

Association for Information Systems AIS Electronic Library (AISeL)

PACIS 2000 Proceedings

Pacific Asia Conference on Information Systems
(PACIS)

December 2000

Growth of Teledensity in Least Developed Countries: Need for a Mitigated Euphoria

Victor Mbarika
Auburn University

Jennie Raymond
Auburn University

Terry Byrd
Auburn University

Follow this and additional works at: <http://aisel.aisnet.org/pacis2000>

Recommended Citation

Mbarika, Victor; Raymond, Jennie; and Byrd, Terry, "Growth of Teledensity in Least Developed Countries: Need for a Mitigated Euphoria" (2000). *PACIS 2000 Proceedings*. 54.
<http://aisel.aisnet.org/pacis2000/54>

This material is brought to you by the Pacific Asia Conference on Information Systems (PACIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in PACIS 2000 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

Growth of Teledensity in Least Developed Countries: Need for a Mitigated Euphoria

Victor W. A. Mbarika¹, Jennie E. Raymond, Terry A. Byrd
College of Business, Department of Management
Auburn University, AL 36849, U.S.A.

Abstract

While having the lowest number of main telephone lines for every one hundred inhabitants (teledensity) over the last decade, the Least Developed Countries (LDCs), have the highest average pre-tax operator profitability in the world. Many LDCs have already opened their terminal equipment markets to competition and some have also done this with data and value-added services. LDCs are greatly behind other regions of the world in terms of their levels of teledensity. This paper combines research from academic and major international organizational literature to examine and synthesize the current understanding of teledensity development in LDCs. The obstacles to growth of teledensity are discussed, and the importance and opportunities for growth of teledensity to solve priority problems and to realize sustainable development in LDCs are examined. Specifically, the framework and findings suggest that various policy, economic, financial, managerial, organizational, technological, political and geographical factors are important determinants for growth of teledensity in LDCs. While it is time for a mitigated euphoria vis-à-vis the poor state of teledensity in these countries, this study suggests a variety of strategies to advance teledensity in LDCs.

Keywords: Teledensity, Telecommunications, Least Developed Countries.

BRT Keywords: BA, BD

1. Introduction

Teledensity is used to refer to the number of main telephone lines for every one hundred inhabitants. Teledensity is also used to refer to the level of a country's telecommunications infrastructure. (Saunders et al, 1994; Gille, 1986).

Least Developed Countries (LDCs) are defined as low-income countries that are suffering from long-term constraints against growth. In particular, these growth constraints include low levels of human resource development and severe structural weaknesses: economic, social, and political (Austin, 1990). These countries are particularly ill-equipped to develop their domestic economies which are vulnerable to external shocks and natural disasters.

Table 1 contains the list of 48 LDCs, as currently defined by the United Nations General Assembly that was used for this study. The list was most recently updated in December 1998 with the "graduation" of Botswana and the addition to the list of two new countries, Angola and Eritrea. Of the 48 LDCs, 30 are in Africa, 13 in Asia and the Pacific, 4 in the Arab Region and 1 in the Americas. There were 25 LDCs in the original group in 1971, indicating that the number has essentially doubled in 20 years. The criteria used by the United Nations General Assembly for inclusion in the list of LDCs are discussed below.

¹ Send all correspondence to Victor W. A. Mbarika, Email: mbarivi@mail.auburn.edu or vmbarika@aol.com

Table 1. The 48 Least Developed Countries as recognized by the UN General Assembly

Countries	Africa	Americas	Asia & Pacific	Arab States	Year of Entry
Afghanistan			X		1971
Angola	X				1998
Bangladesh			X		1975
Benin	X				1971
Bhutan			X		1971
Burkina Faso	X				1971
Burundi	X				1971
Cambodia			X		1991
Cape Verde	X				1977
Central African Republic	X				1975
Chad	X				1971
Comoros	X				1977
Djibouti				X	1982
Equatorial Guinea	X				1982
Eritrea	X				1998
Ethiopia	X				1971
Gambia	X				1975
Guinea	X				1971
Guinea Bissau	X				1981
Haiti		X			1971
Kiribati			X		1986
Lao (PDR)			X		1971
Lesotho	X				1971
Liberia	X				1990
Madagascar	X				1991
Malawi	X				1971
Maldives			X		1971
Mali	X				1971
Mauritania				X	1986
Mozambique	X				1988
Myanmar			X		1987
Nepal			X		1971
Niger	X				1971
Rwanda	X				1971
São Tomé & Príncipe	X				1982
Sierra Leone	X				1982
Solomon Islands			X		1991
Somalia				X	1971
Sudan				X	1971
Tanzania	X				1971
Togo	X				1982
Tuvalu			X		1986
Uganda	X				1971
Vanuatu			X		1985
Western Samoa			X		1971
Yemen				X	1971
Zaire	X				1991
Zambia	X				1991
<i>Total</i>	48	29	1	13	5

Source: *United Nations General Assembly, December 1998*

2. Criteria for inclusion

2.1 Old criteria for inclusion

The original set of criteria for constructing a list of countries classified as LDCs was adopted in 1971. This includes:

1. Per capita income per year less than US \$200. This figure has been revised periodically, and stood at US \$600 in 1998.
2. Share of industrial production in the Gross National Product (GNP) under 10 percent.
3. Adult literacy rate less than 20 percent.

2.2 New criteria for inclusion

New criteria for determining LDCs was established in 1994:

1. Population less than 75 million.
2. Per capita Gross Domestic Product (GDP) less than US \$700 (average 1990- 92).
3. Augmented physical quality of life index (APQLI) less than 47.²
4. Economic diversification index (EDI) less than 26.³

3. Premise of this study

In a study carried out by the International Telecommunications Union (ITU World Telecommunication Indicators, 1995), LDCs were represented to be among the least developed in terms of the state of their telecommunication networks and limited range of services offered. The study shows evidence that LDCs are falling farther behind other developing countries in the race to construct modern telecommunication networks. For example, as far back as 1984, among commonwealth countries, Singapore (a developing country) generated the fourth highest telecommunications traffic after the UK, Australia, and Canada (developed countries), as opposed to LDCs that currently have less than one telephone for every 100 inhabitants (Eward, 1984).

The same ITU study mentioned above shows further evidence that the falling of LDCs behind other developing countries in the race to construct modern telecommunication networks arises not so much because they are not installing the latest equipment - in many cases the LDCs have modern, state-of-the-art digital networks – but rather that they are not expanding fast enough to close the teledensity gap with other developing countries.

