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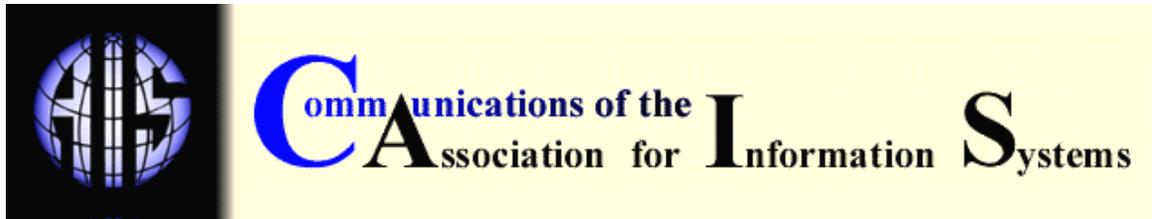
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GLOBAL DIFFUSION OF THE INTERNET VI: THE INTERNET IN TOGO

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ABSTRACT

The Global Diffusion of the Internet (GDI) framework is used to examine Internet diffusion in Togo along six dimensions: Pervasiveness, Geographical Dispersion, Sectoral Absorption, Connectivity Infrastructure, Organizational Infrastructure, and Sophistication of Use. The Internet in Togo originated in the private sector in 1996. In the years that followed, the Togolese Internet grew at a slower rate than the Internet in many other countries over the same period of time. After examining how each dimension evolved, this study concludes, amongst many suggestions, that the Togolese government should encourage more telecommunication infrastructure development by allowing private companies to utilize Togo Telecom's network.

Keywords: Internet diffusion, Togo, ISP, Togo Telecom, GDI framework, Mosaic

I. INTRODUCTION

As the Internet becomes more commonplace around the world, the Internet is supporting a greater breadth and depth of economic and non-economic activity. Togo is attempting to enhance its role in the expanding network of the Internet and is only having limited success. Studying the Internet in Togo and the reasons its diffusion has been impeded deepens our understanding of Internet diffusion in other countries. Distinctive features of the Internet in Togo include the government's initial inability to recognize the value of the Internet, the actions of the national telecommunications carrier to limit competition, and the country's overall lack of resources to make major improvements in multiple sectors of its society. Additionally, a historical analysis of the development of the Internet in Togo identifies obstacles other countries in the region may face.

This study uses the framework for analysis described in Wolcott et al. (2001) and summarized in Appendix A. Internet diffusion has been analyzed in over 40 countries using this framework. The authors applied this methodology to collect data from interviews with business representatives in the Internet services industry. Additional data was collected from the World Wide Web. All information contained in this study is current as of Summer 2004.

After providing background information about Togo and a history of the Internet in the nation, this paper assesses Internet diffusion in Togo using a longitudinal analysis along six dimensions. Examining a series of determinants, this study identifies issues that account for the pattern of diffusion taking place. These determinants have proven useful in other national studies for understanding the factors that contributed to the state of the Internet in a particular country. The conclusion offers suggestions for how the Togolese government can promote the evolution of the Internet in Togo.

II. BACKGROUND

Located in West Africa and bordering the Gulf of Guinea, the Republic of Togo, known as Togoland during its colonial period, is a strip of land 57,000 km² in size. Beginning in the 1600s this area was raided for slaves by the Ashanti Empire from what is now Ghana. The Ashanti sold the slaves to European traders on the coast. In the late 1800s, most of Togoland came under German control through a series of treaties and military expansions. The Germans built roads, railroads, and a port at the city of Lome to create an infrastructure that supported Togoland's agriculture industry. One of the first Allied victories of World War I was the capture of Togoland by British and French forces. The League of Nations then divided Togoland into an eastern region under French protection and a western region under British protection. The western portion of Togoland is now part of Ghana and the eastern portion constitutes the Republic of Togo.

At the time of its independence from France in 1960, Togo was a stable area enjoying economic prosperity. Lome, the country's largest city, became the nation's capital. The country adopted a presidential form of government in 1961.

When the country's first President was assassinated, Togo came under military rule. It experienced several coups since then. President, Lt. Col. Gnassingbe Eyadema, served as Togo's head of state from 1967 to early 2005, approximately three quarters of the country's short history. The length of time Eyadema was in public office gave him the distinction of being one of the world's longest continuously serving heads of state. Following his death, the military tried to install his son as President but a popular revolt replaced him with Abass Bonfoh¹

A brief statistical overview of Togo is shown in Table 1.

ECONOMY

In the early 1970s, Togo's government initiated an elaborate agenda to build up infrastructure while industrializing the work force of the nation through state enterprises. Initially funded by the increased revenue from phosphate exports and a world market commodity boom, the initiative lost financial backing when the commodity boom ended in the late 1970s. Consequently, Togo sought aid through International Monetary Fund (IMF) and World Bank loans. As part of the stipulations of the loans, the country implemented changes in its governmental structure by eliminating state monopolies, reducing the complexity of tax codes, shrinking the number of public employees, and privatizing major state enterprises.

¹ For a brief history of Togo with a discussion of the political upheaval in early 2005, see http://news.bbc.co.uk/1/hi/world/africa/country_profiles/1064470.stm

Table 1. Togo Statistics

Population	5.55 million (July 2004 estimate)
Population growth rate	2.27% (2004 estimate)
GDP	\$8.2 billion (2003 estimate)
GDP per Capita	\$1,500 (2003 estimate)
Inflation rate	1% (2003 estimate)
Telephones (main lines in use)	60,600 (2003)
Telephones (mobile cellular)	220,000 (2003)
Teledensity	1.09 main telephone lines per 100 inhabitants (2003 estimate)
Literacy Rate	60.9% of those age 15 and over can read and write (2003 estimate)
Infant Mortality	67.66 deaths per 1,000 live births

Source: World Fact Book, 2004



Source: World Fact Book, 2004

Figure 1. Map of Togo

The changes in governmental structure came to a halt in 1990 when a portion of the Togolese population and the World Bank forced a democratic governmental system to be implemented. A struggle ensued for several years between the old governmental system of dictatorship and the

new one. In 1994, the old governmental system was put back into place. This political instability caused a financial crisis in Togo. The country utilized the IMF to help restore macroeconomic stability and financial security. Today, Togo is still attempting to implement reforms with the advice of outside organizations [World Fact Book, 2003].

Presently, over 60% of Togo's workforce is involved in agriculture. Cocoa, coffee, and cotton are the major exports while industrial equipment and petroleum products are major imports. The country achieved self-sufficiency in crops such as corn, yams, and millet. Though economic reforms continue to move slowly, Togo is trying to increase its gross domestic product through privatization, opening government financial operations, and attracting support from foreign donors [Encyclopedia.com, 2003].

