, which abolished BTC's monopoly (Schorr and Sunberg, 2001; and McCormick 2001).

When Botswana Telecommunications Corporation was created, it boasted a customer base of 6,500 subscriber lines with no pay phones (McCormick, 2001). Today, BTC has since grown to become one of the most advanced networks in Africa. BTC boasts a telecommunications network that is comprised of high quality service. The current network consists of 7300 kilometers of microwave radio and fiber optics links with a switching unit comprising a capacity of about 160,000 lines. For increased connectivity, BTC added a new wireless local loop technology on its assets to enhance quality (BTC website, 2004).

In 1994, BTC had a customer base of about of 40,000 subscriber lines and about 500 pay phones (Kigplat and Werner, 1994). Today, BTC has a customer base of about 135,000 and is able to provide international access to every country in the world (BTC website, 2004).

Botswana Telecommunications Corporation offers a wide range of services comprising national and international telephony, private wires, leased circuits, small aperture terminals, toll free services, paging, public telephones, voice messaging and packet switching (McCormick, 2001).

Despite the BTC 's achievement of boasting one of the most modern telecommunications infrastructures in Africa it never satisfied its customers. On the road map to introduce competition in the sector, the government of Botswana, found that BTC was unable to meet its demands and it was ineffective in offering efficient services, so the government introduced the Botswana Telecommunication Authority to monitor regulation of the industry (McCormick, 2001).

Therefore, in 1992 the government of Botswana directed the then Ministry of Works, Transport and Communication to devise and refurbish the telecommunications sector (McCormick, 2001). The 1996 Telecommunications Act gave birth to the Botswana Telecommunications Authority (BTA), which allowed the introduction of competition in the industry.

Botswana Telecommunications Authority (BTA)

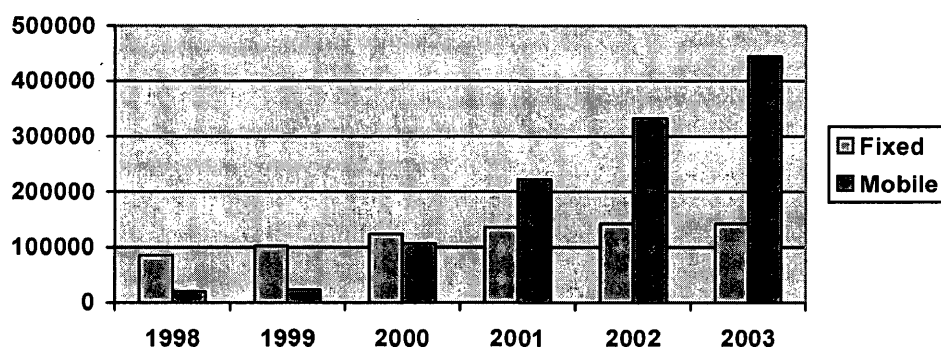
The 1996 Act gave BTA full authority to license all operators, which meant that even BTC would have to provide services within BTA guidelines (Schorr and Sunberg, 2001).

BTA was established in December 1996 to promote and supervise the provision of effective telecommunications services in Botswana (Schorr and Sunberg, 2001). BTA's main responsibilities included the issuing of service licenses, systems licenses, and radio licenses to resolve disputes among operators and to promote and monitor free and fair competition among operators (McCormick, 2001). In 1998, Botswana Telecommunications Authority licensed its first new market entrants, Mascom Wireless and Orange Botswana to supply mobile cellular services (Schorr and Sunberg, 2001).

Botswana is one of the first countries to establish a telecommunications regulatory body in Africa with complete autonomy independent from the government (BTA website, 2004). Schorr and Sunberg (2001) said that Botswana's regulatory body has crafted some of the best practices, which could be emulated by other small countries with limited resources and low telecommunication penetration. BTA serve as a world model because of its achievement as an independent body and through its capacity to sustain its regulatory mandate (Schorr and Sunberg, 2001).

The growth of mobile cellular service in Botswana has increased teledensity of the country. Moreover, in just a matter of six years in operation, the two new cellular service providers have already surpassed BTC's customer base (McCormick 2001).

Figure 8: Telephone growth in Botswana



Source: BTC, Mascom, and BTA.

According to Schorr and Sunberg, (2001), the introduction of Mascom wireless and Orange Botswana has also forced BTC to improve its performance or risk losing customers. BTC's situation resembles that of Hungary when the monopoly status of

Matav (the government owned telecommunication company) was reduced. Both BTC and Matav were forced by competition to improve and expand services (Xavier, 2000 and Schorr and Sunberg, (2001).

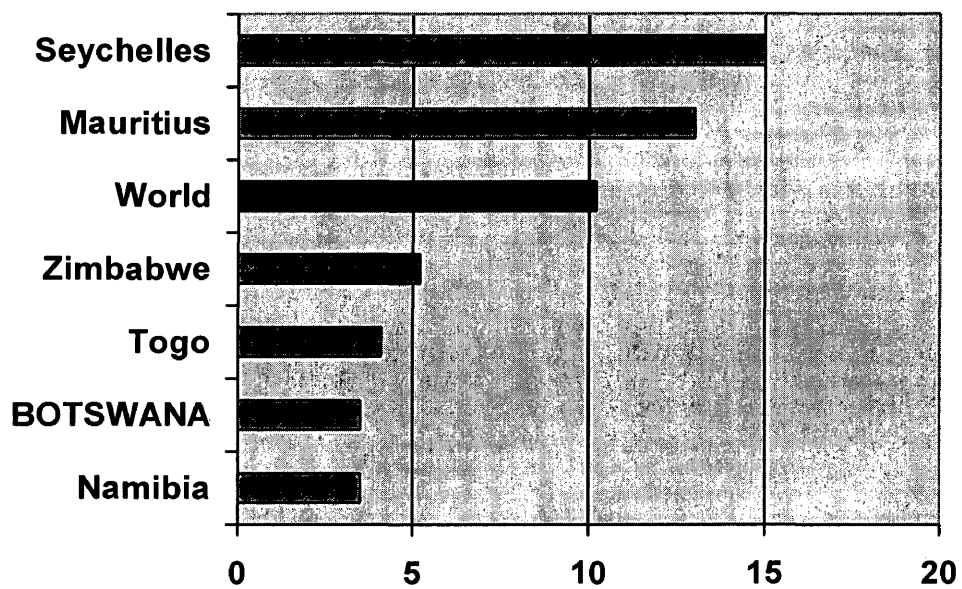
Botswana Telecommunication Authority did not only bring about mobile telephony through liberalization, but also took charge of Internet Service providers in the country (ISPs).