The Maitland Commission (1984) described the teledensity gap as the unbalanced distribution of telephones across the world, with low teledensity, a shortage of exchange capacity, long waiting periods for acquiring a new telephone line, low quality of service, and imbalance of telecommunications infrastructure between urban and rural areas. The ITU (1994) uses national teledensity, which is the relationship between a country's population and the number of main telephone lines.

The literature synthesized here addresses the following research questions:

- Why are LDCs not expanding their teledensities fast enough, as compared to developed countries or other developing countries, considering that these LDCs are investing in the latest equipment? Specifically, what are those factors that influence growth of teledensity in LDCs?
- Given the factors that hinder growth in Teledensity for LDCs, what strategies can these countries implement in order to improve growth of their teledensities?

While previous studies have addressed the probable factors that influence growth of teledensity, these studies are over-generalized to include both developing and developed countries (DCs) as a whole.

² APQLI comprises four indicators: life expectancy at birth, per capita calorie supply, school enrolment ratio, and adult literacy rate.

³ EDI comprises the share of manufacturing in GDP, the share of employment in industry, per capita electricity consumption, and the export concentration ratio.

Our research focuses on LDCs and combines various existing economic, political, technological and geographical factors that influence growth of teledensity in LDCs. We also suggest strategic actions LDCs can implement to promote growth of teledensity.

The literature used for this study include:

- Refereed journals in the area of global information technology management and global telecommunications.
- Books which describe LDCs' economical, political, telecommunications, and cultural history.
- Materials published by international development organizations such as the International Development and Research Center (IDRC), the International Telecommunications Union (ITU), the World Bank, the International Monetary fund (IMF), and the United States Agency for International Development (USAID).

The level of analysis is international, but the focus specifically directed towards least developed countries as earlier defined. We now turn to a discussion on the importance of growth of teledensity in LDCs and the need for such a study.

4. Importance of Teledensity

In his paper "The Dream of E-Commerce: Reality in 1999," Levine relates telephone penetration to Internet and electronic commerce penetration (Levine, 1999).

It has been well documented that world-wide there is a high correlation between the level of telecommunications infrastructure represented by teledensity and the level of economic power represented by the national per capita Gross Domestic Product (GDP) (Saunders et al, 1994). This strong correlation was first pointed out by Jipp in 1963 (as cited in Gille, 1986). Since then many studies have examined the contributions of teledensity to economy and society.

Hardy (1980) established a relationship between the telecommunications infrastructure and the national economy in over 60 nations. He showed that the number of telephones per million people at a particular time had a significant relationship with GDP at a time one period in the future. Cronin, Parker, Colleran, and Gold (1991) statistically confirmed that the two variables representing overall US economic activity, the sum of the output of all industries and the annual Gross National Product, were causally associated with the annual amount of US telecommunications investment. Cronin, Colleran, Herber, and Lewitzky (1993) further showed that investment in telecommunications infrastructure (represented by teledensity) was a reliable predictor of national productivity in the United States.

Another study in the United States conducted by Dholakia and Harlam (1994) looked at the influence of independent variables, such as the number of business access lines per employee, rural highway miles and energy consumption on economic development measured. The two dependent variables used in their study were average annual pay and per capita income. They found that teledensity was an important predictor of the two dependent variables when it was treated as a single independent variable. Even when teledensity was combined with the other independent variables, its effect on the dependent variables was higher than the others in all but one case.

Looking at teledensity in the French and Spanish economies, Berry (1983) concluded that growth of teledensity precede economic development and argued that the ultimate cost of underestimating the significance of teledensity would be quite high. Jussawalla (1988) supported the above claim in her study that shows how growth of teledensity promotes resource mobilization through improved division of labor, and hence, an agent of development. She further argues that in most economies, investment in information-oriented industries would give rise to overall demand in other sectors. Saunders (1982) discussed the benefits of teledensity in terms of financial and economic returns. He showed that the World Bank's teledensity investment projects brought an average financial rate of return of 18 percent and economic rate of returns ranging from 20 percent to 50 percent.

Clarke and Laufenberg (1983) showed that growth of teledensity brought a variety of social benefits in addition to economic benefits in rural Sub-Saharan Africa. Social benefits were identified in health and social service delivery, education, development projects, the stabilization of migrants and the handling of natural and social disasters. Hudson (1984, 1989) also presented a number of social as well as economic benefits of telephone services in rural areas, both in LDCs and developed countries (DCs).

Considering the importance of growth of teledensity, this study borrows from past literature to examine those factors that promote or hinder growth of teledensity in LDCs, and strategies overcome such obstacles. The next sections will discuss the factors that influence growth of teledensity in LDCs, and also strategies to overcome obstacles to growth of teledensity in LDCs.

5. Factors that influence growth of teledensity in LDCs

Bernt and Weiss (1993) group international telecommunications issues into four categories: regulatory, organizational, economic, and technical. Regulatory issues include monopoly versus competition, deregulation, privatization and tariff structures; organizational issues concern operating entities and international/regional telecommunications-related organizations; economic issues include accounting rates, pricing and standards, and technical issues concern telecommunications technologies. The factors examined in this study are classified as economic, financial, technological, managerial, organizational, policy, political, and geographical in nature.

5.1 Economic Factors

Several studies have been conducted which examine the link between teledensity and economic factors. In particular, the International Telecommunications Union's CCITT (International Consultative Committee on Telephone and Telegraph) has sponsored several studies which establish a strong correlation between teledensity and variables such as Gross Domestic Product (GDP), as well as a positive relationship between teledensity and economic development. Conversely the same studies found a negative correlation between teledensity and population size. The results indicated that as GDP increases, telephone density increases more rapidly (Saunders et al., 1983) and that as the population size increases telephone density decreases.

Mbarika (1999) in an empirical study on growth of teledensity in LDCs established a close relationship between GDP per capita and teledensity in LDCs. One of the most noticeable observations was that the countries that were doing better than expected in terms of their

income level had relatively small populations. This should be a major concern for LDCs that generally have a very low average per capita income of US \$283 per year. This is just 7 percent of the global average of US \$3,980 per year.