GEOGRAPHY AND DEMOGRAPHICS

Togo's 56 kilometers of coastline are on the Atlantic Ocean on the Bight of Benin. The terrain consists of savannas in the north, hills in the central region, plateaus in the south, and low lying areas with marshes along the coast. The terrain creates a climate that varies from tropical along the coast to temperate in the savanna areas [World Fact Book, 2003].

Ninety-nine per cent of Togo's five and a half million people belong to a tribe. Of the thirty seven indigenous tribes, the Ewe is the largest. Half of the population follows local beliefs while the other half is somewhat evenly divided between Christian and Muslim. Although Ewe and Mina are widely spoken languages in the southern regions of Togo, French is the official language as the country is a member of the Franc Zone. The most common languages found in the north are Kabye and Dagomba. The population is 61% literate, meaning they can read and write by the age of fifteen in a language [World Fact Book, 2003].

NETWORKS IN TOGO

The Origin of the Togolese Internet

In 1992, the members of the French Institute for Scientific Research for Development and Cooperation, known as ORSTOM, created a limited network in Togo using Unix-to-Unix Copy (UUCP). The network improved research communication with other countries, but the Internet was not available to the general public until late 1995. The Centre d'Assistance de Formation et d'Etudes (C.A.F.E., commonly rendered as 'Café') Informatique organized a conference in Togo in 1995 for key actors in the telecommunications industry from government and interested private parties. The World Bank, which already provided money to Togo's government, desired an open market in the telecommunications sector before it would provide more money for rebuilding the economy. The World Bank wished to see private companies offer services that used the Internet and the Global System for Mobile Communication (GSM) networks [Yawo, 2003]. World Bank pressure led to the creation of a national telecommunications carrier (Togo Telecom), a national regulatory authority for telecommunications, and new cybercafe services. Café Informatique became the front-runner for these cybercafes.

Café Informatique.

Café Informatique was founded in 1987 by Togolese entrepreneurs and initially operated as a computer school. The company learned about the potential of the Internet and expressed an interest to the government in bringing the Internet to Togo. The 1995 telecommunications conference provided the conduit for discussions to take place between the Togolese Postal Administration and Telecommunication Office (part of which is now Togo Telecom) and the privately owned Café Informatique. However, when negotiations to give Café Informatique control over part of Togo Telecom's land lines failed, the company pursued negotiations with Dr. Nii Quaynor of Network Computer Systems (NCS) in neighboring Ghana. In 1996, the negotiations resulted in the establishment of a land line connection with speeds less than 9600 Kbps between NCS and Café Informatique [Hountomey, 2003]. At that time, NCS's international

dialup to the global internet produced unstable and unreliable connections for Café Informatique's Internet users. To remedy the problem, Togo's Regulatory Authority of the Postal and Telecommunications Sectors granted Café Informatique the first VSAT license in Togo for data communication [ART&P, 2004]. The VSAT license allowed Café Informatique to obtain a reliable international connection to the Internet.

In the mid 1990's, Togo's government lacked interest in pursuing the necessary resources to support the Internet in the country. At the same time, laws in Togo regarding VSAT licenses were not restrictive. Thus, in spite of Togo Telecom's strong objections, Café Informatique persuaded the government to give the company a VSAT license. However, following the granting of the VSAT license to Café Informatique, Togo Telecom convinced the government to reject all further applications for commercial use VSAT licenses. Café Informatique immediately applied for IP addresses from the European Network Internet Provider [RIPE, 2004].

The company's primary use of the Internet was for UUCP-based e-mail services. Café Informatique's equipment consisted of two 100 Mhz Pentium servers running Linux Slackware, one ftp server, a CISCO 2511 for a dialup server, one MultiTech modem for remote UUCP, and three USRobotics modems for remote PPP [Hountomey, 2003]. A company in Montreal, Canada helped run this service.

In 1997, the Togolese government granted permission to Café Informatique to operate as a private Internet Service Provider and authorized a satellite connection. After obtaining IP addresses, Café Informatique installed an antennae from Netsat for satellite communication and began offering service. Because Café Informatique was the first Togolese company to market the Internet, the firm manages and owns the ".tg" domain, the suffix that identifies Togo on the Internet. The state did attempt to acquire ownership of the domain but failed during the bidding for it [Louassi and Robins, 2002, p. 143].

The country's first continuous connectivity to the Internet was through UUNet using Panamsat. UUNet is one of the major ISPs in Southern Africa, providing Internet Protocol (IP) Internet access since 1993. Café Informatique began offering IP service to the public in 1997 with speeds of 128 Kbps down and 64 Kbps up [Hountomey, 2003].

In 1998, Café Informatique began selling leased lines to its customers. In late 1999, the company switched satellite services from Panamsat to InterPacket when Panamsat was unable to expand bandwidth to 512 Kbps down. Café Informatique served over 500 Internet accounts including store-and-forward networks. In 2000, Café Informatique expanded its bandwidth to 1 Mbps while keeping its connection through UUNet with InterPacket. One year later, Café Informatique received the second Voice Over IP (VOIP) license given out by the Togolese government. (The first VOIP license was never used.) The license permitted Café Informatique to offer telephone services using the IP network. After receiving the VOIP license, the company switched from the InterPacket satellite service to the Pacamtel service.

At the time of this writing, in 2004, Café Informatique is the only privately owned ISP with direct international Internet access. With its satellite service from Intelsat at speeds of 1.5 Mbps down and 780 Kbps up, Café Informatique offers wireless Internet service and approximately 60 dial-up lines. Many of the employees of Café Informatique are graduates from the University of Benin (Lome campus). The company charges US\$ 60 a year to maintain a .tg domain name. Registering Togo websites with the country's top level domain name is not common practice--only 59 registered .tg names were in use in July 2003 [Yawo, 2003].

Café Informatique Topology. As a result of unsuccessful negotiations with Togo Telecom, Café Informatique does not utilize a nationwide backbone. The company's network is based primarily on wireless connections, dial-up users, and locally leased land lines. In early 2000, Café Informatique's international connection through UUNet allowed the company to provide point-to-multipoint wireless access to the Internet at speeds of 1.2 Mbps. The customer base consisted of one educational and research facility, two cybercafes, and five private business subscribers. By

2001, the customer base expanded to several more cybercafes and approximately five more private business subscribers [Topology of the Internet in Togo, 2003].

Togo Telecom. In 1996, fulfilling the World Bank's wishes, the Togolese Postal Administration and Telecommunication Office (OPTT) became two separate departments, Togo Telecom for the telecommunications sector and the Togolese Postal Society (SPT) for the postal service. Togo Telecom manages the nation's telephone wires, telex, dedicated lines, and parcel data transmissions [Louassi and Robins, 2002]. In 1998, Togo Telecom became Togo's second full service ISP with a 256 Kbps international link via Sprint and a 128 Kbps link via Alternet². The Alternet link was installed with the intention of selling the bandwidth to future private ISPs. When Togo Telecom went live, it offered a cheap, fixed-price, tax-free access number for Internet service that could be dialed from anywhere in the nation [AIS-Connect National ICT Profile 2003]. That year, at the request of the World Bank, Togo's government passed a law privatizing the telecommunications sector.