The Internet in Botswana

Internet services in Botswana were provided right after BTA was established. On her paper presented to ITU summit, Bopa (2000) said that Internet services in Botswana are now liberalized. She added that all ISPs are required to be licensed, as stipulated by the BTA act of 1996. The ISPs licenses are valid for two years, and can be renewed. In 2000, there were six licensed Internet Service Providers while in 2003 there were 13 (TRASA, 2004).

Although Internet service is still limited in Botswana, there has been a sharp rise since 1995. In 1995, number of Internet subscribers per thousand people was reported at 1.0 while in 2001 there were 50.0 (World Bank, 2003).

Figure 9: Internet users per 100 people: Top African Countries, 2003



Source: ITU, 2004

McCormick (2003) said that in 2000 most Southern African countries had access to Internet especially in cities.

Botswana Telecommunications Authority still enjoys a good reputation as one of the pioneers in Africa to form an independent regulatory agency. Since the early 1990's telecommunications reform has been a top priority of many African countries especially those in the Southern African Development Community (SADC). With BTA serving as a model in telecommunications regulation in SADC, The Telecommunication Regulators' Association of Southern Africa (TRASA) was established to manage regulatory matters and share ideas and experiences concerning all aspects of telecommunications regulation in Southern Africa (Schorr and Sunberg, 2001). To draw a more precise picture of TRASA, let us look at its members, goals and objectives.

TRASA

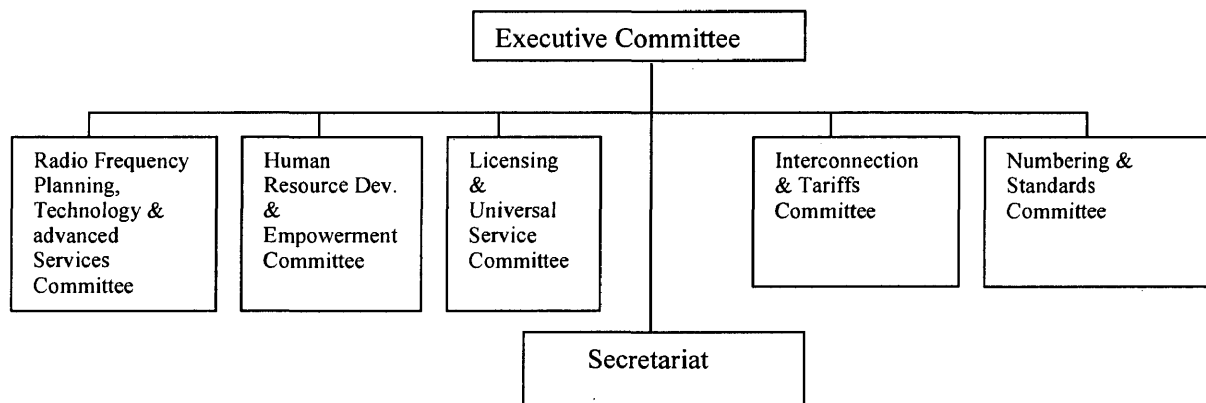
The Telecommunication Regulators Association of Southern Africa (TRASA) was established in 1998 by 14 member states of Southern African Development Community (SADC). The organization (SADC) was formed in 1980 to create a regional trading area that would link their national economies independent from the influence of the then oppressive South African regime (McCormick, 2003).

While SADC placed more of its emphasis on political and economical issues, the organization realized that more emphasis should also be placed on telecommunications infrastructure development as a way to attract foreign firms to do business in their region (McCormick, 2003). SADC's stand in telecommunications reform was to form a tripartite industry structure with the respective government as the policy maker, an independent

regulatory body and licensed service providers governed by suitable legislation to promote a competitive environment (McCormick, 2003). To make sure that SADC objectives in telecommunications reform were achieved, TRASA was formed by Botswana, Mozambique, Namibia, South Africa, Tanzania and Zambia. Members of TRASA are independent from their countries operators and government ministries (TRASA, 2004).

The goals and objectives of TRASA are to form a uniform body that link a region's regulatory bodies to share ideas, and also to form an enabling environment by sharing human capital in a cost effective way (Schorr and Sunberg, 2001). Membership in TRASA is based on the countrys will to form an autonomous regulatory body. This means that for a country to have full voting powers in TRASA, it should have an independent or separate telecommunication regulator. Countries without independent telecommunication regulators serve only as observers (Schorr and Sunberg, 2001). Currently 11 members of TRASA have full voting rights except Seychelles, Swaziland and Democratic Republic of Congo (TRASA, 2004).

Figure 10: Trasa's Organizational Structure



Source: Schorr and Sunberg, 2001.