Other studies that have examined the relationship between teledensity and socio-economic factors suggest a strong correlation between changes in international telecommunications traffic over time, the number of tourists per year, and the volume of international trade. One such study, conducted by (Yatrakis, 1992), suggests that the volume of trade (measured as the dollar value of imports and exports) is an important determinant of the demand for international telegraph and telex services. The World Bank has conducted a number of telecommunications studies using structural economic analysis. These studies model teledensity as input into the production process and postulate that telecommunications services are not equally important to all sectors of the economy. Various country studies suggest that telecommunications services are more intensively used in the secondary and tertiary sectors, such as manufacturing and tourism industries respectively, than in the primary sector, such as agriculture. A 1995 CCITT comparison of employment and telecommunications in Germany suggested that although 25 percent of the economically active population was employed in agriculture, this sector accounted for only 7 percent of telephone lines and 4 percent of telephone revenues. Commerce and transport sectors (service sectors) employed 16 percent of the work force, but accounted for 39 percent of telephone lines and 41 percent of revenues.

Other country studies confirm this result (CCITT, Blue Book, vol. 2, Geneva: ITU, 1965 as reported in Saunders et al., 1983). A 1969 United Nations (UN) input-output study of communications patterns in 20 countries in the 1960s suggests that communications output is primarily used by service sector industries, followed by manufacturing and mining (UN, 1969). The results suggest that communications-intensive industries tend to be characterized by high value added relative to other industries. (Saunders et al., 1983). This therefore suggests that as contribution of the service sector share to GDP in the economy of LDCs increases so will the level of teledensity.

Mbarika (1999) established a close relationship between contribution of the service sector share to GDP and teledensity. The service sector is one of the biggest customers of telephone services typically accounting for over half of telecommunications operator's revenues. Service sector customers include industries such as banking, trade, tourism and administration. Given that the service sector was such a heavy user of telephone services, one would intuitively expect a relation between the importance of the service sector in a national economy and the level of teledensity. Although the size of the service sector's contribution to GDP has been found to be highly correlated with teledensity, the unresolved question is whether services increase teledensity or whether telecommunications development leads to growth in the service sector. It is probably a bit of both. Since services are big users of communications, their demand will increase the telecommunications operator's revenues, allowing further network investment to take place. At the same time, higher levels of teledensity will tend to lower costs for the service sector, triggering expansion and attraction of new service industries. This mutually beneficial relation between service sector and teledensity suggests that the LDCs may want to encourage development of the service sector.

5.2 Financial Factors

The Maitland Commission (1984) analyzed several financial obstacles against the growth of teledensity. They are summarized as follows:

1. Funding:

- LDCs need more capital than they can raise themselves.
- There is scarcity of hard currency necessary for purchasing telecommunications equipment abroad.

2. Priority of telecommunications:

Other sectors such as agriculture, health, education and roads get a higher priority in national budgets than telecommunications due to the lack of understanding of the catalytic role of teledensity in development.

Wellenius (1989) argues that a major obstacle for LDCs to overcome is that of scarcity of foreign exchange which is very difficult to come across considering poor state of the LDCs' banking systems. The ITU World Telecommunication Development Report(1994a) examined the issue of scarcity foreign exchange and found that:

- Hard currency is limited due to high external debt and limited export earnings.
- Foreign exchange through the international accounting rate system tends to be transferred to the central bank instead of being directly used for telecommunications development.

Lack of re-investment is another major financial obstacle. Whereas rapid growth of teledensity was achieved in countries where at least 50 percent of telecommunications revenues were reinvested, the level of reinvestment is still low in many other LDCs. (ITU World Telecommunication Development Report, 1994a). Also, the same ITU report argues that LDCs experience the following major investment inefficiencies:

- In many LDCs, the cost of installing one telephone line is far beyond the widely used figure of around US \$1,500.
- Higher installation cost per line in rural areas hinders the extension of the network to those areas.
- Such promising low cost technologies as cellular radio and VSAT (Very Small Aperture Terminal) suitable for rural areas tend to be provided primarily to urban areas.

5.3 Technological Factors

In the World Telecommunication Development Report (1994a), the ITU reports that LDCs use outdated equipment that are also inadequately maintained resulting in poor quality of service and loss of revenues. The Maitland Commission (1984) also analyzed several technological obstacles against the growth of teledensity. The main obstacle found concerns imported equipment.

- The design of imported equipment is less suited to the environments and needs of LDCs.
- Manufacturers abroad have stopped producing old systems that are still widely used in LDCS, and as a result, LDCs are forced to replace their equipment.
- Various types of equipment installed over a number of years lead to difficulties in training, compatibility and maintenance.

Furthermore, Kirunda-Kivenjinja (1995) shows that maintenance of existing equipment leaves much to be desired. In some countries malfunctioning telephone equipment waits for months before a maintenance team arrives to the rescue. The maintenance process is slow

even after problems are identified unless the team gets 'benefits' (a spiced term used for bribery).

5.4 Managerial Factor

Regarding managerial constraints, Kyong (1995) suggests that experts in such fields as management consulting, legal issues on technology, finance and policy in relation to information and communications are in short supply. Moran (1994) stated that telecommunications administrations in LDCs are having difficulties making telephone service available to every one in the country, keeping abreast in digital technology and keeping up with an ever-changing environment. These problems come from the insufficient planning capabilities of the operator and the government. Kirunda-Kivenjinja (1995) pointed to obstacles such as inappropriate organizational and managerial ability, the loss of trained staff, the necessity to adapt training materials to advanced technologies, and the difficulty of keeping up with technology. He showed that there are organizational, managerial, human resources and technology related obstacles in LDCs. Lack of management plans for maintenance and low salaries open the way to corruption and perpetuate the sluggish maintenance processes. Other external factors such as weather, roads, and sewerage tunnel building make maintenance much more difficult. The latter is a menace to the reliability of telecommunication networks. Wellenius (1989) argued that the operating entities' lack of internal organization and management in LDCs is a major obstacles to growth of teledensity.

5.5 Organizational Factors

In the World Telecommunication Development Report, the ITU discussed the organizational factors that are obstacles to growth of teledensity (1994a).

- Because telephone services are provided by monopoly, government-run organizations in most LDCs, there are few incentives for better performance.
- It is difficult to retain qualified staff due to low salaries.

Saunders (1982) also points out some major organizational obstacles such as inadequate efforts by telecommunications entities to achieve a higher national priority for the telecommunications sector, and lack of understanding among planning and finance ministers of the significant importance of higher levels of teledensity.

5.6 Policy Factors

A major policy issue that posits as an obstacle to growth of teledensity is insufficient autonomy of the operating entity from government. Most LDC governments are still in full control of the telecommunications sector. (Wellenius, 1989). This hinders private investors from getting into the industry, thus preventing competition. The ITU World Telecommunication Development Report (1994a) also presents evidence that the private sector involvement has not yet been adopted by many LDCS. The same ITU report shows that many LDCs lack a universal access policy, which explains the many rural areas that do not have a single telephone line for whole villages (or counties in U.S. terms). (Mbarika, 1999).