In 1999, Togo Telecom shares were traded publicly. The company serviced approximately 700 customer accounts in 1999 including accounts through seven private ISPs leasing lines from Togo Telecom. In 2000, the company operated an expanded network with 1 Mbps of bandwidth from an international connection with SprintLink. It provided service at 64 Kbps to seven private ISP companies, three education and research facilities, three cybercafes, and five other private businesses [Topology of the Internet in Togo, 2003]. In 2003, Togo Telecom used 10 Mbps down and 6 Mbps up of bandwidth it bought from IPPlanet. Leased lines and 512 dialup lines were available to its customers for Internet service. The leased lines bandwidth was 64 Kbps while the dial-up users would access the Internet at a speed between 36 Kbps and 56 Kbps. In addition, Togo Telecom had 2 Mbps available from OpenTransit. During 2003, the company cut its service cost in half. As a result, the number of customer accounts grew to around 1300, nearly double the number of accounts in 1999. With multiple computers and users per customer account, Togo Telecom's networks were operating at three quarters of their capacity, an increase since 2002 when the networks were at two thirds capacity [Hountomey, 2003].

III. ANALYTIC FRAMEWORK DIMENSIONS

PERVASIVENESS

Since a telecommunication regulatory agency was not fully established until 2001, hard historical data on Internet use in Togo does not exist. Table 2 shows estimates of the numbers of subscribers and users. The estimates in the table are boundary points based on interviews with employees of Café Informatique and corroborated with estimates and statistics from other resources.

Table 2. Estimates of Numbers of Internet Users

Date	Subscribers	Users (% of population)
late 1997	<100	<500 (<0.01%)
late 1998	<1,700	<5,000 (<0.11%)
late 1999	>1,700	>10,000 (>0.23%)
mid 2003	Unknown	>50,000 (>0.94%)

² Togo Telecom was actually the fourth Internet provider but only the second to offer Internet services to the general public.

The chart indicates significant growth since the Internet was first introduced to the country. In December of 1998, over a thousand Internet accounts were created. Under the assumption that all of these new accounts were not fully utilized until at least the next month, Togo went from a Level 1 (Embryonic) to a Level 2 (Established) in 1999. This characteristic is described in Table 3. Growth continued over the past several years causing Togo to reach the next level of pervasiveness by the end of 2003, thereby making the Internet a common entity in the country.

Table 3. Pervasiveness of the Internet in Togo

Level 0	<i>Non-existent</i> : The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	<i>Embryonic</i> : The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	<i>Established</i> : The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	<i>Common</i> : The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	<i>Pervasive</i> : The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least one in ten (10% or greater).

GEOGRAPHIC DISPERSION

The geographic spread of the Internet can be estimated by examining how geographically dispersed the Internet is through the Points of Presence (POPs) located in a nation's first-tier political subdivisions, commonly called regions in Togo. The Internet was created in Togo's capital, Lome, which is located in the Maritime region. Of the five regions in Togo, only one other, Kara, offers any advanced telecommunications. However, this telecommunications infrastructure consists only of X.25 technology used for educational purposes. Consequently, the Maritime region--more specifically, Lome--remains the only area with a POP. As indicated in Table 4, Togo is rated at Level 1 (Single Location) for geographic dispersion.

Table 4. Geographic Dispersion of the Internet in Togo

Level 0	<i>Non-existent</i> : The Internet does not exist in a viable form in this country. No computers with International IP connections are located within the country. A country may be using UUCP connections for e-mail and USENET.
Level 1	<i>Single location</i> : Internet points-of-presence are confined to one major population center.
Level 2	<i>Moderately dispersed</i> : Internet points-of presence are located in multiple first-tier political subdivisions of the country.
Level 3	<i>Highly Dispersed</i> : Internet points-of-presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	<i>Nationwide</i> : Internet points-of-presence are located in essentially all first-tier political subdivisions of the country. Rural access is publicly and commonly available.

Due to the country's small size and the availability of a cheap nationwide fixed-price dial-up number for Internet access, Café Informatique and Togo Telecom do not plan to place POPs in the country's other regions at this time. Since the Internet is accessible from anywhere a telephone line exists and all five regions in Togo provide telephone access, all five regions can potentially access the Internet.

SECTORAL ABSORPTION

The sectoral absorption dimension assesses the extent of adoption of the Internet in a number of economic sectors. Unlike many countries, where the Internet first started in academic settings, the Internet in Togo began with one small company in the commercial sector. Although Togo Telecom had the capacity to offer the Internet to the general public as early as 1991, it did not identify the Internet as a top commercial priority [Louassi and Robins, 2002]. The academic institutions in Togo lacked the influence and financial capacity to drive the spread of the Internet. Overall, by the end of 1999, Togo's sectoral absorption increased to a very weak Level 2 (Moderate) from a Level 1 (Rare). The country remained at that level during 2003 with approximately one percent of Internet absorption in all sectors other than commercial. Tables 5 and 6 describe in more detail the sectoral absorption as of 2003.

Table 5. Absorption of the Internet by Sectors of Togo's Economy

Sector	Minimal (1 point)	Medium (2 points)	Great Majority (3 points)
Academic (primary and secondary schools, universities)	>0%-10% leased line Internet connectivity	10%-90% leased line Internet connectivity	90% leased line Internet connectivity
Commercial	>0%-10% Internet Servers	10%-90% Internet Servers	90% Internet Servers
Health (hospitals and clinics)	>0%-10% leased line Internet connectivity	10%-90% leased-line Internet connectivity	90% leased-line Internet connectivity
Public (top- and second-tier government entities)	>0%-10% Internet servers	10%-90% Internet servers	90% Internet servers

Table 6. Sectoral Absorption of the Internet in Togo

Sectoral Point Total	Absorption Dimension Rating
0	Level 0: Non-existent
1-3	Level 1: Rare
4-6	Level 2: Moderate
7-9	Level 3: Common
10-12	Level 4: Widely Used

Educational institutions in Togo began experimenting with networking technologies in 1992 when French scientists were working with the ORSTOM network using UUCP. In 1997, Centre Syfed on the University of Benin (Lome) campus became the second access provider, but used X.25 technology rather than Internet Protocol. Aiming to promote the sharing of information between academics in Togo and other Francophone countries, the network served French-speaking students, teachers, and researchers through three computers. Three more computers were added to the network in 1999, but inadequate equipment remains the major limitation.