Botswana Telecommunication Authority has been playing an integral part since the creation of TRASA. For example, BTA has been serving as a secretariat for TRASA since 2001 with additional two BTA members of staff at the organization. TRASA is headquartered in Botswana. BTA also serve as a treasurer by keeping TRASA's financial records. These BTA employees spent most of their time at TRASA (Schorr and Sunberg, 2001).

Tariffs

Using ITU definition, Frempong and Atubra, (2001), said a tariff is a price set for the number of units per telephone call "within an exchange or international system using the subscribers own terminal equipment" (p.203). In short, they described tariffs as prices consumers pay when they use telecommunication services. For example, when one makes a call either locally or internationally, there is a charge for it depending on the duration. According to ITU, the tariffs can promote effective use of the network and

city) might still be considered a local call because it originated from and ended in the same area (BTC website, 2004).

Chapter 4

RESULTS

The purpose of this study was to determine whether there is a relationship between telecommunications and economic development. The data were analyzed by using statistical correlation test to find out if the variables, GDP per capita and teledensity are correlated.

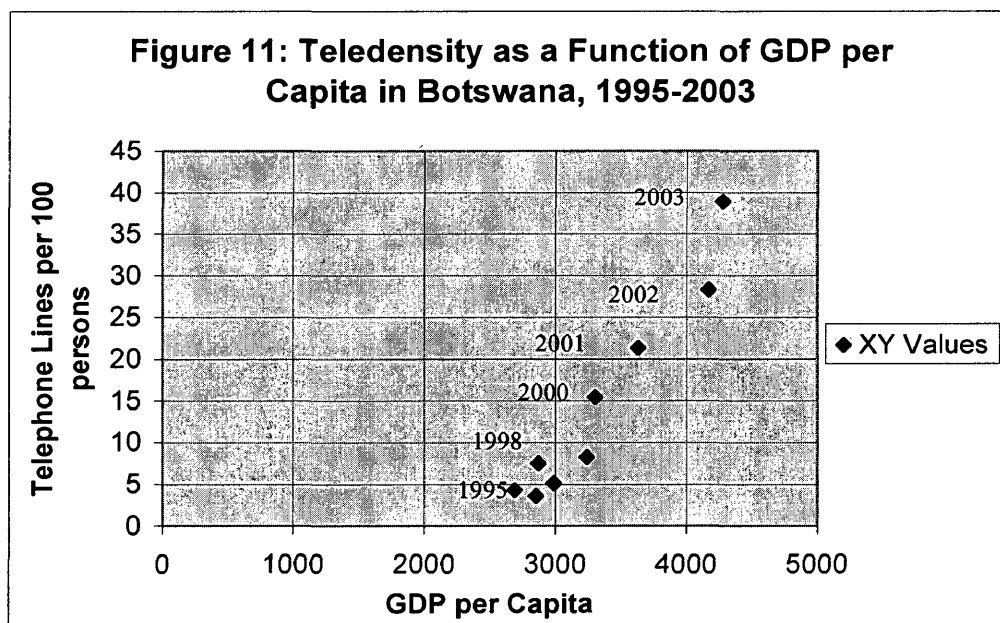


Figure 11 above shows the rate of teledensity in relation to the corresponding GDP per capita. The figure shows a more gradual growth of GDP per capita as evidenced by the data clustered between \$ 2,800 and \$3,000 between 1995 through 1998. The figure above shows that between the years 1995 and 1998, Botswana's GDP didn't grow as expected in relation to the growth of telephones in those years. From 1995 till 1998, Botswana's GDP per capita stood at \$2,900. During the same period, teledensity grew at an enormous rate from 3.6% in 1995 to 7.5 % in 1998.

services, improve universal service and contribute to the development of other sectors of the economy, because telecommunication is regarded as a facilitator of economic development (ITU, 2004).

In the past, carriers operating within their territory used to set prices for international services. If there were two carriers in one territory or country both engaged in international calls, they would agree on a price ex-ante (the accounting rate) and then share it (Tang, 2001). If one operator places more calls than they receives, then it will have to give its foreign partners a settlement payment. This practice was viewed as a bad policy because it resulted in a net trade deficit in telecommunication services for the country with more outgoing calls (Tang, 2001). Economic factors have caused some imbalances in telephone traffic. Tang (2001) said that the influx of immigrants from poor countries to well off countries such as the United States and Canada contribute to this factor. The relative numbers of immigrants from less developed countries are positively correlated to the net outbound calls from the United States (Tang, 2001).

In Ghana, the 1996 tariffs separated charges for mobile cellular calls and local calls (Frempong and Atubra, 2001). Xavier (2000) said that price trends require supervision to make sure it is within the context of the existing price regulation regime.

In accord with BTA regulations, Botswana Telecommunication Corporation introduced the seven-digit numbering range and reassigned charging zones in May 2003 (BTC website, 2004). BTC tariffs are charged according to zones whereby a zone could encompass the entire city and maybe the surrounding areas. For example, a call made from Gaborone (the capital of Botswana) to Gabane (which is a small village outside the

From the scatter plot above, the points of the variables GDP per capita and teledensity tend along a line going from the bottom left to the upper right, which means that the correlation is positive.

Results of correlation analysis are summarized in tables 3, 4 and 5 below. The analysis revealed a significant relationship between telecommunication and economic growth. As table 3 indicates, the correlation analysis revealed a strong positive relationship ($r = .967$) between teledensity and GDP per capita.

