The Internet in Turkey and Pakistan: A Comparative Analysis

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Executive Summary

Introduction

The Global Diffusion of the Internet Project was initiated in 1997 to study the diffusion and absorption of the Internet to, and within, many diverse countries. This research has resulted in an ongoing series of reports and articles that have developed an analytic framework for evaluating the Internet within countries and applied it to more than 25 countries. (See http://mosaic.unomaha.edu/gdi.html for links to some of these reports and articles.)

The current report applies the analytic framework to compare and contrast the Internet experiences of Turkey and Pakistan, through mid-2000. Although historically these countries have not been closely related, there are significant parallels between the two that make them well suited for a comparative study of the absorption of the Internet. Turkey and Pakistan are among the largest non-Arab Muslim countries in the world. In contrast to most of their Arab counterparts, their governments were founded as secular, parliamentary democracies. Both countries have had stormy political histories, however, with periodic coups and authoritarian governments. Each country has firmly entrenched bureaucracies with closed and, to varying degrees, corrupt processes.

Their economies have been similarly troubled, with periods of relative hopefulness punctuated by stagnation and decline. Both countries have suffered from erratic growth rates, high inflation, and high deficits. For most of their histories, their economies were rather closed and autarkic.

In recent decades, each country has taken substantial steps to move toward a more open, market-oriented economy and made expansion of

the telecommunications infrastructure a high priority. Each country has sought, less successfully than had been hoped, to attract foreign investment and integrate itself more fully with the global economy.

Each country has a number of national security concerns. Turkey and Pakistan both have histories of serious domestic terrorism and persistent conflict with a non-Muslim neighbor.

In spite of the macro-similarities, there are numerous differences between the two countries. Pakistan is considerably poorer and less developed than Turkey; it has had more coups and assassinations, deeper economic troughs, greater heterogeneity within its population, and more endemic corruption.

The Internet in Turkey

The first international Internet connection from Turkey (to the U.S. National Science Foundation) was established In 1993. In 1996, Türk Telekom, the national telecommunications services provider, granted a contract for the creation of a national Internet backbone to the GlobalOne consortium. This backbone, TURNET, went online during the fall of 1996 and provided the foundation for private, commercial Internet service providers (ISPs).

The creation of TURNET and a competitive ISP market led to a dramatic expansion of Internet usage in Turkey. During the first two years of TURNET operation the number of ISPs increased by 600 percent. Between 1996 and 1999, the number of Internet users in Turkey grew by approximately 800 percent, reaching over 1 percent of the population by 1999. The rollout of an ATM network called TTNet in 1999–2000 has dramatically increased domestic and international bandwidth capacity and supported continued expansion of the Internet. In 2000, 3–4 percent of Turkish citizens were Internet users.

The Internet in Pakistan

The first international Internet service in Pakistan was launched by Digicom in 1995. The licensing of commercial Internet service providers began in 1996. By mid-1999 licenses to provide Internet services had been issued to approximately 100 organizations, of which approximately 40 were offering service. By mid-2000, the number of Pakistani users had grown to 500,000–700,000, or nearly 0.5 percent of the population.

Unlike Turkey, Pakistan lacks a proper Internet backbone. Each ISP leases lines for both domestic and international connections. Only in 2000

were developments underway to create a network access point (NAP) at which Pakistani ISPs could exchange traffic. Without such NAPs, traffic from one domestic ISP to another has to travel outside the country and back.

Similarities and Differences

The dramatic growth in the Internet user population in both countries has been fueled in part by a highly competitive and expanding community of Internet service providers that have been increasing access, reducing prices, and promoting content attractive to local and expatriate communities. The ISPs, in turn, have benefited from long-term efforts to expand and improve the telecommunications infrastructure as well as periodic price reductions by the national telecommunications providers. Internet use in the health, education, government, and, especially, commercial sectors has grown significantly, although not uniformly.

Turkey and Pakistan share other, less positive features. The vast majority of citizens are still without Internet access. Only in 1999 did Internet penetration reach 1 percent of the population in Turkey; Pakistan may not cross this threshold until the year 2001. For most, the cost and difficulty of accessing the Internet are prohibitive. Neither country has been able to develop infrastructure fast enough to accommodate growing demand. The domestic and international infrastructures are often saturated.

In spite of these similarities, the two countries have significant differences. Turkey's per capita usage of the Internet is over six times that of Pakistan. While Turkey has been rolling out its second-generation national backbone, Pakistan is still talking about developing its first. While the Internet is accessible from nearly every Turkish village, access in Pakistan is limited to major urban areas. Many major Turkish corporations are embracing the Internet and its new business models. Such activity is much less widespread in Pakistan.

While many factors play a role in shaping the Internet within countries, the analysis of Turkey and Pakistan suggests three factors that play particularly important roles: the state of the overall economy, the state of the telecommunications infrastructure, and the often complicated triangular relationship between the government, the telecommunications service provider(s), and the Internet service providers.

The state of the economy has a powerful impact on a number of key factors, such as the affordability of services and the resources necessary to expand infrastructure and promote innovative economic activity. Unfortunately, this is one of the most difficult factors to improve. While neither

country has a particularly strong economy, Pakistan's economy lags Turkey's on all major indicators.

While both countries have invested substantially in expanding telecommunications infrastructure, Turkey's has far greater scope and penetration than Pakistan's. The quality and extent of Internet access within a country depends directly on the basic telecommunications services available to users and ISPs.