In 1998, the Centre Africain de Formation a la Maintenance Micro-Informatique, a school that trains computer science technicians, began offering Internet access to its students and teachers. Six computers were reserved for students and two for teachers [Louassi and Robins, 2002]. The ORSTOM network ceased operation in the same year.

By 2000, at least one institute of higher learning leased a line and several more institutions were in the process of obtaining them. In 2003, only a handful of primary or secondary schools (such as The British School of Lome) used leased lines. Clearly, the academic absorption rate is not above ten percent.

Though the number of cybercafes is growing, particularly in Lome, and business interest in the Internet is expanding, the commercial sector is as under-developed as the academic sector. By July 2003, only 59 companies—much less than 10%-- registered top level domain names.

The health and public sectors played insignificant roles in shaping the Internet in Togo. Since the first health institution connected through a leased line in 1999, Internet use by the health sector increased slowly, if at all. The public sector is similarly stagnant. The largest public sector absorption took place when Togo Telecom began offering Internet services in 1998. Since then, little work has been done to bring additional government institutions online. Only a handful of government agencies, such as the nation's port authority and the government's central administration have their own servers and websites.

CONNECTIVITY INFRASTRUCTURE

The connectivity infrastructure dimension assesses the connectivity and access capacity of the infrastructure. Table 7 indicates Togo's connectivity infrastructure level as of July 2003.

Table 7. Connectivity Infrastructure of the Internet in Togo (2003)

Level	Domestic Backbone	International Links	Internet Exchanges	Access Methods
0: Non-existent	None	None	None	None
1: Thin	<=2 Mbps	<=128 Kbps	None	Modem
2: Expanded	>2 Mbps- 200 Mbps	>128 Kbps- 45 Mbps	1	Modem 64 Kbps leased lines
3: Broad	201 Mbps – 100 Gbps	46 Mbps- 10 Gbps	More than 1; Bilateral or Open	Modem 64 Kbps leased lines
4: Extensive	>100 Gbps	>10 Gbps	Many; both Bilateral and Open	<90% modem 64 Kbps leased lines

International Links

The first international IP connection in Togo was established in 1997 when Café Informatique went live as an ISP. Café Informatique's connection at the time and, consequently, the international connectivity of the whole nation was 128Kbps down, putting the country at a Level 1 (Thin) for international connectivity. When Togo Telecom entered the ISP business in 1998, international connections totaled 384 Kbps, and Togo rose to a Level 1.5 (Expanded) for international connectivity. Even with the increased bandwidth, the country still does not have more than 25 Mbps of international bandwidth.

Domestic Backbone

Because Togo Telecom would not allow Café Informatique to use any of its existing infrastructure, Café Informatique was forced to create its own network through wireless connections and local dial-up lines [Yawo, 2003]. Not until 2001, when Café Informatique added a 2 Mbps E1 land line, did a domestic link with capacity above 2 Mbps exist for Internet use. Even so, this land connection hardly qualified as a nationwide backbone.

Togo Telecom continued to expand its networks and bandwidth over the last several years. While the country is not close to having a domestic back with speeds reaching 200 Mbps, Togo's domestic backbone, the network operated by Togo Telecom, is operating at speeds greater than 2 Mbps putting the domestic connectivity at a Level 1.5 (Expanded).

Internet Exchanges

With the relatively small size of the country and a business atmosphere not conducive to communication and cooperation, Togo Telecom and Café Informatique held no meaningful discussions about the idea of an Internet Exchange Point (IXP).

Access Methods

When Café Informatique began providing Internet service in 1997, the only access method available was through a modem. The following year, leased lines were sold to customers of both Togo Telecom and Café Informatique, indicating that Togo had reached Level 2 (Established) in access methods. Since a large majority of present day Internet connections in Togo are still through modems, the country remains at that level today.

ORGANIZATIONAL INFRASTRUCTURE

The organizational infrastructure dimension measures the strength of the Internet industry by assessing the level of competition and the existence of organizations that support and promote the industry. Café Informatique obtained its VSAT license from the Togolese government at the time when the state-operated PTT was being broken into two departments. Once Togo Telecom established itself, the company ensured that all further requests for commercial VSAT licenses would be rejected. Consequently, there are only two international connections, with Togo Telecom's connection monopolizing the telecommunications infrastructure. Of the several ISPs in the country, only Café Informatique is truly independent of the state-owned telecommunications monopoly. The other ISPs lease lines from Togo Telecom. The domestic backbone is also primarily operated by Togo Telecom. There is a noticeable lack of industry groups promoting the Internet in Togo. As shown by Table 8, these indicators all demonstrate that Togo is at Level 2 (Controlled) in organizational infrastructure. This arrangement is unchanged since Togo began offering Internet services.

Table 8. Organizational Infrastructure of the Internet in Togo

Level 0	<i>None:</i> The Internet is not present in this country
Level 1	<i>Single:</i> A single ISP has a monopoly in the Internet service provision market. The ISP is generally owned or significantly controlled by the government.
Level 2	<i>Controlled:</i> There are only a few ISPs and the market is closely controlled through high barriers to entry. All ISPs connect to the international Internet through a monopoly telecommunications service provider. The provision of domestic infrastructure is also a monopoly.
Level 3	<i>Competitive:</i> The Internet market is competitive. There are many ISPs and low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or visa versa.
Level 4	<i>Robust:</i> There is a rich service provision infrastructure. There are many ISPs and low barriers to market entry. International links and domestic infrastructure are open to competition. There are collaborative organizations and arrangements such as public exchanges, industry associations, and emergency response teams.

SOPHISTICATION OF USE

Sophistication of use refers to the extent to which the Internet is used for innovative or transforming purposes within a country. The Internet in Togo is used primarily for communication through e-mail, VOIP, and data content on a website. The information technology industry is weak, due in part to a 40% import tax on computers, plus 18% more for a value-added tax. With little use of credit cards in the country, there is no e-commerce. There are some "hunters" who search the Internet for the cheapest price of an item sold in another nation. They then secure the purchase through whatever means they have. This practice is not very common. Togo is at a Level 2 (Conventional) for sophistication of use. Judging by the technology available and how it was applied by the Internet user base, this level was reached in 1999. Table 9 describes in more detail how the Internet started "taking hold" in Togo.

Table 9. Sophistication of Use of the Internet in Togo

Level 0	<i>None:</i> The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	<i>Minimal:</i> The user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	<i>Conventional:</i> The user community changes established practices somewhat in response to or in order to accommodate the technology, but few established processes are changed dramatically. The Internet is used as a substitute or straightforward enhancement for an existing process (e.g. e-mail vs. post). This is the first level at which we can say that the Internet has taken hold in a country.
Level 3	<i>Transforming:</i> The use of the Internet by certain segments of users results in new applications, or significant changes in existing processes and practices, although these innovations may not necessarily stretch the boundaries of the technology's capabilities.
Level 4	<i>Innovating:</i> Segments of the user community are discriminating and highly demanding. These segments are regularly applying, or seeking to apply, the Internet in innovative ways that push the capabilities of the technology. They play a significant role in driving the state-of-the-art and have a mutually beneficial and synergistic relationship with developers.