Table 3:Correlations (1995-2003)

		Teledensity	GDP per capita
Teledensity	Pearson Correlation	1	.967**
	Sig. (2-tailed)	.	.000
	N	9	9
GDP per capita	Pearson Correlation	.967**	1
	Sig. (2-tailed)	.000	.
	N	9	9

**Correlation is significant at the 0.01 level (2-tailed)

The Pearson correlation in the table above shows the strength and direction of the linear relationship, while N is the number of cases that was used. In this study, the period of analysis was from 1995-2003 making 9 cases.

We see that the relationship between GDP per capita and teledensity is positive (.967) and based on the P value (.000) it is statistically significant.

As GDP per capita slumped between 1995 and 1998, teledensity never slowed down. Below are the results of correlation analysis from 1995 and 1998.

Table 4: Correlations (1995-1998)

		Teledensity	Teledensity
Teledensity	Pearson Correlation	1	.266**
	Sig. (2-tailed)	.	.734
	N	4	4
GDP per capita	Pearson Correlation	.266**	1
	Sig. (2-tailed)	.734	.
	N	4	4

**Correlation is significant at the 0.01 level (2-tailed)

The correlation analysis above revealed a weak positive relationship ($r = .266$) between GDP per capita and teledensity. This suggests that between 1995 and 1998, telecommunications somewhat did not have effect on the economy. This signifies the period before telecommunication regulation.

Table 5:Correlations (1999-2003)

		Teledensity	Teledensity
Teledensity	Pearson Correlation	1	.953**
	Sig. (2-tailed)	.	.012
	N	5	5
GDP per capita	Pearson Correlation	.953**	1
	Sig. (2-tailed)	.012	.
	N	5	5

**Correlation is significant at the 0.05level (2-tailed)

The correlations in the table above are interpreted the same way as those in tables 3 and 4 above. We can see that the correlation between GDP per capita and teledensity is highly positive ($r = .953$). This correlation is only from 1999 through 2003, which signifies a period when liberalization was introduced.

Chapter 5

DISCUSSION

The purpose of this study was to test the relationship between the telecommunication sector and the national economy. The goal was to determine if telecommunications plays an important role in economic growth by looking at GDP per capita and teledensity in Botswana. In order to accomplish this, statistical correlation tests were run to test if the two variables had a relationship.

The results of the statistical analyses conducted in this study provided evidence that there is a positive relationship between GDP per capita and teledensity as evidenced in Figure 9 and Table 4. These findings are consistent with previous ones conducted by Forestier et al, (2002), Dholakia et al (1994), Hendrick and Waverman (2001), Norton (1992), Hardy (1980), Hudson (1984), Saunders et al (1994) and Cronin et al (1991) reaffirming the idea that telecommunication does contribute to economic development.

At the same time, however, it must be noted that liberalization could have played a role in the growth of both teledensity and GDP per capita. The results from table 5, which were a period before competition was introduced, revealed a weak positive relationship between the two variables leaving us (with a conclusion that liberalization played a positive role in economic development).

This study found that the relationship between GDP per capita and teledensity became significant in 1998 right after Botswana Telecommunication Authority licensed cellular services. This is a period when competition was allowed in the telecommunication industry. Since then, GDP per capita has grown consistently which indicates that the two variables were related. Even though teledensity never slowed down,

we can conclude that the introduction of liberalization might have jump started the economy or fueled its growth.

Telecommunications regulation in Botswana played a positive role in economic development in the sense that it provided the atmosphere conducive for competition, which in turn contributed to economic growth. As Botswana moved towards a more private and regulated telephone provision, more people had access to telephone services even in rural areas.

It should be noted that this study was not trying to establish causation. For example, when GDP per capita was showing a weak growth between 1995 and 1998, we should not have expected teledensity to decline because correlation is just a test for combined variation. We can only suggest that the results above provided a basis to argue that investment in telecommunication enhances economic growth while demands for telecommunications growth are stimulated by economic growth.

The results of this study clearly provide continued support for the claim that telecommunications is directly connected to economic development. The results provided us with evidence that countries with better economies tend to develop faster. Botswana, as a middle-income country, is currently developing a little faster than her neighbors. This means that as the country develops, availability of telecommunication facilities and telephone use increases. Cellular services in the country have led the Botswana Telecommunications Corporation to reevaluate its services and improve infrastructure nationwide to keep its landline customers. This competition between the main line and

mobile industries for customers meant more investment in telecommunications, which ultimately contributed to the economic growth.

We can conclude that for a developing country like Botswana, teledensity will continue to grow faster than GDP because telecommunications is still in high demand. Providing telecommunication service in rural areas was a challenge for Botswana Telecommunications Corporation. As far as telecommunication infrastructure is concerned, customers who lived in rural settlements with low population densities were at a disadvantage because the costs of providing them with landline service were high.

With the introduction of cellular services in the country, more rural areas were able to get the services to connect with the rest of the world. For example, teledensity grew from 28.3% in 2002 to 38.9% in 2003 while GDP grew from 2.6 % in 2002 to 3.5% in 2003. From the above analysis, it is reasonable to guess that access to telephones can play a significant role in income generating opportunities in rural areas. For example, public cellular phone service in Botswana has grown significantly in rural areas in creating employment and income for a significant number of rural area residents (Mmegi Business Week, 2004).

Competition in the telecommunication industry in Botswana led to more people with choices for services. Moreover, Botswana experienced increased teledensity and relatively high economic growth. GDP per capita has grown by 29% from 1995 to 2003.

There are other factors that could have played a role in economic growth. As telecommunication and economic development is concerned, the results for this study showed that GDP growth and telephones per capita are related.