While the state of the economy and telecommunications infrastructure set a basic landscape for the Internet, they do not help us understand why the Internet "took off" in these two countries in a relatively short period of time. One of the more interesting aspects of Internet evolution that can help explain this phenomenon has been the relationship between the government, the ISPs, and the telecommunications services providers.

While policy-makers as a whole in both countries have been rather indifferent to the Internet, each country has had a number of policy-makers (some with cabinet level rank) and interest groups that have been strong proponents. In contrast, we have not observed any organized, significant opposition to the Internet by interest groups in either country. A turning point in both countries occurred when policy-makers permitted the creation of privately owned ISPs. Once Internet service became available at affordable (for many) costs, the desire to socialize, be entertained, and access information drew hundreds of thousands of individuals in both countries into cyberspace.

The relationship between the ISPs and the telecommunications service providers, on the other hand, strongly differentiates Turkey and Pakistan. While Türk Telekom was somewhat hostile toward ISPs in the early days of the Turkish Internet, by 1996 it had positioned itself not as a direct competitor of, but as a provider of infrastructure to these new companies and their users. While the relationship has not been free of conflict, it is, on the whole, rather supportive and mutually beneficial.

In contrast, the Pakistan Telecommunication Company Limited (PTCL) and the Pakistani ISPs have had a much more confrontational relationship. PTCL views the ISPs not so much as valued customers for high-capacity services but as competitors of its own ISP, PakNet. At the same time, to enhance its privatization prospects, PTCL has sought to maintain its profit margins on basic services. It has dropped prices more slowly than Türk Telekom and has not provided a national backbone the way Türk Telekom has. While the competition with ISPs has caused PakNet to improve its service and lower its prices, the hostile relationship between PTCL and the ISPs has hindered Internet growth overall.

While there are countries that have taken strong measures to counter the perceived negative effects and threats of the Internet, Turkey and Paki-

stan are not among them. In both countries, the positive perceptions of the Internet as an enabler of economic development and integration have dominated policy-making in this area. The beneficiaries of Internet growth, the ISPs and the commercial interests that are gaining from information dissemination and electronic commerce–related investment and transactions, are increasingly exercising lobbying power to promote support of the Internet. At this point, the window of opportunity for a concerted opposition to dramatically curtail the spread of the Internet is closing.

Each country's government has a range of measures that can be taken to promote the Internet. Some of these are relatively easy: dropping rates for domestic and international connectivity, promoting legislation establishing a proper framework for electronic commerce, and continuing to invest in infrastructure. Somewhat more difficult are the expansion of IT education and the promotion of a competitive environment for all communications services, including basic ones.

The future of the Internet in both countries is promising. Whether and how quickly the Internet will reach its potential and keep pace with other countries, however, depends strongly on measures taken by the governments and the national telecommunications service providers to remove limiting factors.

1. Introduction

In 1969, the experimental ARPANET (Advanced Research Projects Agency Network) being developed by the U.S. Department of Defense consisted of four host computers all located in the United States. England and Norway were added in the early 1970s. In 1980, 213 host computers in less than a half dozen North Atlantic Treaty Organization (NATO) countries were connected. By 1989, only a few years after the ARPANET migrated out of the Department of Defense and became the Internet, connectivity jumped to more than 20 countries and 100,000 host computers.

During the 1990s, annual worldwide growth of both hosts and users was often in the neighborhood of 100 percent, and much higher in some countries. The millionth host was connected in 1992. Today there are over 200 countries with full TCP/IP connectivity, approaching 350 million users.

The spread of the Internet arguably has been one of the most rapid and extensive diffusions of advanced technology in history. Given its present and potential technological features and uses, it was inevitable that the Internet itself, or as a surrogate for similar wide-area networks, would become the object and locus of a great deal of attention, speculation, and conflict. Furthermore, the forms and extent of the absorption of the Internet are viewed by some as a barometer for a nation's level of freedom and democracy, its commercial energy, its desire to become part of the increasingly interconnected new world order and its empowerment therein, and its vulnerabilities.

The Internet has become fertile ground for commentators and visionaries with vivid imaginations. It will do much to bring about world peace and harmony, or it will greatly expand global commerce, or it will be the

locus of forms of information warfare from which nobody who is anybody can be safe, or it will bring about the end of the sovereign state. All this, and much more, is said to be here or on the way via the Internet.

But so far little of this has happened. The Internet is still far less widespread than the telephone or television or radio. It is in fact less widespread, in spite of some awesome growth rates, than many people assume or believe. Its spread and use have been very nonuniform. Much of what there is in many countries is concentrated in one or at most a very small number of major cities, although this is starting to change.

The goals of the Global Diffusion of the Internet Project are:

1. To provide an analytic framework for describing the diffusion and absorption of the Internet to, and within, many diverse countries. The framework should capture a rich set of details that goes well beyond simply counting hosts, yet still be practical and useful.
2. To provide some explanation of how the Internet's present state came about and how it is evolving.

The unit of analysis is the nation-state, and particular attention is being given to policy issues and government roles that arise with regard to the spread and control of the Internet around the world. So far, the Internet is hardly making the nation-state obsolete, but is in fact the source of many additional agenda items for governments to consider.

The project is proceeding by developing a framework for analysis in parallel with an inductive study of a fair number of countries and regions. The two efforts are intended to be complementary: The analytic framework is used for each new country or regional study, and each new country or regional study is used to further test and refine the framework.