One of the key trends in growth of teledensity during the past decade is the shift of control, i.e., deregulation, liberalization and privatization of telecommunications entities worldwide. The divestiture of AT&T in the United States and the privatization movement in the United

Kingdom in the early 1980s triggered this trend. Regardless of this prevailing trend and the notorious structural problems of government-operated telecommunications entities, many LDCs have not yet changed how they provide telecommunications services. Most of these reforms are opposed by the government departments providing telecommunication services in many LDCs. (Chowdary, 1992). Such resistance to change can be an organizational hindrance to telecommunications development in LDCs. In addition, Pisciotta (1994) found that significant resistance to reform comes from national security concerns. This is a political obstacle to reform.

The monopolistic and parochial culture of LDCs telecommunications operators is also reflected in the mounting tariff and awkward traffic situation in LDCs. The average telecommunications revenue per subscriber line in Europe is about US \$770 while the average in LDCs is roughly the double of that at US \$1,460 (Paltridge, 1997). Given the lower per capita income in LDCs the ratio of revenue in LDCs to that of Europe is extremely high. Restrictions for private investors to provide telecommunications services further raise the high cost of telecommunications services. Statistics show that data transmission in Europe costs two to three times that of the US due to more restrictions in Europe (Paltridge, 1997). In LDCs, where restrictions are even higher, the costs are also exorbitantly high. Institutions and/or individuals are charged a rate of four to eight times that of Europe and four to twenty times that of the United States for the same volume of calls. An unanswered question here is whether complete privatization will bring down these costs.

In some countries, the governments are the sole operator of telecommunications and ban the importation of telecommunications equipment. Consumers are denied the freedom to attach or own their preferred equipment for computing or communications to telephone networks. Telecommunications administrations in many LDCs lack basic knowledge of key global trends in the telecommunications sector. (Jensen, 1995). Saunders (1982) points to some policy issues such as telecommunications pricing and investment policy not analyzed together with national investment policies, and incorrect perception that rural public telephone service is unprofitable. (Saunders, 1982).

5.7 Political Factors

Governments in many LDCs have been dependent on the telecommunications sector's cash flow for use in other sectors. Furthermore, capital investment in teledensity has often been linked to the next available foreign aid package (Tabai, 1994). These problems are political obstacles to development of the teledensity. Parker (1992) identified another political obstacle. He pointed out that power holders in government tended to oppose development of teledensity fearing that the development might weaken their position. He argued that existing economic and political power holders needed to be persuaded that the growth of teledensity could be a "win-win" proposition.

5.8 Geographical Factors

Various geographical barriers to remote areas as well as lower monetary returns from those areas reduce the incentives to extend telecommunications services to those areas. (Maitland Commission, 1984). There is insufficient regional cooperation in that cooperation for regional links, pooled equipment purchases, shared training and technical specifications on equipment has rarely been fully developed (ITU, 1994a).

Hudson (1983) presented one geographical obstacle attributed to LDCs. She pointed out that international development institutions charged with assisting LDCs had not well understood the role of teledensity for LDCs. She argued that those institutions were inclined to regard telecommunications in general as an urban luxury and their loan requirements tended to ignore services in rural areas. A summary of the obstacles to growth of teledensity in LDCs is presented in table 2.

Table 2. Obstacles to growth of teledensity in LDCs

Factor	Summary	Reference
Economic	<ul style="list-style-type: none"> • low Gross Domestic Product • low Gross Domestic Product per capita • low telecommunications traffic over time, number of tourists per year, low volume of international trade, • insufficient financial autonomy of the operating entities 	<ul style="list-style-type: none"> • Saunders et al., (1983) • Mbarika (1999) • Yatrakis, (1992) • Saunders (1982)
Financial	<ul style="list-style-type: none"> • scarcity of foreign exchange • investment inefficiencies (lack of re-investment; high installation cost per line) 	<ul style="list-style-type: none"> • Wellenius (1989)
Technological	<ul style="list-style-type: none"> • outdated equipment • inadequate maintenance 	<ul style="list-style-type: none"> • ITU World Telecommunication Development Report (1998)
Managerial	<ul style="list-style-type: none"> • lack of internal organization and management • shortage of managerial consultants/ experts • inappropriate organizational and managerial ability and loss of trained staff 	<ul style="list-style-type: none"> • Wellenius (1989) • Kyong (1995) • Kirunda-Kivenjinja (1995)
Organizational	<ul style="list-style-type: none"> • insufficient management autonomy of the operating entities • telephone services are provided by monopoly, government-run organizations 	<ul style="list-style-type: none"> • Saunders (1982) • ITU World Telecommunication Development Report (1998)
Policy	<ul style="list-style-type: none"> • absence of universal access policy • inadequate private sector involvement • incorrect perception that rural public telephone service is unprofitable 	<ul style="list-style-type: none"> • ITU World Telecommunication Development Report (1998) • Saunders (1982)
Political	<ul style="list-style-type: none"> • the next available aid package • power holders in government tend to oppose development of teledensity fearing that the development would weaken their position • government resistance due to national security concerns 	<ul style="list-style-type: none"> • Tabai (1994) • Parker (1992), Chowdary, (1992) • Pisciotta (1994)
Geographical	<ul style="list-style-type: none"> • insufficient regional cooperation • international development institutions charged with assisting LDCs regard telecommunications in general as an urban luxury (their loan requirements tend to ignore services in rural areas). 	<ul style="list-style-type: none"> • ITU World Telecommunication Development Report (1998) • Hudson (1983)

6. Strategies to overcoming the obstacles

Equally important to an analysis of the obstacles to growth of teledensity is an analysis of strategies to overcome them. The discussion that follows will examine some fundamental strategies that LDCs must consider as the panacea for the obstacles to growth of teledensity. This discussion will also include three success stories of countries that have graduated from the LDC status, and the strategies they implemented. Table 3 summarizes some of the strategies to overcoming the obstacles.