Allowing Mascom Wireless and Orange to participate and compete in the market, draws us to the conclusion that telecommunication regulation in Botswana had a positive role in stimulating economic growth through market access

We can go in to details of other factors that stimulate economic development, but with the present study results, we can only guess that with better telecommunications infrastructure in place, corporations were able to communicate quickly over distances in the coordination of their economic enterprises. Corporations use telecommunications facilities to convey the information through which they coordinate their operations. This helped businesses to grow or organize themselves better. This is one of the many factors that could have stimulated economic growth.

The reason Botswana's economy was performing badly between 1995 and 1998 was the rate at which HIV/AIDS epidemic was growing. This means that the nations' skilled manpower became weak and negatively affected the country's economic output. The country spent millions of Pula devising strategies and programs in dealing with the epidemic. More money was spent in educating the people. Even though HIV/AIDS is still a major cause of death in Botswana, programs that were put in place in the fight against the disease seems to be yielding some results (National AIDS Co-ordinating Agency, 2003). This means that companies are not negatively affected as it was the case before. Hence, from 1999 until now, the economy has been showing signs of stability and positive growth. With the economy in good shape, the number of consumers for telephones will keep growing.

Chapter 6

CONCLUSIONS

The relationship between telecommunication infrastructure and economic development has been established in many studies. The previous studies have provided detailed descriptions for the role of telecommunication in economic development in various countries. There is a general consensus that the two are related.

These studies have collected and analyzed data on economic indicators and telecommunication infrastructure to find correlation between the two. Most of the findings succeeded in assuming that indeed there is a relationship between telecommunications and economic development. However, it is still not yet clear how the relationship between economic development and telecommunications infrastructure occurs. Previous studies have not yet illustrated how the two occurs but the few studies that have tried to establish the causal relationship claimed that a relationship between telecommunication infrastructure and economic development exists in both directions.

Telecommunication's role in economic development is a very broad topic, which incorporates a lot of factors and indicators. For this study, the literature review covered the theories necessary for development, benefits of telecommunications, the link between telecommunications and economic development and how telecommunication contributes to rural development.

Beyond providing the social and economic benefits of telecommunications, the literature also covered telecommunications regulation and liberalization to understand the full scope of telecommunications and economic development.

From the literature review, the overall benefits of telecommunications on economic development are that telecommunications improve the productivity of labor due to better education and health care services stimulated by advanced telecommunications infrastructure. Telecommunication infrastructure has been seen as a potential factor in economic development by providing access to human capital and telemedicine. Moreover, information could be disseminated faster to rural areas through telecommunication and students in remote areas can advance their education through long distance learning which is made possible by telecommunications.

While economic development and telecommunication infrastructure have been seen as important factors to sustain social life, regulation of telecommunication has also promoted the growth of telecommunications as evidenced by increasing teledensity. Botswana liberalized its telecommunications in 1996 to promote effective telecommunications services. Since then, Botswana has experienced a huge growth in teledensity and economic returns.

The current study looked at the relationship between telecommunication infrastructure and economic development. The objective of this study was to look at the relationship between economic development and telecommunications. The study used a quantitative correlation analysis. The study used Gross Domestic Product per capita as a measure for economic growth and teledensity as a measure for telecommunications. A statistical correlation was run between GDP per capita and teledensity to establish the relationship between the two variables.

Quantitative analysis was used for this study because the only way we to get a clear sense of the relationship was to run a statistical test. The statistical test showed the correlation coefficient, and level of significance. The results showed that there was indeed a high correlation between telecommunications and economic development in Botswana from 1995 through 2003. When we ran the same test from 1995 until 1998, we got different results. However, the results for this period were not surprising because, if we look at Botswana's economic performance at that time, the GDP was unpredictable as it was up one year and down the following year.

Limitations

Even though results of this study showed a positive correlation between GDP per capita and teledensity, other variables such as energy consumption, employment rate, income or trade would have helped us further understand the relationship of the telecommunications and economic output. However, it is very hard to get data for these variables. These suggested variables would have been correlated with GDP per capita and numbers of telephones to see if coefficients results would have been different.

Although this study contributes to our understanding of telecommunications industry and economic development in Botswana, certain corporations such as Botswana Telecommunication Corporation and Orange were unwilling to provide data significant for this study. BTC and Orange's unwillingness to provide data was based on the pretext that information requested was confidential. It is reasonable to note that failure by these corporations to provide information and data to scholars does not only limit researchers,

Limit Research. (Tk)
 but studies like this could fail in providing a more extensive framework and picture of telecommunications in Botswana.

It is imperative that studies like this be supported because they provide data and literature vital for future studies. Therefore, results of this study were limited by lack of appropriate data.

While the primary limitation of this study was lack of data from Botswana for other variables, studies that have been done in telecommunications and economic development were more than enough for the literature review. Literature on telecommunication regulation and liberalization in Africa was very limited. Many studies that covered this topic analyzed low-income countries such as China and India. Therefore, it was a little hard to get in-depth information about telecommunication regulation in Africa.

Data for GDP per capita in Botswana was somewhat difficult to follow. World organizations such as United Nations, the World Bank and I.M.F all had conflicting data. This study used data from the UN and IMF because the data they provided for GDP per capita were somewhat the same. Statistics from some of these bodies about Botswana's profile were only available for recent years. This meant that data for years and years back was not available.

Future Research

While many studies haven't established a causal link for this topic, future research should continue trying to establish the causal link especially in low-income countries or developing countries. Another aspect that future research should address is regulation and

economic development. Future studies should look at how telecommunication regulation stimulates economic development through market access. Considerations should be more on competition and liberalization. Future researcher should compare a country that has an independent regulatory body with a country that doesn't have an independent telecommunication regulatory body to see how the countries differ in terms of correlation between telecommunications and economic development. Regulation is perceived as crucial to protect consumer's welfare and promotes competition. Future research should find out how much regulation is needed in telecommunications industry. Do we need less regulation in an environment where several firms operate in the competitive same market, or do we need more regulation only in a monopoly environment.