The first major report of the project, entitled *An Initial Inductive Study*, was completed in March of 1998.[1] An initial framework was presented, based on one that was developed for national studies over a wider set of information technology topics.[2] A set of variables was defined that provided a six-dimensional description of the status of the Internet in a country, and that could also conveniently represent how this status changed over time. Each variable is intended to describe an important, measurable feature of Internet presence in a country. The six variables chosen were: per capita pervasiveness, geographic dispersion, sectoral absorption, connectivity infrastructure, organizational infrastructure, and sophistication of use. A more loosely defined set of determinants was also put forward with the intent of using these to explain how the national Internet status came to be and how and why it is changing. Since 1998, the project has produced a number of single-country and multicountry studies employing this analytic framework (see http://mosaic.unomaha.edu/gdi.html).

The current report applies the analytic framework to compare and contrast the Internet experiences of two countries, Turkey and Pakistan, through mid-2000. Although historically these countries have not been closely related, there are significant parallels between the two that make them well suited for a comparative study of the absorption of the Internet. Turkey and Pakistan are among the largest non-Arab Muslim countries in the world. In contrast to most of their Arab counterparts, their governments were founded as secular, parliamentary democracies. Both countries have had stormy political histories, however, with periodic coups and authoritarian governments. Each country has firmly entrenched bureaucracies with closed and, to varying degrees, corrupt processes.

Their economies have been similarly troubled, with periods of relative hopefulness punctuated by stagnation and decline. Both countries have suffered from erratic growth rates, high inflation, and high deficits. For most of their histories, their economies were rather closed and autarkic.

In recent decades, each country has taken substantial steps to move toward a more open, market-oriented economy. Each continues to carry out extensive privatization campaigns, both to generate revenue for the central treasury and to invigorate segments of the economy. In these efforts, results have been mixed. In particular, both countries have long tried to privatize their national telecommunications service providers, but only recently have they come close to reaching this objective. Both Turkey and Pakistan have placed a high priority on the expansion of the telephone system, and while by some metrics (e.g., number of main lines per 100 population) Turkey (24 percent) is ahead of Pakistan (2 percent), both countries have made sizable investments in this area and have seen their telecommunications infrastructures grow considerably. Each country has sought, less successfully than had been hoped, to attract foreign investment and integrate itself more fully with the global economy.

Turkey and Pakistan also share a history of serious domestic terrorism as well as persistent conflict with a non-Muslim neighbor, although Pakistan's conflicts with India have burned considerably hotter than have Turkey's with Greece.

In spite of the macro-similarities, there are numerous differences between the two countries. Pakistan is considerably poorer and less developed than Turkey, and it has had more coups and assassinations, deeper economic troughs, greater heterogeneity within its population, and more endemic corruption.

The combination of similarities and differences makes the two countries well suited for a comparative analysis of the Internet. Like the countries more generally, the Internet experiences of the two have similarities and differences that, when analyzed in the context of a broader understanding

of the countries and the factors shaping Internet development, shed light on the reasons why the Internet evolves as it does and can lead us closer to an understanding of the Internet throughout the world.

Chapter 2 provides a description of an analytic framework for studying the global diffusion of the Internet. Chapters 3 and 4 present the development and absorption of the Internet in Turkey and Pakistan, describing its state in terms of the analytic framework's six dimensions.

Chapter 5 presents a comparative analysis of the determinants of Internet diffusion. This chapter offers the most detailed insight into the similarities and differences between Turkey and Pakistan in the factors shaping the Internet's evolution.

Chapter 6, the conclusion, highlights some of the key similarities and differences and concludes with a discussion of measures Turkish and Pakistani policy-makers might take to further promote the Internet in their countries.

2. The Analytic Framework

Most broadly, the framework used in this study consists of *dimensions* and *determinants*. The dimensions are six variables that capture the status of the Internet within a country at a given point in time. Evaluations of dimensions at intervals over time are used for longitudinal studies. Evaluations of dimensions for different countries at the same point in time can support comparisons between countries. Both are used in the current comparison of the Turkish and Pakistani Internets. Determinants reflect those factors that led to the current conditions and will likely influence future development.

What to measure is not as obvious or well established as in other areas, such as telephony. In developing the current framework, researchers tried to balance the needs of theoretical richness with the practical application. 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.

Framework Dimensions

The six dimensions of Internet diffusion are shown in Table 1.

Table 1. Dimensions of the Diffusion of the Internet

Dimension	Description
Pervasiveness	Number of users per capita
Geographic Dispersion	Physical dispersion of infrastructure and access
Sectoral Absorption	Connectivity in various social sectors
Connectivity Infrastructure	Capacity of the technical infrastructure
Organizational Infrastructure	Internet services market characteristics
Sophistication of Use	Integration and innovation

Of the six dimensions, three answer the question, "How much?" The final three reflect structural variables: Connectivity infrastructure represents the degree to which users can effectively communicate via the Internet and the number and speed of a country's international connections. Organizational infrastructure describes the richness and robustness of the Internet service provision market and hence the potential for further proliferation. It also is the dimension that most directly reflects one of the most important variables in Internet diffusion, government policy. The final dimension, sophistication of use, represents the degree to which the technology has really caught hold within a country and become a part of that country's social, economic, and management fabric.