Table 3. Summary of strategies to overcoming the obstacles

Obstacle	Strategy to overcome obstacle	Reference
Government regulations	<ul style="list-style-type: none"> • privatization of the government operator • establishment of an independent regulatory body 	<ul style="list-style-type: none"> • Ras-Work (1995); Kiula (1994) • Sekizawa (1995)
Technological	<ul style="list-style-type: none"> • establish wireless access networks • avoid use of obsolete technologies • promote local manufacturing 	<ul style="list-style-type: none"> • Harrington (1995); Cutler (1994) • Kiula (1994) • Olanrewaju (1995)
Managerial	<ul style="list-style-type: none"> • restructuring of the telecommunications sector • reform should proceed with a clear vision of national economic development 	<ul style="list-style-type: none"> • Harrington (1995); • Ure (1993)
Financial	<ul style="list-style-type: none"> • attract capital by restructuring of the telecommunications sector. • creation of a private domestic telecommunication financing institution. • increase size of the national budget by helping local industries to expand their turnover and employment. 	<ul style="list-style-type: none"> • Harrington (1995) • ITU World Telecommunication Development Report (1994) • ITU World Telecommunication Development Report (1994)
Absence of universal access policy	<ul style="list-style-type: none"> • establish pay phone services in every village. 	<ul style="list-style-type: none"> • ITU World Telecommunication Development Report (1998)

Much research has been carried out to study the “current status” or the “recent progresses” of the telecommunications sector in general and of teledensity in particular for selected LDCs.

Hukill and Jussawalla (1991) examined the current condition of teledensity growth in ASEAN (Association of Southeast Asian Nations) countries. Jussawalla (1992) surveyed the progress of teledensity growth over the past decade in a number of countries in Asia, the Pacific, Latin America, Arab and Africa. Ogden (1995) examined some of the global teledensity trends in the context of Pacific Island developing countries. Ure (1995a, 1995b) researched recent telecommunications development in such Asian countries as Brunei, Burma, Cambodia, China, Hong Kong, Indonesia, Laos, Malaysia, the Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam.

The ITU suggested some strategies LDCs can use to attract funding for growth of teledensity (ITU, 1994):

- Creation of a private domestic telecommunication financing institution to mobilize funds from local institutional investors such as pension funds, insurance firms, banks, etc. The institution will be guaranteed an interest rate on their finances. When the time is ripe for private equity participation, the loan can be converted to equity (preference, shares).
- Increase size of the national budget by helping local industries to expand their turnover and employment. An initial step may be to invite foreign investments, then to localize their production by technology transfer.

Regarding policy and regulation related strategies, Ras-Work (1995) advocated the BOT (Build Operate Transfer) scheme as an alternative to privatization of the government operator in LDCs. Kelly (1995) regarded the new licensing policy for cellular operators and international gateways in the Philippines as the primary factor that brought the dramatic increase of main lines in 1993 (p. 4). Gatica (1994) attributed the growth of teledensity in Chile to a new legal framework adopted by the government (p. 35). In order to promote investment from the private sector and alleviate risks born by private operators, Sekizawa (1995) suggested policies such as the establishment of an independent regulatory body, securing fair interconnection among operators and securing a minimum return for private operators. In Tanzania, Kiula (1994) suggested that sector restructuring and commercialization should first be implemented and privatization should be introduced where feasible.

Regarding the reform of policy and regulation, Harrington (1995) surveyed a number of telecommunications reforms taking place in the Asia Pacific region and argued that the restructuring of the telecommunications sector in LDCs should be a way to attract capital to promote the growth of teledensity. While admitting the importance of restructuring the telecommunications sector, Ure added that reform should proceed with a clear vision of national economic development (1993, P. 5).

As to technology related strategies, Harrington (1995) discussed the advantages of a wireless access network. Cutler (1994) also advocated the use of wireless technologies in the local loop (p. 6). Kiula (1994) warned that LDCs should avoid use of obsolete technologies and non-standardized equipment from DCs. Regarding local manufacturing, Olanrewaju (1995) argued that local manufacturing capability would ensure rapid development of telecommunications services in LDCs.

Some of these strategies and more have been implemented by some LDCs leading to a tremendous growth of their teledensity. The next section points to two success stories.

6.1 Two success stories: Botswana and The Gambia

It has not been all-bad for LDCs. There have been several success stories of countries that have graduated from the LDC status. The ITU World Telecommunication Development Report (1998) used the case of Botswana and The Gambia that “graduated” from the list of Least Developed Countries.

The case of Botswana is in line with the fact that its telecommunications infrastructure is one of the most modern and extensive in Africa. Ogden (1995). The same ITU report earlier mentioned shows that some 43,500 subscriber lines are in operation and all are connected to digital exchanges. That gives a teledensity of 3.1 lines per 100 population which is the third highest in sub-Saharan Africa. The network has grown at a rate of 20 percent per year since 1987. The national operator, Botswana Telecommunications Corporation (BTC), completed a fiber optic backbone network in 1994. This links the main cities and is intended to supplement the existing microwave inter- exchange network. The focus of investment is now shifting to customer networks, particularly in rural areas. Investment in new technology has enabled the BTC to offer packet- switching services since June 1992 and radio-paging since May 1992. A mobile cellular service is under development.

Clearly Botswana is not representative of LDCs as a whole. Its economy is based on diamonds and other natural resources, and it has a growing income from tourism. It also has a small population, 1.4 million, spread over a very wide area. Nevertheless, there are certain steps that Botswana has taken since independence which could be emulated by the LDCs. These steps include:

Government regulations

- Separation of the Public Telecommunication Operator (PTO) from the State. Even though BTC is government-owned, it was formally separated from the state in 1980 and is managed by the British-based company, Cable & Wireless.

Technological and Managerial

- BTC maintains a high quality of service with some 80 percent of all faults repaired by the next working day. It recently launched a Total Quality Management strategy and has been sampling customer satisfaction levels on a monthly basis.

Universal policy

- While concentrating initially on providing services to the business community, BTC is now widening its reach. For the first time in 1992, more than 50 percent of all lines served residential subscribers and the number of payphones installed grew by 10 percent. BTC has publicly announced a policy of providing at least one pay phone in every village of the country with more than a population of 500.

The case of The Gambia (“small can be beautiful”) is also a major success story. The Gambia is one of the smallest countries in Africa, a narrow return strip of land astride the River Gambia covering some 11,300 square kilometers and with a population or less than one million. It is also one of the most developed nations in Africa from a telecommunications perspective and it stands among the top five fastest growing telecommunication economics over the last decade.

Government regulations and financial

The Gambia Telecommunications Company (GAMTEL) has a somewhat unusual structure in that it is owned by the Ministry of Finance and Economic Affairs (99 percent) and by the Gambia National Insurance Company Ltd. (1 percent). One of the reasons for its success is that the process of "corporatization," or separation of the operator from the state, took place relatively early. In March 1984, GAMTEL was established as a private limited company under the Companies Act. As such, it has found it easier than other telecommunications operators in Africa to attract funds for investment.