BIBLIOGRAPHY

- Abdala, M.A. (2000). Institutional Roots of Post-Privatization Regulatory Outcomes. *Telecommunications Policy*, 24 (8/9), 645-668.
- Andrew, T. & Petkov, D. (2003). The Need for a Systems Thinking Approach to the Planning of Rural Telecommunications Infrastructure. *Telecommunications Policy*, 27 (1/2), 75-93.
- Anokwa, K., Lin, C., & Salwen, M. (2003). International Communication: Concepts and Cases. Belmont, CA: Wadsworth.
- Backer, T.E. & Rogers, E. (1998). Diffusion of Innovations Theory and Work-Site AIDS Programs. *Journal of Health Communication*, 3 (1), 17-29.
- Bank of Botswana. (n.d.) Botswana Financial Statistics. Retrieved from February 14, 2004, from <http://www.bankofbotswana.bw>
- Bertolini, R. (2002). Telecommunication Services in Sub-Saharan Africa: An Analysis of Access and Use in the Southern Volta Region in Ghana. Frankfurt, Germany: Peter Lang.
- Bopa, S. (2000). Overview of the Internet in Botswana. Retrieved September 20, 2004 from http://www.itu.int/africainternet2000/countryreports/bwa_e.htm
- Bordenave, J.E.D. (1977). Communication and Rural Development. Gembloux, Germany: United Nations.
- Borg, P.W. (1988). Telecommunications and Economic Development in the Caribbean. United States Department of State: Bureau of Public Affairs. Washington: DC. (Current Policy No. 1136).

- Botswana Telecommunications Authority (n.d.). Retrieved February 25, 2004 from <http://www.bta.bw.org>
- Botswana Telecommunications Corporation (n.d.) Retrieved April 05, 2004 from <http://www.btc.bw>
- Bourreau, M. & Dogan, P. (2001). Regulation and Innovation in the Telecommunications Industry. *Telecommunications Policy*, 25 (3), 167-184.
- Cave, M. & Crandall, R. W. (2001). Telecommunications Liberalization on Two Sides of the Atlantic. Washington, DC: Brookings Institution Press.
- C.I.A. World Fact Book (2003). Retrieved April 25, 2004 from <http://www.cia.gov/cia/publications/factbook/geos/bc.html>
- Cowan, G.L. (1990). Privatization in the Developing world. New York: Greenwood Press.
- Cronin, F.J., Parker, E.B., Colleran, E. K., & Gold, M.K. (1991). Telecommunications Infrastructure and Economic Growth. *Telecommunications Policy*, 15(6). 529-535.
- Cronin, F.J., McGovern, P.M., Miller M.R., & Parker, E.B. (1995). The Rural Economic Development Implications of Telecommunications. *Telecommunications Policy*, 19 (7), 545-559.
- Danevad, A. (1995). Responsiveness in Botswana Politics: Do Elections Matter? *The Journal of Modern African Studies* 33 (3), 381-402.
- Dholakia, R. & Bary, Harlam. (1994). Telecommunications and Economic Development:

- Econometric Analysis of the U.S. Experience. *Telecommunications Policy*, 18 (6), 470-477.
- Donohue, G.A., Tichenor, P.A., & Olien, C.N. (1986). Metro Daily Pullback and Knowledge Gaps: Within and Between Communities. *Communication Research* 13 (3), 453-471.
- Forestier, E., Grace, J. & Kenny, C. (2002). Can Information and Communication Technologies be Pro Poor. *Telecommunications Policy*, 26 (11), 623-646.
- Frempong, G.K. & Atubra, W.H. (2001). Liberalization of Telecoms: The Ghanaian Experience. *Telecommunications Policy* 25 (3), 197-210.
- Gandal, N., Salant, D. & Waverman, L. (2003). Standards in Wireless Telephone Networks. *Telecommunications Policy*, 27 (5/6), 325-333.
- Gao, P. & Lyytinen, K. (2000). Transformation of China's Telecommunications Sector: A Macro Perspective. *Telecommunications Policy*, 24 (10/11), 719-730.
- Gazette. (2004, January 14) The Index of World Freedom has placed Botswana as Africa's freest economy, Retrieved January 14, 2004, from <http://www.gazette.bw>
- Hackler, D. (2003). Invisible Infrastructure and the City. *American Behavioral Scientist*. 46 (8), 1034-1055.
- Hardy, A.P. (1980). The Role of Telephone in Economic Development. *Telecommunications Policy*, 4 (4), 278-286.
- Harper, J.M. (1989). Telecommunications Policy and Management. London, Britain: Pinter Publishers.
- Hendrick, R., & Waverman, L. (2001). Telecommunications Infrastructure and Economic