Pervasiveness

Pervasiveness is a function principally of the number of subscribers and hosts per capita. It differs from commonly used Internet growth metrics only in that the final measure of pervasiveness is not an absolute number but a ranking of that number in one of five levels. The intent is to depict the fraction of a population that uses the Internet regularly. Such numbers are not readily available. However, it is often possible to obtain or reasonably estimate the number of subscribers, that is, Internet account holders. The actual number of users is usually larger by amounts that vary greatly from country to country, from ISP to ISP, and even within a country.

Table 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.

Table 2. The Pervasiveness of the Internet

Level 0	**Nonexistent:** 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	**Embryonic:** The ratio of users per capita is on the order of magnitude of less than 1 in 1,000 (less than 0.1%).
Level 2	**Nascent:** The ratio of Internet users per capita is on the order of magnitude of at least 1 in 1,000 (0.1% or greater).
Level 3	**Established:** The ratio of Internet users per capita is on the order of magnitude of at least 1 in 100 (1% or greater).
Level 4	**Common:** The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least 1 in 10 (10% or greater).

Geographic Dispersion

Geographic dispersion describes the physical dispersion of the Internet within a country, there being benefits to having multiple points of presence (POPs), redundant transmission paths, and multiple international access points. Many countries are also subdivided ethnically by geography. High geographic dispersion is a requirement for the Internet to transform the country as a whole and not just a few isolated cities. It often implies less "digital divide" between rich and poor, between urban and rural citizens. Table 3 illustrates the levels of geographic dispersion.

Table 3. The Geographic Dispersion of the Internet

Level 0	**Nonexistent:** The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country.
Level 1	**Single Location:** Internet points of presence are confined to one major population center.
Level 2	**Moderately Dispersed:** Internet points of presence are located in multiple first-tier political subdivisions of the country.
Level 3	**Highly Dispersed:** Internet points of presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	**Nationwide:** Internet points of presence are located in essentially all first-tier political subdivisions of the country. Rural access is publicly and commonly available.

Sectoral Absorption

Sectoral absorption recognizes the differing impacts of the degrees to which four major potential Internet-using sectors of society have taken up the technology: the academic, commercial, health, and public (government) sectors. While the sectors describe the major social and economic divisions in society, none is homogeneous, as depicted in Table 4. Personal use is not considered in this metric.

Table 4. Internet-Using Sectors of the Economy

Sector	Subsectors
Academic	Primary and secondary education, university education
Commercial	Distribution, finance, manufacturing, retail, service
Health	Hospitals, clinics, research centers, physicians/ practitioners
Public	Central government, regional and local governments, public companies, military

Internet use within each sector is rated as rare, moderate, or common, according to the guidelines in Table 5. To rate the country as a whole, each sector with a *Minimal* rating is assigned one point, each *Medium* sector two points, and each *Great Majority* rating three points. If a sector has no Internet presence, it receives zero points. Table 6 translates the points to levels of sectoral absorption.

Table 5. Sectoral Use of the Internet

Sector	Minimal	Medium	Great Majority
Academic (primary and secondary schools, universities)	<10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Commercial (businesses with more than 100 employees)	<10% have Internet servers	10-90% have Internet servers	>90% have Internet servers
Health (hospitals and clinics)	<10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Public (top- and second-tier government entities)	<10% have Internet servers	10-90% have Internet servers	>90% have Internet servers

Table 6. The Sectoral Absorption of the Internet

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

Connectivity Infrastructure

Connectivity infrastructure comprises four components: the aggregate bandwidth of the domestic backbone(s), the aggregate bandwidth of the international IP links, the number and type of interconnection exchanges, and the type and sophistication of local access methods being used. Table 7 depicts how these factors are related to the assessment of the infrastructure's level of development, with Level 0 assigned to a country with no Internet presence (and hence, no infrastructure) and Level 4 assigned to a country with a robust domestic infrastructure, multiple high-speed international links, many bilateral ("peering") and open Internet exchanges—facilities where two or more IP networks exchange traffic—and a variety of access methods in use.

Table 7. The Connectivity Infrastructure of the Internet

Level	Domestic Backbone	International Links	Internet Exchanges	Access Methods
0: **Nonexistent**	None	None	None	None
1: **Thin**	<3 Mbps	<129 Kbps	None	Modem
2: **Expanded**	3-200 Mbps	129 Kbps-45 Mbps	1	Modem 64 Kbps DDN 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

Organizational Infrastructure

Just as the connectivity infrastructure assessed the extent and robustness of the physical structure of the network, organizational infrastructure, derived from the number of ISPs and the competitive environment, assesses the robustness of the market and services themselves (see Table 8).

Table 8. The Organizational Infrastructure of the Internet

Level 0	**None:** The Internet is not present in this country.
Level 1	**Single:** A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	**Controlled:** There are only a few ISPs because the market is closely controlled through maintenance of 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	**Competitive:** The Internet market is competitive, and there are many ISPs due to the existence of low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	**Robust:** 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

To understand the Internet capability of a country, it is necessary to understand not only how many and where people use the services, but also how the Internet is employed. Of particular interest is the point reached when the Internet attracts interest and use outside a narrow community of technicians. A second major milestone is reached when the user community transitions from only using the Internet to creating new applications, sometimes eventually having an impact on the Internet elsewhere. Table 9 depicts the development stages that reflect an increasing sophistication in the use of the Internet.