SUMMARY OF ANALYTIC FRAMEWORK DIMENSIONS

Figure 2 shows the growth of the Internet in Togo over time. In general, Togo's geographic dispersion of the Internet remained stagnant while the other categories show signs of growth over the six year period from 1996 to 2003.

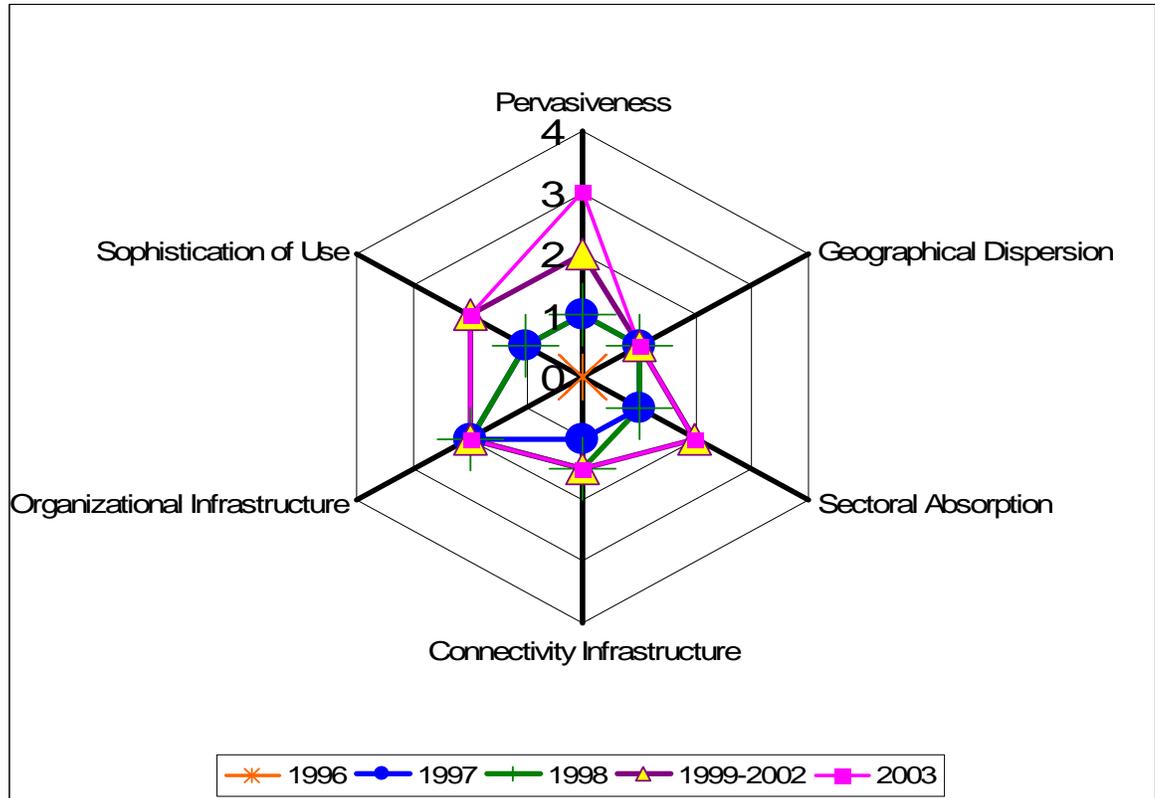


Figure 2. Internet Diffusion Dimensions in Togo

IV. DETERMINANTS OF INTERNET DIFFUSION

Why did the Internet evolve in Togo as it did? The GDI framework suggests a number of factors that can help explain movement along the dimensions described in Figure 2 and suggest measures a government can take to promote the Internet.

ACCESS TO THE INTERNET

Individual Access to the Internet

To use the Internet, users must be able to access it. The majority of Internet users in Togo access the Internet via modems, a method that requires an established network of telephone lines. Togo's teledensity is less than 2%, which strongly limits how effectively the Internet can be dispersed throughout the nation.

A factor facilitating the spread of the Internet is the nationwide fixed-price dial-up access number that Togo Telecom offers. In February 2004, the cost to use this number was approximately 9.5 cents without taxes for every five minutes [Hountomey, 2003]. Though telephone access is available in just about every city and village, most rural locations access the telephone through a telecenter.

To increase revenue, Togo Telecom set up telecenters in many rural areas. Each telecenter may offer a variety of telecommunication services such as sending fax messages and making phone calls. Any person may receive a phone call at the telecenter that is prepaid for by the caller [Information Society website of the European Commission, 2003]. In general, Togolese are too poor to afford the cost of an outgoing phone call. As a result, the teledensity is somewhat higher than the actual potential for Internet growth. Members of rural villages access the Internet through a local cybercafe or a telecenter if they access the Internet at all. The 40% import tax on computers in the country also discourages households from obtaining the necessary hardware and software to access the Internet.

ISP Access to the Internet Backbone

Togo Telecom runs the only nationwide Internet backbone in the country. Except for Café Informatique, all of the ISPs use this network.

Café Informatique's network is primarily located in and around the surrounding areas of Lome. This network is tailored for citizens in that area. The company would like to expand its network, but lacks needed capital. There have been no recent discussions to let Café Informatique use Togo Telecom's existing infrastructure [Yawo, 2003].

Cost of Internet Access

To be used on a large scale, the Internet must be accessible at affordable costs. In other countries, access costs and the spread of the Internet are inversely related. As prices go down, the potential market for Internet growth expands.

Based on the costs compared to income, Internet access is expensive. The average Togolese income in 2002 was \$1,600.00. In 2001, Café Informatique charged about \$20.00 a month on average for unlimited dial-up access and around \$800.00 a month for dedicated wireless access at speeds of 1.2Mbps [Hountomey, 2003]. Togo Telecom was charging an average of \$1,150.00 a month for leased line activity at speeds of 64Kbps at about the same time [NICI Indicators, 2003]. The following year, Café Informatique raised its prices to be in the same range as Togo Telecom's, around \$1,050.00 a month for leased line access at speeds of 64Kbps [Hountomey, 2003]. In 2003, Togo Telecom cut its price in half. Café Informatique quickly followed Togo Telecom's lead and slashed its price as well. As of July 2003, Togo Telecom was charging slightly over \$500 a month for leased line activity while Café Informatique was charging slightly over \$600 a month for the same service.

The large drops in prices for leased line activity could mean an increased diffusion of the Internet throughout Togo. Alternatively, the prices may have been so high to begin with that the price drop would have little effect other than to reduce the cost of Internet access so that it more closely reflects what the economic market in Togo demands. The slow increase in the number of users over the period of the writing of this paper, indicates that both theories may be partially valid.