- Development: A simultaneous Approach. *The American Economic Review*, 91 (4), 909-923.
- Hermans, T. (Ed). (1999). Botswana's Stock Exchange Ranked Fourth in Africa. *Marung*, 17 (143), 1-7.
- Hills, J. (1990). The Telecommunications Rich and Poor. *Third World Quarterly*, 12 (2), 71-89.
- Hills, J. (1998). Liberalization, Regulation, and Development: Telecommunications. *Gazette: International Journal for Communication studies*, 60 (6), 459-476.
- Hindman, D.B. (2000). The Rural-Urban Digital Divide. *Journalism & Mass Communication Quarterly* 77(3), 549-560.
- Hudson, H. (1984). When telephones reach the village: The Role of Telecommunications In Rural Development. Norwood, NJ: Albex.
- Hudson, H. (1988). A bibliography of Telecommunications and Socio-Economic Development. Norwood, MA: Artech House.
- Hudson, H. (1997). Global Connections: International Telecommunications Infrastructure and Policy. New York, NY: Van Nostrand Reinhold.
- IMF (International Monetary Fund) (n.d). Sub Saharan African Regional Economic Outlook. Retrieved August 01, 2004 from <http://www.imf.org/external/pubs/ft/afr/reo/2003/eng/01/pdf/reo0603.pdf>
- ITU (International Telecommunication Union) (2004). Tariffs Policies, Tariffs models and Methods of Determining the Cost of National Telecommunication Services including Spectrum Aspects. Retrieved April 10, 2004 from

http://www.itu.int/ITU-D/study_groups/SGP_2002-2006/SG1/Documents/2001/134REV3V2E.doc

ITU (International Telecommunication Union) (2004). African Telecommunication Indicators 2004. (7th ed). Retrieved September 20, 2004 from <http://www.itu.int/ITU-D/ict/publications/africa/2004/>

ITU (International Telecommunication Union) (n.d) Promoting Universal Access to ICT's—Practical Tools for Regulation. Retrieved November 22, 2003 from <http://www.tu.int/publications/docs/trends2003.html>

Kaplan, D. (1992). The development of Telecommunications in South Africa: The Equipment Supply Industry. *Critical Arts Journal*, 6 (1), 96-108.

Kiplagat, B.A. & Werner, M.C.M. (1994). Telecommunications and Development in Africa. Washington, DC: IOS press.

Knauer, L.T., Machtley, R.K. and Lynch, T.M. (Eds.). (1996). Telecommunications Act Handbook. Rockville, MD: Government Institutes, Inc.

Koch, S.E. (1991). Telecommunications and Economic Development in the Great Lakes Region. Bloomington, IN: Indiana University.

Koppich, J. (2002, September 19). Lessons from the Fastest Growing Nation: Botswana. *Business Week*. 3796, 116-118.

Korsching, P.F., Hipple, P.A. & Abbott, E.A. (2000). Having all the Right Connections: Telecommunications and Rural Viability. Westport, CT: Praeger.

Kwabena, R. (1993). Telecommunications Development: A case of Africa. Langham, MD: University Press of America.

- Langdale, J. (1982). Competition in Telecommunications. *Telecommunications Policy*, Lapuerta, C. & Tye, B. (1999). Promoting Effective Competition through Interconnection Policy. *Telecommunications Policy*, 23(2), 129-145.
- Leff, N.H. (1984). Externalities, Information Costs, and Social Benefit- Cost analysis for Economic Development: An Example from Telecommunications. *Journal of Economic Development and Cultural Change*, 32 (2), 255-276.
- Lehr, W. (1995). Quality and Reliability of Telecommunications Infrastructure. Mahwah, NJ: Laurence Erlbaum Associates, Publishers.
- Lentz, R.G. & Oden, M.D. (2001). Digital Divide or Digital Opportunity in the Mississippi Delta Region of the US. *Telecommunications Policy*, 25 (5), 291-313.
- Madden, G. & Macdonald, S. (1998). Telecommunications and Socio-Economic Development. Amsterdam: Netherlands: Elsevier Science B.V.
- Makhaya, G. & Roberts, S. (2003). Telecommunications in Developing Countries: Reflections from the South African Experience. *Telecommunications Policy*, 27 (1/2), 41-61.
- M'bayo, R. (1997). Africa and the Global Information Infrastructure. *Gazette: International Journal of Communication Studies*, 59 (4/5), 345-365.
- McMaster, S.E. (2002). The telecommunications Industry. Westport, CT: Greenwood Press.
- McCormick, P.K. (2003). Telecommunications in Southern Africa: The Role of Southern African Development Community, *Telecommunications Policy*, 27 (1/2), 109-134.

- McCormick, P.K. (2001). Telecommunications Reform in Botswana: A Policy Model for African States. *Telecommunications Policy* 25 (6), 409-420.
- Merriam's Webster's Pocket Dictionary (1995). (p. 296). Springfield MA: Merriam-Webster, Incorporated.
- Michalis, M. (2001). Local Competition and the Role of Regulation: The EU Debate and Britain's Experience. *Telecommunications Policy* 25 (10/11) 759-776.
- Minges, M. (1999). Mobile cellular Communications in the Southern African Region. *Telecommunications Policy*, 23 (7/8), 585-594.
- Mmegi Business Week, 21 (174). Cellular Phone Boom in Mochudi. Retrieved November 15, 2004, from <http://www.mmegi.bw/2004/November/monday/15/972618911424.html>
- Mmegi Business Week, 21 (32). Botswana is Africa's most Globalized Nation. Retrieved February 27, 2004, from <http://www.mmegi.bw/2004/february/friday/27/844167553490.html>
- Mody, B., Bauer, J.M., & Straubhaar, J.D. (Eds) (1995). Telecommunications Politics: Ownership and Control of the Information Highway in Developing Countries. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
- Mosco, V. (1988). Toward a Theory of the State and Telecommunications Policy. *Journal of Communication*, 38 (1), 107-124.
- Mureithi, M. (2003). Self-Destructive Competition in Cellular: Regulatory Options to Harness the Benefits of Liberalization. *Telecommunications Policy*, 27 (1/2), 11-19.