Framework Determinants

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

Table 9. The Sophistication of Use of the Internet

Level 0	**None:** The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	**Minimal:** The small user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	**Conventional:** 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 for or straightforward enhancement of an existing process (e.g., email vs. post). This is the first level at which we can say that the Internet has "taken hold" in a country.
Level 3	**Transforming:** 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	**Innovating:** 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.

evolve to the state it has. Understanding these factors not only has explanatory utility but also can indicate the principal mechanisms, factors, and policies that may be applied to promote (or hinder) the Internet's development. Figure 1 lists the collection of top-level factors that our research suggests 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 impact the dimensions only indirectly, by shaping other determinants. The arrows reflect the direction of causality between the independent variables (determinants) and the dependent variables (dimensions) used in this study. This is not to imply that other causalities do not exist. For example, government policy-makers may formulate policies in part as a reaction to the state of the Internet itself. Each of the determinants is a rather high-level variable that may consist of a number of more specific variables. We provide a brief description of each, followed by a more precise treatment of the relationship between determinants and dimensions.

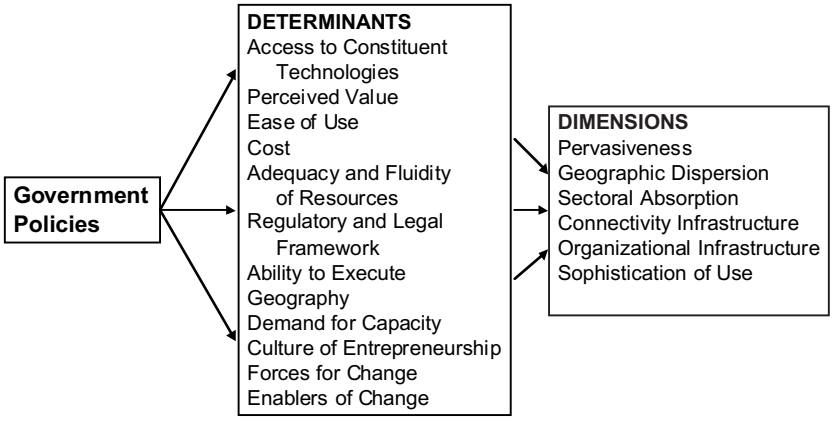

Figure 1. Determinants of Internet Diffusion

Access to Constituent Technologies

Users must be able to access the Internet. Internet services must be available, and users must have access to the personal computers, modems, and dial-up lines or networks by which to access them. Internet service providers must have access to the domestic and international circuits necessary to connect to the global Internet.

Perceived Value

There must be a net perceived value to use of the Internet. Some of the reasons perceived value may increase include communication, entertainment, access to information (e.g., scientific, governmental, etc.), engaging in activism to promote one's agenda, or seeking profit. At the same time, there may be reasons decreasing the perceived value, including objection to social values promulgated on the Internet, the fear of electronic communications, and violations of privacy. For the Internet to be widely used, the net value of using the Internet must be positive for many people.

Individual organizations may view the Internet positively, as a source of competitive advantage or opportunity, or as a threat to entrenched interests, security, etc.

In any country many interest groups and stakeholders may have widely differing views about the value of the Internet. Some may view a robust Internet as beneficial to the country's international image or economic environment. Others may view it as a threat to national security, social values, etc. We postulate that there exists a "balance of national tensions"

that can be calculated (in relative rather than absolute terms) as a function of the number and relative strength of the constituencies on either side of the Internet development question. The nature of this balance of tensions is likely to have a strong impact on policy-making, resource allocation, etc.

Ease of Use

The Internet must be sufficiently easy to use. One of the developments that sparked the explosion of the Internet in the United States was the development of the web browser, which offered a single, integrated, point-and-click interface to a wide variety of information sources. At the same time, users must have the basic literacy necessary to boot up a computer, start an application, and read the contents of a webpage. The Internet may not be perceived as easy to use in countries where there is a dearth of webpages in one's native language, or where a large fraction of the population lacks the ability to read or write.

Cost

The Internet must be accessible at an affordable cost. The cost to the end user is a function of a number of upstream costs, including the rates and terms charged by ISPs to end users, long-distance and local telephone charges for dial-up access, the cost to the ISPs of domestic lines, and the cost of international lines. Clearly, affordability is also a function of income levels.

Adequacy and Fluidity of Resources

Resources fall into five broad categories: financial, informational, human, technological or capital, and material. Material resources—raw materials, energy—are usually not a major issue in the development of the Internet, although there are countries whose power grids reach a limited percentage of the country, are unreliable, or both. Technological resources are, in the case of the Internet, the hardware and software components that constitute the infrastructure: routers, cables, switches, and so forth with the software to make it function. The term human resources refers to the quantity and quality of know-how necessary not only to install an infrastructure but also to keep it operating over time. Informational resources consist largely of the documentation relevant to all the tasks that are part of building and maintaining an infrastructure. Financial resources may often substitute for other resources. For example, granting contracts to organizations with the wherewithal to carry out an infrastructure development project may compensate for shortcomings in technology or know-

how. Financial resources may come through government allocations, domestic private investment, or foreign investment. Fluidity of resources refers to the ease with which resources can flow from where they are to where they are needed. For example, countries in which life-long loyalty to one's employer is common will have much less fluidity of human resources than countries in which loyalty to one's employer is not valued as highly as personal advancement, wages, etc. Countries with well-developed venture capital markets have much greater fluidity of financial resources than those without such markets.