EASE OF USE

For significant absorption throughout a country, the Internet must be easy to use. With slightly more than a 60% literacy rate and a much smaller percentage able to read English, the Internet is not an easy tool for Togo's inhabitants to use. Most of the websites hosted in Togo are in French, but Togo does not host many websites. Togolese often surf websites hosted in France as well as French versions of English-based websites (such as Yahoo's French e-mail service) [Hountomey, 2003].

The utilization of cybercafes also increases the difficulty level for Internet use. Cybercafés are few in the rural areas of Togo. The fact that most Togolese cannot access the Internet easily and that their educational background is inadequate to manipulate it is likely to be a prohibitive factor for future Internet growth.

PERCEIVED VALUE OF THE INTERNET

For significant Internet diffusion to take place, potential users must perceive Internet use as beneficial to them, for communication, entertainment, information access, or otherwise. The more educated individuals in Togo see the Internet as a source of opportunity for business and education. Though increasing in number, they are a small minority of the population. Throughout the nation as a whole, the Internet is seen primarily as an alternative tool to the telephone to communicate with those who live far away. This alternative, available in cybercafés, is better because it is cheaper than the telephone.

RESOURCES

Togo lacks many of the fundamental resources needed for growth of the Internet, such as an expansive telecommunications infrastructure, finances, and reliable power. The high tax on computers and low teledensity severely constrain the affordability and availability of technology necessary for people to access the Internet. The government's financial problems further inhibit the expansion and improvement of the telecommunications networks. Private capital is similarly limited. Furthermore, Togo's power grid is neither stable nor reliable. [Yawo, 2003]. Human resources are not a limiting factor, however. Enough technically qualified people are looking for employment to match the demand. However, this human capital does not make up for the lack of financial and infrastructure resources.

LEGAL AND REGULATORY FRAMEWORK

IP Address and Domain Name Allocation

For the Internet to exist in a country, a system must be present for providing IP addresses and domain names. Both Togo Telecom and Café Informatique have their own block of IP addresses to allocate as they wish. Café Informatique is in charge of the country's top-level domain name, .tg. As of July 2003, only 59 domain names were registered. The existence and organization of this structure is an indication that some of the necessary administrative framework for the Internet to spread is in place. The government does not censor the Internet in Togo.

Licensing of ISPs

After Café Informatique received its license to operate a VSAT for data communication and Internet services, Togo Telecom persuaded Togo's regulatory authority for telecommunications not to grant any more VSAT licenses for Internet use. Through licensing applications, Togo Telecom now tightly controls the number of ISPs that are allowed to enter the market. The lack of a free market economic structure for ISPs limits competition and allows higher prices to be charged for Internet access.

GEOGRAPHY

In nations with a widely distributed population, rough terrain, a large landmass, or many islands, the country's geography creates obstacles for widespread Internet coverage. Togo's geography poses little difficulty to Internet growth. There are no major mountains or bodies of water in the country. The small land area should be an aid in the expansion of Internet use in Togo.

DEMAND FOR CAPACITY

A real or perceived demand must exist for the Internet to continue to expand in a country. In Togo, lack of demand, even at high prices, is not a factor limiting Internet growth. Both Café Informatique's network and Togo Telecom's network expanded a number of times over the years as their networks came closer to full capacity. Following the reduction in Internet service prices in July 2003, Togo Telecom operated at three quarters of its network capacity, up from two thirds the year before. If the two companies continue to provide reliable services and compete for customers by reducing prices, demand should increase across the nation.

CULTURE OF ENTREPRENEURSHIP

Internet-based initiatives and service providers are numerous in countries where the culture of entrepreneurship encourages innovation and does not dishonor an individual who fails. With its economy mainly based on agriculture, Togo lacks an innovative entrepreneurial culture related to telecommunications. Software and information technology companies are largely nonexistent in Togo. Due in part to low incomes and a dearth of tax incentives for private companies, entrepreneurs find establishing successful businesses difficult.

FORCES FOR CHANGE

The growth of the Internet in a country is encouraged, aided, and caused by forces for change. In Togo's case, there are two such forces.

1. The owners of Café Informatique fueled the creation of the Internet in Togo. Their actions played a major role in Togo Telecom entering the ISP market only a year later. Competition between these two companies helps to drive the cost of Internet access down, improve Internet services, and expand the networks that use the Internet. This process could be sped up by further deregulating the telecommunications and ISP industries.

2. The World Bank gave Togo a mandate to deregulate and dissolve Togo Telecom's monopoly in the telecommunications sector. The fulfillment of this mandate, by allowing more companies to obtain VSAT licenses and to use Togo Telecom's telecommunications infrastructure, should encourage further spread of the Internet in Togo.

ENABLERS OF CHANGE

When a force for change and a receptive user community exist, other factors may influence the degree to which the change occurs. The most significant of these enablers of change in Togo is the University of Benin, which produces graduates who are capable of working with the Internet and its underlying technologies. If Togo is always able to match the demand for the number of technically minded people looking for jobs, the Internet's chance of growing increases. Beyond this, Togo has few elements that, in other countries, help speed the rate at which change occurs. For example, Togo lacks areas of technical strengths (e.g. a vibrant software industry), a legal framework in which new companies can be created quickly and thrive, or a culture that values change and innovation.

V. TOGO AND GHANA³

A comparison of the Internet in Togo with the Internet in Togo's neighbor to the west, Ghana, can further sharpen our understanding of the diffusion of the Internet. Ghana's history, landscape, demographic, and culture is similar. Despite these similarities, Ghana experienced a more rapid and extensive diffusion of the Internet, as shown in Tables 10 and 11.

In neither country is Internet diffusion strong, but in nearly every dimension, Ghana enjoys a lead over Togo. An analysis of the determinants for each country indicates factors that hinder Internet diffusion in both countries as well as factors that have led to relatively greater Internet growth in Ghana. Both countries suffer from a lack of computers and telephone lines and plan to expand the telephone network in the future. Neither country has a strong domestic Internet backbone. However, Ghana allows ISPs to obtain VSAT licenses for international Internet connections. A dial-up connection in Togo costs around \$240 a year (15% of the annual average income); the same connection in Ghana is more expensive in absolute terms (\$300 per year), but cheaper relative to the average annual income (13.5% of income). The Ghanaians are more likely to find

³ This section is not part of the GDI framework for analysis. It is included here to illustrate the importance of government decisions on the diffusion of the Internet in a country.