Technological

As well as upgrading its basic telephone network through the installation of fiber optic links in the inter-exchange network, GAMTEL has also introduced new telecommunication services, often setting the pace among other African nations in this regard. Its mobile cellular service (GAMCEL) had a subscriber base of 450 at the end of March 1994. During the year, a packet-switching service was introduced to complement the leased line service already offered to customers.

7. Conclusion and implications for further research

This study has explored academic and organizational literature to examine those factors that promote or hinder growth of teledensity in LDCs. This study shows that various policy, economic, financial, managerial, organizational, technological, political and geographical factors are important determinants for growth of teledensity in LDCs (Figure 1). This is a step further than the Bernt and Weiss (1993) general framework for determinants for growth in teledensity that had four factors: regulatory, economic, organizational, and technical.

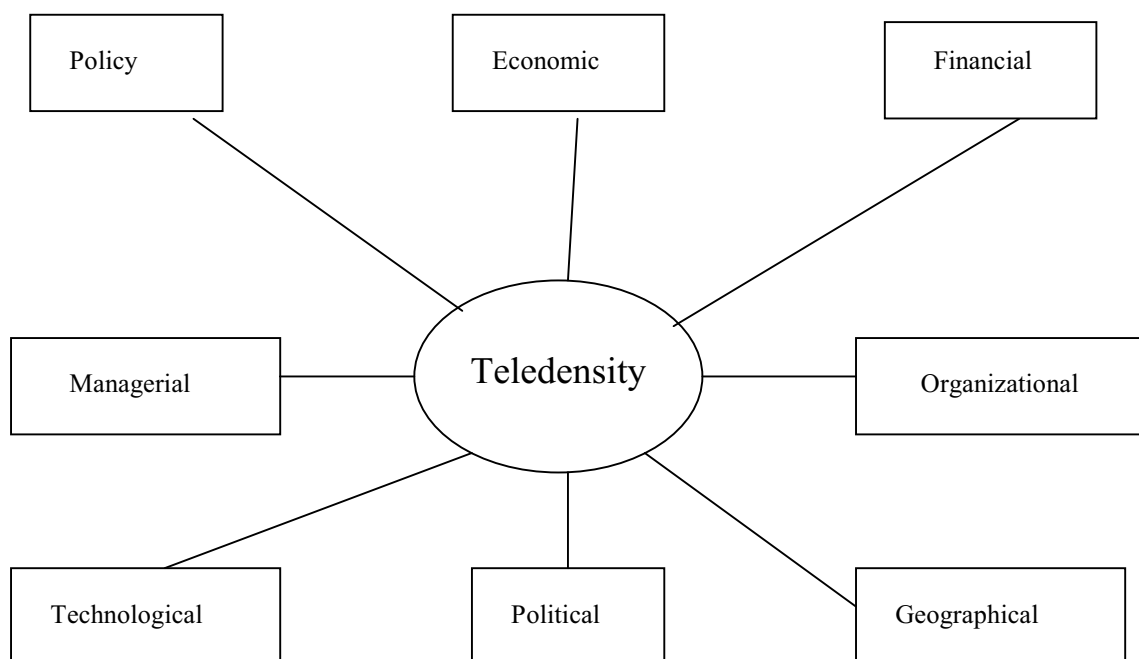


Figure 1. Factors that influence growth of teledensity in LDCs.

Therefore, a major contribution of the study is the extension of our knowledge in four important areas:

- the importance of high levels of teledensity for LDCs.

- the nature of the underdevelopment of teledensity in LDCs.
- the obstacles that have slowed the expected advancement of teledensity development.
- possible future strategies that may be effective in overcoming the obstacles.

Considering the obstacles to growth of teledensity for LDCs, another major contribution of this study is linking the obstacles to growth of teledensity in LDCs with specific strategies to overcome these obstacles. Past literature have established several individual factors that are obstacles to growth of teledensity. However the link between obstacles and strategies was never explicitly examined in those studies. Those studies proposed strategies without clarifying the targeted obstacles. Further research is therefore needed in this area.

Much of the research on factors that influence growth of teledensity globally have been qualitative. The factors identified in this study can be used to develop a set of hypotheses that can be empirically tested so as to make the findings more generalizable.

Research on the diffusion of mobile telecommunications infrastructure is needed. This is especially important when we consider the difficulty and labor intensity to dig trenches in order to establish new physical telephone circuits. Such research could hopefully be an answer to the issue of universal service that will benefit both urban and rural areas since an important characteristic of mobile communications is that it has minimal geographical limitations as compared to the traditional plain old telephone systems (POTS).

Furthermore, from a theoretical point of view, this study can be expanded to focus on those countries at a similar stage of telecommunications infrastructure and service development. Toffler (1990) identifies three distinct groupings among LDCs according to their economic development. Similarly, Jamison (1991) claims that in many domains of modern intellectual life, implicit assumptions of uniformity or homogeneity have been discredited and largely abandoned. The discovery of an unexpected degree of variability in systems being studied has led to a revision of theory and practice in fields. Thus, a study that will not see LDCs as one coherent group of countries in the world but take into account their heterogeneity will be necessary to diagnose their unique problems and prescribe the most appropriate solutions.

For instance, a study can be carried out specifically for LDCs in Africa. Such a study can explore the factors that influence growth of teledensity in African LDCs. Such a study could enrich awareness of the state of teledensity in specific African LDCs and highlight some of the particular complexities the countries on the continent face in the challenge to expand their levels of teledensity. Also, this could serve as a basis to establish specific strategies to promote growth of teledensity in the region.

To conclude, the findings in this study can be used to provide prescriptive directions to the policy makers of LDCs and development agencies who are in charge of improving the teledensity of the countries. These policy makers and development agencies can look at some the strategies mentioned above as well as examples of countries that have used similar strategies to improve on their levels of teledensity. We believe this can be done considering that certain LDCs, both large and small in size, have been able to establish high quality telecommunication services at least as good as some developed countries in spite of low levels or GDP per capita. This demonstrates that with a well-managed telecommunication organization, even the poorest country can have an efficient telecommunication network and services and hence, high levels of teledensity.