Regulatory and Legal Framework

All wide-area (interorganizational) networks require some sort of agreed-upon regulatory arrangement if the many pieces are to function together. In the case of the Internet, there must exist some provision for allocating IP addresses and domain names in a systematic fashion. The regulatory environment must allow, or at least tolerate, the existence of Internet service provider organizations if Internet access is to be possible. Laws may be passed regarding cyber crime, taxation, accounting, legal status of electronic signatures and documents, and so forth.

Ability to Execute

An abundance of resources and good intentions will not result in expansion of the Internet if the organizations involved in the development of the Internet do not have an ability to execute. The ability to execute reflects an ability to develop a sound strategy and a suitable design given existing opportunities and constraints, and the ability to manage the plans through to completion. The ability to execute may be compromised by political infighting or instability, corruption, red tape, historical legacies (e.g., existing but inadequate infrastructure or legacy hardware/software systems), or simply a mismatch between the scope of the project and the organization's expertise.

Geography

Although the "virtual" quality of cyberspace is often touted, the Internet infrastructure and the people who use it are ultimately grounded on the earth. Countries with large landmass, widely distributed population centers, rough or hostile terrain, or a multitude of islands are likely to find it more difficult to achieve good geographic coverage than small countries free of geographic obstacles. The need to overcome difficult geographies may drive countries to develop or apply new technologies as a means of national integration.

Demand for Capacity

While in some countries the determination of the capacity of the Internet infrastructure may be divorced from the question of real and perceived demand, in most countries existing and projected demand does influence decisions affecting the investment in and design of the Internet infrastructure.

Culture of Entrepreneurship

The willingness and ability of individuals and organizations to pursue activities related to the use or creation of the Internet and Internet services are influenced by the overall culture of entrepreneurship and business creation that exists within a country. In countries where individual initiative is highly valued and failure is not viewed as a serious blow to one's honor or professional career, one can expect to see a broad array of Internet service providers.

Forces for Change

Forces for change are those factors that encourage or facilitate change within a country. For example, a number of scholars have identified a competitive environment as a particularly strong determinant of technological capability.[3] The impetus for change can come from many quarters: competitive forces, strong customer demands, a persuasive champion or agent of change, the opportunity to pursue personal or collective objectives, challenges that prevent the same, a cultural predisposition to change ("change is good") especially in the technical arenas, and mandates or other imperatives such as defeat in war.[4]

Enablers of Change

When a force for change and a receptive user community exist, other factors may influence the degree and nature of change. These factors may be a part of the nation's landscape: the national innovation system,[5] the existence of historical strengths (e.g., Israeli expertise in security issues), the legal framework for creating new companies, and so forth.

Impact of Determinants on Dimensions

Table 10 indicates relationships between the determinants and the dimensions. An *X* in a cell indicates that a particular determinant has a significant impact on a particular dimension. The matrix is not exhaustive; one can imagine some secondary impacts not shown in this matrix.

Table 10. Internet Diffusion Dimensions and Determinants

Determinants	Dimensions					
	Pervasiveness	Geographic Dispersion	Sectoral Absorption	Connectivity Infrastructure	Organizational Infrastructure	Sophistication of Use
Access to Internet	X	X	X		X	X
Perceived Value	X	X	X	X	X	X
Ease of Use of the Internet	X		X		X	X
Cost of Internet Access	X		X	X	X	
Adequacy and Fluidity of Resources		X	X	X	X	X
Regulatory and Legal Framework		X	X	X	X	X
Ability to Execute		X		X		
Geography		X				
Demand for Capacity				X		
Culture of Entrepreneurship						X
Forces for Change	X	X	X	X	X	X
Enablers of Change	X		X		X	X

Examining the *X*'s within a particular column can give some insight into how growth in a particular dimension can be encouraged (or discouraged) through a manipulation of the associated determinants. For example, pervasiveness is a function of access, 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. The presence of forces for and enablers of change will impact the rate of change of

pervasiveness. At the same time, incremental increases in individual determinants may have a positive impact on the dimension. For example, pervasiveness is likely to be improved by the following:

- improving access to the constituent technologies (basic telephone service, Internet services, personal computers, and modems)
- enhancing the perceived value of the Internet (often a social phenomenon, but one that may be enhanced by providing desirable content or making previously laborious tasks—e.g., banking—easier, cheaper, or both)
- making the Internet easier to use (e.g., by increasing local language content or improving literacy rates)
- reducing the cost of access (e.g., through lower ISP subscription rates, reduced costs to ISPs by the telecommunications services providers, etc.)

Correspondingly, pervasiveness can be hindered by making any of these four conditions less favorable.

Government Policies

Government policy belongs in a category by itself, since it overlays all other determinants, affecting both their nature and their effectiveness, based upon a government's ability to exercise coercive power. The policies created by a government are generally intended to achieve the fulfillment of that government's goals, which may be more or less closely related to the goals of those governed, depending upon the form of government. The government's policies may also appear to be more or less rational, depending upon how well the policy reflects the realities of its milieu, but governments can—and all too often do—create policies that reflect a lack of awareness or understanding of their environment or an excessive optimism regarding the government's ability to overcome obstacles to its policies. The most important levers are:

- passage of legislation and directives that shape the legal environment within which a society functions
- enforcement of laws and the wishes of those in control of security forces
- taxation, fees, and other forms of revenue generation
- allocation of resources: financial, informational, technical, human, and material

Governments' ability to apply the levers of power to shape determinants is by no means uniform across determinants. Some determinants, such as geography, are, for the most part, outside the realm of influence of the government. Other determinants, for example resources and legal and regulatory environment, lie firmly within the reach of governments' levers of power. Still other determinants lie somewhere in between. While governments may over time work to create an entrepreneurial culture within a country, for example, this is usually a slow and uncertain process.