Table 10. General Statistics for Togo and Ghana

	Togo	Ghana
Population	5.55 million (July 2004 estimate)	20.5 million (July 2003 estimate)
GDP – per capita	\$1,600 (2003 estimate)	\$2,200 (2003 estimate)
Telephones (main lines in use)	60,600 (2003)	240,000 (2001)
Telephones (mobile cellular)	220,000 (2003)	150,000 (2001)
Teledensity (Main Lines Per 100)	1.09 main telephone lines per 100	1.3 (2001)
Literacy Rate	60.90%	74.80%

Source for Ghana statistics: Foster [2004]

Table 11. Comparison of GDI Framework Dimensions

Dimension	Level - Togo	Level - Ghana
Pervasiveness	Level 3: 1% or greater (weak)	Level 3: 1% or greater (strong)
Geographic Dispersion	Level 1: Single Location	Level 3: Highly Dispersed
Sectoral Absorption	Level 2: Moderate (weak)	Level 2: Moderate (strong)
Connectivity Infrastructure	Level 1.5: Expanded	Level 1.5: Expanded
Organizational Infrastructure	Level 2: Controlled	Level 3: Competitive
Sophistication of Use	Level 2: Conventional	Level 2: Conventional

Source for Ghana GDI dimensions: Foster [2004]

the Internet easier to use since their native language is English and the information on the Internet is predominantly written in English. The citizens of Ghana and Togo perceive the Internet similarly, as a cheaper and more advanced tool for communicating with people over long distances. Resources are scarce for both nations. Togo fully developed an independent telecommunications regulator five years after Ghana established one. Geographic obstacles are nonexistent for both countries. Ghana has multiple forces for change in the academic, government, and business sectors, while Togo has few forces for change in the business and public sectors.

In summary, the major differences between Ghana and Togo are the availability of VSAT licenses and competitiveness of the Internet services market, the native languages, the time since an independent telecommunications regulator was established, and the breadth and number of the forces for change in each country. These differences indicate areas the Togolese government should consider when making future decisions that affect Internet growth.

VI. LIMITATIONS

Due to time constraints while visiting Togo, academic and government representatives were not interviewed directly for this study. As a result, the study lacks detailed information from the academic and government perspectives.

VII. CONCLUSIONS

The statistics in Table 1 in Section II, demonstrates the weaknesses in Togo's economy, education system, health system, and infrastructure. With an inadequate GDP per capita, Togo has little purchasing power to make much needed improvements across all sectors of its society. Most of sub-Saharan Africa is caught in this quandary. The World Bank and International Monetary Fund donated and lent money to Togo to improve the conditions in the country. However, the government of Togo did not use this money efficiently or effectively.

Lacking the capital to implement telecommunications infrastructure improvements, the government of Togo needs to focus on changing policy to encourage the development of new ISPs and technology related businesses. We believe that these companies should be privately owned, be able to access to the national telecommunications infrastructure, have permission to expand the infrastructure, and be able to purchase their own VSATs.

Private sector competition would drive the improvements for the telecommunications infrastructure and simultaneously eliminate the nearly complete monopolization of the telecom industry by Togo Telecom. Liberalization of the communications market would reduce two major obstacles of Internet diffusion: inadequate telecommunications infrastructure and lack of competition within the telecom industry. In the short term, liberalization might reduce revenue for Togo Telecom, but in the long run the whole country would benefit from improved infrastructure giving the average citizen local, fast, affordable Internet access to the global economy.

The commercial sector in Togo drove Internet development because the government failed to appreciate the economic value of the technology and the academic sector lacked the resources and initiative to lead the way. For the Internet to thrive, the government must take a more active role in promoting low-cost and convenient Internet access to its citizens.

OPPORTUNITIES FOR THE FUTURE

As the teledensity increases, the availability of a nationwide set price dial-up Internet access number is a very promising service that will aid in the diffusion of the Internet. Togo's geography poses few obstacles to Internet growth. While not as advanced as in industrialized nations, the university system offers competent graduates who can work in the slowly developing IT field in Togo. These factors will encourage Internet diffusion. Table 12 outlines these and other measures to promote the Internet in Togo.

The deficiencies in the telecommunications infrastructure can be reduced by allowing private industry to utilize and expand existent infrastructure. Allowing private industry to utilize and expand infrastructure also removes the restrictive hold that Togo Telecom uses to prevent competition from driving down prices and providing the best services possible. The IT industry would also greatly improve if the education system at the primary and secondary levels used computers to train students and if there were no taxes (or at least not especially high taxes) on computers. Once individuals are exposed to the services a computer and the Internet can offer, they will find a way to keep those services.

For Togo, expanding the Internet incurs a high opportunity cost. In the short term, the government must be willing to lose tax revenue and allow independent access to Togo Telecom's infrastructure. However, in the long term, the Internet should expand, giving the citizens of Togo access to the global economy which in turn should increase all levels of Togo's economy. To be competitive in the global economic market, a strong Internet presence is essential. The expansion of the Internet in Togo depends significantly on the actions the government takes in the near future.

Table 12. Measures the Togolese Government Might Take to Promote the Internet

Determinant	Measures That Might Be Taken by the Togolese Government
Access	Eliminate tax on computers. Increase number of phone lines.
Perceived Value	Educate people to use the Internet as to generate revenue and knowledge.
Ease of Use of the Internet	Create web pages in French that offer government services
Cost of Internet Access	Reduce the cost of leased lines. Eliminate excessive taxes on computers and other information technologies. Promote ISP competition.
Adequacy and Fluidity of Resources	Create education programs in computing at the primary and secondary schools. Stabilize the power grid. Improve investment climate by stabilizing the economy.
Regulatory and Legal Framework	Allow private industry to obtain VSAT licenses for commercial use. Encourage more competition in providing of Internet services.
Demand for Capacity	Increase demand by educating more individuals about the opportunities the Internet offers. Make the Internet more accessible.
Culture of Entrepreneurship	Improve the investments in the private sector by stabilizing the economy and passing legislation that allows for more venture capital.
Forces for Change	Extend Internet use to more government offices and services. Increase ISP competition by dissolving Togo Telecom's monopolistic hold on telecommunications infrastructure.
Enablers of Change	Implement a technology curriculum in the education system.

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EDITOR'S NOTE: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the paper on the Web, can gain direct access to these linked references. Readers are warned, however, that

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APPENDIX I⁴

GLOBAL DIFFUSION OF THE INTERNET FRAMEWORK

The analytic framework used in this study is laid out in "A Framework for Assessing the Global Diffusion of the Internet " [Wolcott et al., 2001] which is available at <http://jais.isworld.org/articles/default.asp?vol=2&art=6>. The framework was initially formulated in *The Global Diffusion of the Internet: An Initial Inductive Study* [Goodman et al., 1998], based on a more general analytic framework developed in *The Information Technology Capability of Nations* [Wolcott, 1997]. Most broadly, the framework consists of dimensions and determinants. Dimensions are six variables, described below, that capture the state of the Internet within a country at a given point in time. Determinants reflect the factors that led to the observed state and will likely influence future development.