References

- Adedeji, A. *Towards a Dynamic African Economy*, 1986, London: Vikas.
- Austin, J.E. *Managing in Developing Countries: Strategic Analysis and Operating Techniques*, 1990, NY, New York: The Free Press.
- Baeza-Yates, R., Piquer, J. M., and Poblete, P. "The African Internet Connection," *Proceedings of International Networking Conference (INET93)*, 1993.
- Bernt, P. and Weiss, M. *International telecommunications*, 1993, Carmel, Indiana: Sams.
- Berry, J. F. "The case of France and Spain," Case study No.1 referred to in the Synthesis Report on the ITU-OECD project: Telecommunications For Development, 1983.
- Brillson, P. V., and Daffner, G. "Telecommunications development in a converging world: An examination of Infrastructure and Regulatory Strategies in the Asia Pacific region," In R. Nickelson & D. J. Wedemeyer (Eds.), *Proceedings of PTC'95*, 1995, Honolulu: Pacific Telecommunications Council, pp. 551-556.
- Carroll, T. O. *The adoption of Telecommunications Infrastructures in the energy sector in developing countries*, in Munasinghe, M., Dow, M. and Fritz, J. (Eds), *Microcomputers for Development*, National Academy of Sciences, Washington, DC, 1985.
- Central Intelligence Agency *The World Fact Book 1995*, Central Intelligence Agency, Washington, D. C. <http://www.odci.gov/cia/publications/95fact/ec.html>, 1995
- Chowdary, T. H. "Telecommunications Restructuring in Developing Countries," *Telecommunications Policy* (16), 1992, pp. 591-602.
- Clarke, D. G., and Laufenberg, W. "The Role Of Telecommunications in Economic Development: With special reference to rural sub-Sahara Africa," Case study No.4 referred to in the Synthesis Report on the ITU-OECD Project "Telecommunications for Development," 1983.
- Cronin, F. J., Parker, E. B., Colleran, E. K., and Gold, M. A. "Telecommunications Infrastructure and Economic Growth: An analysis of causality," *Telecommunications Policy* (15), 1991, pp. 529-535.
- Cronin, F. J., Colleran, E. K., Herber, P. L., and Lewitzky S. "Telecommunications And Growth: The Contribution of Telecommunications Infrastructure Investment to Aggregate and Sectoral Productivity," *Telecommunications Policy* (17), 1993, pp. 677-690.
- Cutler, T. "Contemporary Telecommunications Issues in the Pacific," *Pacific Telecommunications Review* (16:2), 1994, pp. 3-8.
- Dholakia, R. R., and Harlam, B. "Telecommunications and Economic Development: Econometric Analysis of the US Experience," *Telecommunications Policy*, pp. 470-477.
- Eagan, B. L. "Building Value Through Telecommunications: Regulatory Roadblocks on the Information Superhighway," *Journal of Telecommunications Policy* (18:8), 1994, pp. 573-87.

Gatica L. "Liberalization and Tariff Legislation in Chile," *IME Communications Magazine* (32:11), 1994, pp. 34-35.

Gille, L. "Growth and Telecommunications," *In Information, Telecommunications and Development* 1986, pp. 25-61, Geneva: ITU.

Hamelink, C. J. "Information imbalance across the globe," In J. Downing, A. Mohammadi & A. Sreberny-Mohammadi (Eds.), *Questioning the media*, Thousand Oaks, 1995, pp. 293-310, CA: SAGE.

Hardy, A. P. *The Role of the Telephone in Economic Development Telecommunications Policy* (4), 1980, pp. 278-286.

Harrington, A. "Companies and Capital in Asia-Pacific Telecommunications," In J. Ure (Ed.), *Telecommunications in Asia*, 1995, pp. 81-110, Hong Kong: Hong Kong University Press.

Hudson, H. E. "The Role of Telecommunications in Development: A Synthesis of Current Research," In O. H. Gandy, P. Espinosa, & J. Ordover (Eds.), *Proceedings of The Tenth Annual Telecommunications Policy Research Conference*, 1983, pp. 291-307, Norwood, NJ: Ablex.

Hudson, H. E.. *When Telephones Reach The Village: The Role Of Telecommunications In Rural Development*, 1984, Norwood, NJ: Ablex.

Hudson, H. E. "Overcoming the barriers of distance: Telecommunications and Rural Development," *IEEE Technology and Social Magazine* (8:4), 1989, pp. 7-10.

Hukll, M. A., and Jussawalla. M. *Trends in Policies for Telecommunication Infrastructure Development and Investment in the ASEAN Countries*, 1991, Honolulu: East- West Center, Institute of Culture and Communication.

Ikenberry. J. G. "The International Spread of Privatization Policies: Inducements, Learning, and 'Policy Bandwagoning'," In E. N. Suleiman & J. Waterbury (Eds.), *The Political Economy of Public Sector Reform and Privatization*, 1990, pp. 88-110. Boulder, CO: Westview Press.

Independent Commission for World Wide Telecommunications Development (The Maitland Commission). *The missing link*, 1984, Geneva: ITU.

International Telecommunication Union (ITU), *World Telecommunication Development Report: 1994*, Geneva: ITU.

International Telecommunication Union (ITU), *World Telecommunication Development Report: 1995*, Geneva: ITU.

International Telecommunication Union (ITU). *World Telecommunication Development Report: 1998*, Geneva: ITU.

Jamison, N. L. "Communication and the New Paradigm for Development," In F. L. Casmir (Ed.), *Communication in Development*, 1991, pp. 27-50. Norwood, New Jersey: Albex.

Jensen, M. "Telematics in a Global Context," Discussion Paper, Africa Regional Symposium on Telematics for Development, Addis Ababa, 1995

Jussawalla, M. "The Information Economy and its Importance for Development of Pacific Region Countries," In *Information, Telecommunications and Development*, 1986, pp. 63- 86, Geneva: ITU.

Jussawalla, M. "Information Economies and the Development of Pacific Countries," In M. Jussawalla, D. M. Lamberton, & N. D. Karunaratne (Eds.), *The Cost of Thinking: Information Economies of Ten Pacific Countries*, 1988, pp. 15-43, Norwood, NJ: Ablex.

Jussawalla, M. "Is the Communications Link Still Missing?" *Telecommunications Policy* (16), 1992, pp. 485-503.

Jussawalla, M. "Bringing Telecoms to the Market and to Market to Telecoms," In Closing the telecommunications development gap: A study paper prepared in advance of ITU World Telecommunications Development Conference, 1994, London: International Institute of Communications.

Jussawalla, M., and Ogden. O. R. "The Pacific Islands: Policy Options for Telecommunications Investment," *Telecommunications Policy* (13), 1989, pp. 40-50.