3. The Internet in Turkey

Introduction

For thousands of years, the land now part of the Republic of Turkey (Figure 2) has been at the crossroads of major trends and forces of civilization. Straddling the boundary between Europe and Asia both geographically and culturally, Turkey is a land of dramatic contrasts. While 98 percent of the population are Muslim, its government is a secular democracy with a parliamentary system similar to that of many European countries. While its cultural roots are Middle Eastern, this NATO country is seeking membership into the European Union. The western portion of the country, centered around Istanbul, offers a cosmopolitan, urban life for over half of Turkey's population. Most of the country's geography, however, consists of pastoral agricultural regions, barren wastelands, serene coastlines, and harsh, mountainous regions.

History

Today's Istanbul was established as Constantinople, the eastern capital of the Roman Empire, in A.D. 324, nearly a thousand years after its founding by Greek colonists. For almost a thousand years the city was the greatest city in the western and near-eastern worlds. In its prime, this capital of Byzantium boasted an order of magnitude greater population than the next largest city in Europe, and its volume of trade probably exceeded all of Europe put together.

The city fell into decline during the first centuries of the second millennium and was captured by Ottoman Turks in 1261. Over the next four

Figure 2. The Republic of Turkey

hundred years, the Ottoman Empire expanded rapidly, reaching at its zenith in 1600 as far east as Hungary and as far west as today's Iraq.

The Ottoman Empire established a legacy of government dominance of all aspects of the economy. Highly bureaucratic and protective of the power of the sultan, the Ottoman Empire checked the emergence of a class of hereditary nobility and managed the economy in minute detail. Prices of all goods, shipping procedures, the quality of yogurt, the ingredients used in making candles, and the hazard posed by chickens in flour mills were all subject to government decree and regulation.[6] Not surprisingly, such detailed control had a stifling effect on innovation. The Ottoman Empire's contributions to the arts and the sciences were minimal. The sense that the government should take care of all the needs of the people was strong.

The Ottoman Empire declined from the late 17th century through the start of the 20th century. Dragged into World War I on the side of the Central Powers, the Ottoman State barely battled the Allies (which were seeking to capture the Dardanelles) to a stalemate. Following the armistice at Mudros in 1918, an Allied fleet began a military occupation of Istanbul.

In May 1919, Greece landed an army in today's Izmir to reestablish Greek control over lands of classical civilization. Within days, Mustafa Kemal, the country's war hero, organized a nationalist resistance with headquarters in Ankara. One of the first measures by the successful resistance was to separate the temporal power from the religious power, banishing the sultanate and later the caliphate from the land.

The Republic of Turkey was founded in 1923 by Kemal, known as Atatürk, the "Father of Turks." Until his death in 1938, Atatürk introduced a number of social, political, linguistic and economic reforms that form the ideological basis for modern Turkey. Known as "Kemalism," the ideology integrates secularism, nationalism, and modernism and views the West as a source of inspiration and support. During World War II, Turkey fought on the side of the Allies. As part of an effort to stem Communist expansion in the countries bordering the Turkish Straits, Turkey joined the North Atlantic Treaty Organization (NATO) in 1952.[7]

Politics

The Republic of Turkey has had a tempestuous political environment that, while democratic, has been characterized by frequent periods of instability and authoritarian rule. From 1923 through 1950, Turkey was governed under one-party rule by the Republican People's Party (CHP) established by Atatürk. The Democratic Party ruled until 1960, when it was overthrown by a military coup. A new constitution was written and

civilian rule reinstated in 1961. Between 1961 and 1965 coalition governments ruled Turkey. In 1965 and 1969, the Justice Party (JP), led by the president of Turkey, Suleyman Demirel, won sizable majorities in the Grand National Assembly and ruled alone. Political agitation and violence by left- and right-wing extremists in the late 1960s and early 1970s led to a "coup by memorandum" in 1971. Demirel's government resigned, and for the following two years a succession of "above party" governments ruled. Although the CHP emerged as the largest party under the leadership of today's prime minister, Bulent Ecevit, in the 1973 elections, Turkey was ruled by a succession of unstable coalitions from 1973 to 1980, led alternately by Demirel and Ecevit.

By 1980, Turkey's economy was in steep decline, and domestic political violence was claiming 20 victims per day. The Council of National Security (CNS) forcibly restored order on September 12, banning political activity, dissolving political parties, capturing thousands of terrorists, and confiscating large volumes of weapons and ammunition. The CNS began work crafting an economic austerity program authored principally by Turgut Ozal, deputy prime minister from 1980 to 1982.

A national referendum approved the current constitution on November 7, 1982, and simultaneously elected the leader of the CNS, General Kenan Evren, to a seven-year term as president. In 1983, political parties were once again permitted to form, provided that none of their leaders had been leaders before 1980. In 1983, the Motherland Party (ANAP), founded by Turgut Ozal, obtained a majority in the Grand National Assembly and began implementation of the austerity program. The 1980s were a period of uncharacteristic political stability, as Ozal's party maintained a comfortable majority in the Grand National Assembly until 1989.