A useful analytic framework should be sufficiently rich that it captures well the multifaceted diversity of countries' experiences with the Internet. At the same time, the number of variables should be small enough that they can be easily kept in mind. Each of the variables should describe an important, somewhat intuitive, and measurable feature of the presence of the Internet in a country. In a rough sense, the variables should form a complete set in that they collectively cover almost everything that might reasonably be of interest, and each variable should have something to offer to the overall picture that the others do not. Finally, for the framework to be useful, it must be feasible to measure the values of the variables given a modest investment of resources. If the analytic framework is based on variables that cannot be measured in practice, then its effectiveness is compromised.

The six dimensions of Internet Diffusion are shown in Table A-1.

Table A-1. Dimensions of the Diffusion of the Internet

Dimension	Description
Pervasiveness	Number of users per capita
Geographic Dispersion	Physical dispersion of infrastructure and access; primarily a function of the fraction of first-tier political subdivisions (states, provinces, governorates, etc.) with Internet points of presence (POPs).
Sectoral Absorption	Extent of connectivity in four social sectors: Education, Commercial, Health, and Government.
Connectivity Infrastructure	Capacity of the technical infrastructure; primarily a function of the capacity of domestic and international backbones, and the types of access (e.g. modem vs. high-speed) available to users.
Organizational Infrastructure	Internet services market characteristics; a measure of the richness, robustness, and level of choice of the Internet service provision market.
Sophistication of Use	Integration, transformation, and innovation; a measure of the nature of Internet usage by a leading segment of the user community.

The Internet within a particular country at a particular point in time may be assigned one of five levels along each dimension. A dimension/level approach was also employed by the United Nations Economic and Social Commission for Asia and the Pacific in its Technology Atlas Project.

⁴ This appendix is taken in its entirety from Appendix I of the Internet in Ghana by William Foster et al. [2004]. Reproduced with permission.

Table A-2 The Pervasiveness of the Internet

Level 0	<i>Non-existent:</i> The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country. There may be some Internet users in the country; however, they obtain a connection via an international telephone call to a foreign ISP.
Level 1	<i>Embryonic:</i> The ratio of users per capita is on the order of magnitude of less than one in a thousand (less than 0.1%).
Level 2	<i>Established:</i> The ratio of Internet users per capita is on the order of magnitude of at least one in a thousand (0.1% or greater).
Level 3	<i>Common:</i> The ratio of Internet users per capita is on the order of magnitude of at least one in a hundred (1% or greater).
Level 4	<i>Pervasive:</i> The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least one in 10 (10% or greater).

Table A-2 illustrates distinctive features, common to all dimensions, of the levels. The levels should progress from less to more in an ordered way. Using an order of magnitude difference between levels has a number of advantages. First, it increases the probability that two observers looking at the same country at the same point in time are likely to come up with the same assignments of levels, in spite of the fact that data about the Internet is often rapidly changing, incomplete, and of variable credibility. Second, while the measure is fundamentally quantitative, there is a qualitative aspect to the levels. When a country progresses from one level to another, the change is substantial enough that one is likely to observe a significant change in the impact and use of the Internet on a country.

While the “state” of the Internet at a given point in time within a given country can be captured using the dimensions outlined above, it is perhaps more important to understand the factors that have caused the Internet to evolve to the state it has. Figure A1 shows the collection of top-level factors that most strongly shape the nature and extent of the Internet within a country. Government policies are identified separately as a determinant because of their importance and because government policies usually impact the dimensions only indirectly, by shaping other determinants. The arrows reflect the direction of influence between the independent variables (determinants) and the dependent variables (dimensions) used in this study. This is not to imply that other influences do not exist. For example, government policy makers may formulate policies in part as a reaction to the state of the Internet itself.

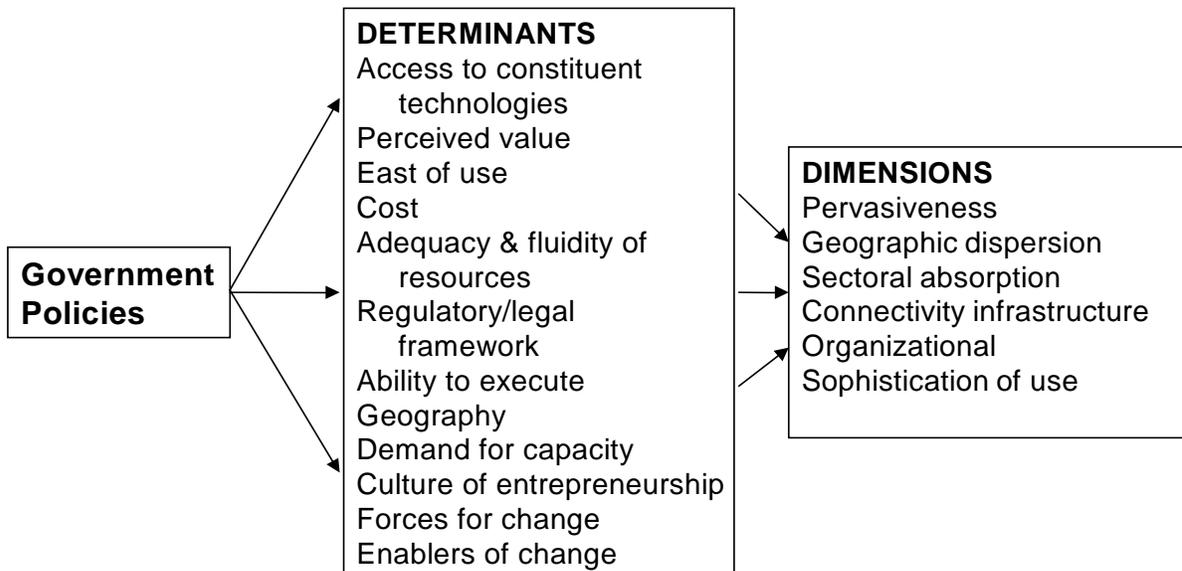


Figure A1. Determinants of Internet Diffusion

Not all determinants have a strong impact on all dimensions. For example, Pervasiveness is primarily a function of access to constituent technologies, perceived value, ease of use, and cost. If any of these factors is highly unfavorable, then individuals will not access the Internet, even if the other three factors are favorable. Identification of the subset of determinants most directly influencing particular dimensions can yield suggestions for policies that can promote (or hinder) development of that dimension.

In summary, the analytic framework employed in the Global Diffusion of the Internet Project captures the state of the Internet within a country in a rich, multifaceted, yet relatively straightforward way through the use of dimensions. The determinants provide insight into factors shaping the Internet's evolution. Together, the dimensions and determinants provide an analytic tool that is helpful for conducting longitudinal studies and multi-country comparisons, and formulating policy recommendations.

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