Kelly, T. "If The Telecommunications Industry is so Successful Why Can't the Waiting List for Telephone Service be Reduced?" *Telecom 95*, 7th World Telecommunication Forum, Strategies Summit Speakers' Papers: Vol. 1, Breaking down barriers towards the global information society (Session 13-10), 1995, Geneva: ITU.

Kerlinger, Fred. N. *Foundations of Behavioral Research (3rd ed.)*, 1986, Fort Worth: Harcourt Brace Jovanovich College Publishers.

Kim. C., Kim, Y. K., and Yoon, C. "Korean Telecommunications Development: Achievements and Cautionary Lessons," *World Development* (20), 1992, pp. 1829-1841.

Kirunda-Kivenjinja, A. "Telecom Risks, Telecom Futures," *Telecom 95*, 7th World Telecommunication Forum, Strategies Summit Speakers' Papers: Vol. 1, Breaking Down Barriers Towards the Global Information Society (Session 16-2), 1995, Geneva: ITU.

Knight, P. "The World Bank vision and strategy on connectivity in Africa," *African Regional Symposium on Telematics for Development*, Addis Ababa, 1995

Kiula. N. "Telecommunications Development in Tanzania," *IEEE Communications Magazine* (32:11), 1994, pp. 36-37.

Kuo, E. C. Y. "Informatization Among Asian NIEs: A Comparative Study," In A. Goonasekera & D. Holaday (Eds.), *Asian Communication Handbook*, 1993, pp. 319-332, Singapore: Asian Mass Communication Research and Information Center.

Kyong, S. H. "Resourcing for Growth: Capital Formation, Human Resources," Telecom 95. 7th World Telecommunication Forum, Strategies Summit Speakers' Papers, Vol. 1, Breaking Down Barriers Towards the Global Information Society (Session 15-3), 1995, Geneva: ITU.

Levine, B. "The dream of e-commerce: Reality in 1999?" *Electronic News* (45:51), 1999, p. 52.

Mbarika, V. "Factors that Affect Growth of Teledensity in Least Developed Countries," *Proceedings of the 22nd Conference on Information Systems Research in the Scandinavia (IRIS 22)*, Jyväskylä, Finland, 1999, pp. 383-396.

McClelland, P. *Causal Explanation and Model Building in History, Economics, and the New Economic History*, 1998, Ithica: Cornell University Press.

Minges. "Towards an African Information Infrastructure," *African Regional Symposium on Telematics for Development*, Addis Ababa, 1995

Montealegre, R. "Implications of Electronic Commerce for Managers in Less-Developed Countries," *Information Technology for Development* (7:3), 1996, pp. 145-52.

Moran, W. M. "Telecommunications In Transition," *IEEE Communications Magazine* (32:11), 1994, pp. 26.

Ogbe, O. "Introductory Remarks, Africa Telecom '90, ITU, Harare, ITU," *Proceedings of Africa Telecom '90*, 1990, Geneva: ITU.

Ogden, M. R. "Widening the Chasm or Closing the Gap?: Converging Information & Pacific Island Microstates," In R. Nickelson & D. J. Wedemeyer (Eds.), *Proceedings of PTC '95*, 1995, pp. 592-599, Honolulu: Pacific Telecommunications Council.

Olanrewaju, A. T. "Investment Needs: Resourcing for Growth -Capital Formation, Human Resources," *Telcom95, 7th World Telecommunication Forum. Strategies Summit Speakers' Papers: Vol. 1, Breaking down barriers toward, the Global Information Society (Session 14-2)*, 1995, Geneva: ITU.

Paltridge, S. "A survey of tariff structures in Africa - comparison to the rest of the world," *Africa Telecom '94*, Cairo, 1994.

Parker, E. B. "Developing Third World Telecommunications Markets," *The Information Society* (8), 1992, pp. 147-167.

Peirce, W. B., and Je'quier, N. *Telecommunications for Development*, 1983, Geneva: ITU.

Pisciotta, A. A. "Telecommunications Reforms: Options, Models, and Global Challenges," *IEEE Communications Magazine* (32:11), 1994, pp. 28-31.

Ras-Work. T. "Are there Alternatives to Privatization?" Telecom 95, 7th World Telecommunication Forum, Strategies Summit Speakers' Papers Vol. 1, Breaking Down Barriers Towards the Global Information Society (Session 12-6), 1995, Geneva: ITU.

Rorissa, A. "The impact of introduction of electronic communication in Ethiopia: A survey," Ethiopian Scientific Society Conference, 1996.

Saunders, R. J. "Telecommunications in Developing Countries: Constraints on Development," In M. Jussawall & D.M. Lambertson (Eds.), *Communication Economics and Development*, 1982, pp. 190-210. Honolulu: The East-West Center.

Saunders, R. J., Warford, J., and Wellinius, R. *Telecommunications and Economic Development*, 1983, Washington D.C.: The World Bank.

Saunders, R. J., Warfbrd, J. I., and Welienius, B. *Telecommunications and economic development (2rd ed.)*, 1994, Baltimore, MD: John Hopkins University Press.

Sekizawa. T. "Critical Formation for Building Telecomm Infrastructure in Developing Countries: Utilization of Private Funds and Mission Of Suppliers," Telecomm 95, 7th World Telecommunication Forum, Strategies Summit Speakers' Papers Vol. 1._Breaking down barriers toward, the Global Information Society (Session 13-6), 1995, Geneva: ITU.

Tabai, L T. "Telecommunications in the Pacific," PTC' 94 Plenary Presentations, 1994, pp. 41-43, Honolulu: Pacific Telecommunications Council.

Toffler. A. *Power Shift*, 1990, New York: Bantam Books.

United Nations *International Comparisons of Inter-industry Data*, 1969, New York: United Nations.

Ure, J. "Corporatization and Privatization of Telecommunications in ASEAN Countries," *Pacific Telecommunications Review* (15:1), 1993, pp. 3-13.

Ure, J. "Telecommunications in China and the Four Dragons," In J. Ure (Ed.), *Telecommunications in Asia*, 1995a, pp. 11-48. Hong Kong: Hong Kong University Press.

Ure, J. "Telecommunications in ASEAN and Indochina," In J. Ure (Ed.). *Telecommunications in Asia*, 1995b, pp. 49-80. Hong Kong: Hong Kong University Press.

Wellenius, B. "The Impact of Modern Telecommunications," *IEEE Technology and Social Magazine* (8:4), 1989, pp. 3-6.

World Telecom Visual Data, 1995, Tokyo: New Nippon ITU Association.

Yatrakis, G. "Determinants of the Demand for International Telecommunications," *Telecommunications Journal* (39:12), 1992, pp. 732-746.