- National AIDS Co-ordinating Agency (2003). National AIDS Strategic Framework 2003-2009. Retrieved April 25, 2004 from <http://hivinsite.ucsf.edu/pdf/cr09-bc-01.pdf>
- Naughton, J. (2000). *A Brief History of the Future: From Radio Days to Internet Years in a Lifetime*. Woodstock, NY: The Overlook Press. Routledge.
- Norton, S. (1992). Transaction Costs, Telecommunications, and the Microeconomics of Macroeconomic Growth. *Economic Development and Cultural Change*. 41, 175-196.
- Ngwainmbi, E.K. (1999). *Exporting Communication Technology To Developing Countries: Sociocultural, Economic, and Factors*. Lanham, MD: University Press of America.
- Picard, L.A. (1985). *The Evolution of Modern Botswana*. Lincoln, NE: University of Nebraska Press.
- Picard, L.A. (1987). *The Politics of Development in Botswana: A Model for Success*. Boulder, CO: Lynne Rienner Publishers Inc.
- Pfeiffer, G. & Wieland, B. (1990). *Telecommunications in Germany: An Economic Perspective*. Germany: Springer-Verlag.
- Pool, I. (1976). *The Influence of International Communications on Development*. Cambridge, MA. M.I.T. press.
- Pool, I. (1977). *The Social Impact of the Telephone*. Cambridge, MA. M.I.T. press
- Read, W.H. & Youtie, J.L. (1996). *Telecommunications Strategy For Economic Development*. Westport, CT: Praeger Publishers.
- Riaz, A. (1997). *The Role of Telecommunications in Economic Growth: Proposal for an*

- Alternative Framework of Analysis. *Media Culture & Society*. 19 (4), 557-584.
- Riverson, L.K. (1993). Telecommunications Development: The Case of Africa. Lanham, MD: University Press of America.
- Rogers, E.M. (1976). Communication and Development: The Passing of the Dominant Paradigm. *Communication Research*, 3 (2), 213-238.
- Samarajiva, R. (2000). Establishing the Legitimacy of New Regulatory Agencies. *Telecommunications Policy*, 24 (3), 183-187.
- Saunders, R.J., Warford, J.J. & Wellenius, B. (1983). Telecommunications and Economic Development. Baltimore, MD: The Johns Hopkins University Press.
- Saunders, R.J., Warford, J.J. & Wellenius, B. (1994). Telecommunications and Economic Development. Baltimore, MD: The Johns Hopkins University Press.
- Saunders, J. & Warford, J. (1979). Evaluation of Telephone Projects in Less Developed Countries. *Telecommunication Journal* 46 (1), 22-28.
- Sapolsky, H.M., Crane, R.J., Neuman, R.W. & Noam, E.L. (1992) The Telecommunications Revolution : Past, Present, and Future. New York, NY: Routledge
- Schmandt, J., Williams, F. & Wilson, R.H. (1989). Telecommunications Policy and Economic Development. Westport, CT: Praeger Publishers.
- Schmandt, J., Williams, J., Wilson, R.H. & Strover, S. (Eds.). (1991). Telecommunications and Rural Development: A Study of Private and Public Sector Innovation. New York, NY. Praeger.
- Tang, L. (2001). The imbalances of Telephone Traffic for the United States.

Telecommunications Policy 25 (6), 421-430.

The Government of Botswana website (n.d). Retrieved November

25, 2003 from <http://www.gov.bw>

Townsend, F. (Ed.) (1994) Botswana: A Review of Commerce and Industry. (15th ed).

Gaborone, Botswana. B & T Directories (PTY) LTD.

TRASA (n.d). TRASA Member Reports 2003. Retrieved September 25, 2004 from

<http://www.trasa.org.bw>

Trends in Telecommunication Reform 2002. (4th ed). Retrieved November 22, 2003,

From <http://www.itu.int/publications/docs/trends2002.html>

Trends in Telecommunication Reform 2003. (5th). Retrieved November 22, 2003,

from <http://www.itu.int/publications/docs/trends2003.html>

United Nations (2001). Africa Recovery. Retrieved April 29, 2004 from

<http://www.un.org/ecosocdev/geninfo/afrec/vol15no1/151aids9.htm>

United Nations (n.d). Statistics Division. Retrieved September 12, 2004 from

<http://unstats.un.org/unsd/snaama/selectionquick.asp>

Wells, J. G. & Anderson, D.K. (1997). Learners in a Telecommunications Course:

Adoption, Diffusion, and Stages of Concern. *Journal of Research on Computing in Education*, 30 (1), 83-106.

Wheatley, J.L. (1999). World Telecommunications Economics. London, UK: The

Institution of Electrical Engineers.

World Bank (2004). Doing Business in 2005: Removing Obstacles to Growth. Retrieved

September 22, 2004 from <http://rru.worldbank.org/doingbusiness/>

- World Health Organization (2002). Epidemiological Fact Sheets on HIV/AIDS and Sexually Transmitted Infections. Retrieved April 29, 2004 from http://www.who.int/emc-hiv/fact_sheets/pdfs/Botswana_EN.pdf
- Xavier, P. (1997). Australia's Post July-1997 Telecommunications Regulation in International Context. *Telecommunications Policy* 21 (6), 533-551.
- Xavier, P. (1998). The Licensing of Telecommunication Suppliers. *Telecommunications Policy* 22 (6), 483-492.
- Xavier, P. (2000). Market Liberalization and Regulation in Hungary's Telecommunications Sector. *Telecommunications Policy* 24 (10/11), 807-841.
- Zhao, D. & Junjia, L. (1994). Telecommunications Development and Economic Growth in China. *Telecommunications Policy* 18 (3), 211-215.

APPENDIX