Since the late 1980s, governments have changed frequently, including a parliamentary crisis in 1995 and 1996 in which: the leading parties (True Path Party under Tansu Çiller and the CHP under Deniz Baykal) failed to form a coalition; a minority government under Çiller lost a no-confidence vote; national elections gave nearly equal representation to the True Path Party, the Motherland Party, and the emerging Islamic-oriented Welfare Party (RP); and the mainstream True Path and Motherland parties failed to form a stable coalition. Recent developments have not been much more hopeful. A July 25, 1999, headline summarized the state of affairs: "Domestic Politics in Tatters."[8]

Turkey continues to struggle with a number of internal and external issues. Since the mid-1980s, the Kurdistan Workers Party (PKK) has been trying to establish an independent Kurdish state in southeastern Turkey. Terrorist attacks have been a prominent tool of the organization. In recent years, the government has engaged in counterinsurgency operations

that have reduced violence in the region's urban areas and resulted in the capture of leading PKK officials, including Abdullah Öcalan and Cevat Soysal.

In 1974, Turkey sent troops to Cyprus to protect the Turkish Cypriot community following the overthrow of the Cypriot government by mainland Greek officers in the Cypriot national guard. In the fighting that followed, Turkey occupied the northern part of the island, which is now known as the Turkish Republic of Northern Cyprus. The unresolved partitioning of the island remains a point of disturbance in Turkey's relationship with the United States and the European Union as well as with Greece.

Economy

In 1923, Atatürk established Turkey's economy as one that was state-directed, near autarkic, and oriented toward import substitution. The economy remained based on these principles until the coup in 1980. In this year the government began to implement an austerity program designed by Turgut Ozal that was based on a philosophy of greater reliance on market forces, decentralization, export-led development, lower taxes, foreign investment, and privatization. These reforms brought Turkey substantial gains, with the gross national product (GNP) enjoying the highest growth rate of any OECD (Organization for Economic Cooperation and Development) country.

During the 1990s, however, weak and uncertain governments and strong entrenched interests prevented the country from following through on many of the reforms initiated in the previous decade. The Turkish government's inability to limit expanding fiscal deficits and high transfers to inefficient state economic enterprises led to an economic crisis in 1994. From 1993 to 1994, the Turkish economy contracted by 11 percent.[9] An austerity program implemented in April 1994 helped the economy grow in 1996 and 1997.

Turkey's economy recovered somewhat during the latter half of the 1990s (see Table 11), although structural reform efforts have had only partial success. The principal economic problem remains inflation, which in 1998 was 75 percent annually. The government has failed to seriously improve the efficiency of tax collection and the streamlining of the social security system, both of which are necessary to relieve pressure on the state budget.[10]

An area of recent success has been privatization. Although sales of state economic enterprises have been below the targets set for the privatization program, Turkey did sell $3.2 billion in public assets in the first half of 1998, almost as much as in the years 1986–1997 combined.[11]

Table 11. Turkey in Statistics

Population	64.57 million (July 1998 estimate)
Population growth rate	1.6% (1998 est.)
GDP	$200 billion (1999 est.)
GDP per capita	$3,200 (1999 est.)
Inflation rate	99% (consumer price index, per annum)
Telephones	14.3 million (1995 est.)
Teledensity	24.11 main telephone lines per 100 inhabitants (1998)
Personal computers (PCs)	1.1 million (1997 est.)
PC density	1 PC per 56 individuals
Literacy rate	82.3% of those age 15 and over can read and write
Infant mortality	38.27 deaths per 1,000 live births (1998 est.)

Sources: Bureau of European Affairs, *Turkey: Background Notes* (Washington, D.C.: U.S. Department of State, October 1999), <http://www.tradeport.org/ts/countries/turkey/bnotes.html> (Oct. 14, 2000); "Increase in Number of Cellular Phones in Turkey," *Istanbul Hurriyet* (January 22, 1999): 7; Ministry of Transport, *The Current Situation and Trends in the World: Sub-tasks, Executive Summary* (Turkish National Information Infrastructure Project [TUENA], January 1998); "Turkey: Recent Economic Developments and Selected Issues," *IMF Staff Country Report No. 98/104* (Washington, D.C.: International Monetary Fund, 1998), <http://www.imf.org/external/pubs/ft/scr/1998/cr98104.pdf>; U.S. Department of Commerce, *Turkey: World Factbook* (Washington, D.C.: National Trade Data Bank, May 6, 1999), <http://www.tradeport.org/ts/countries/turkey/wofact.html> (June 23, 1999).

One of the most important enterprises currently in the process of being privatized is Türk Telekom, the state telecommunications company.

Geography and Demographics

The Republic of Turkey occupies over 780,000 square kilometers, slightly more than the state of Texas. Over 60 percent of its population of 64.57 million (July 1998 estimate) live in urban areas.[12] The population is overwhelmingly Muslim (98.8 percent, mostly Sunni); 80 percent are ethnically Turkish, while approximately 20 percent are Kurdish. The latter live predominantly in the eastern portion of the country.

Turkey is divided between Europe and Asia. The small European portion lies to the west of the straits that separate the two continents. The Asian portion of Turkey consists of a large, dry Central Plateau that rises to mountains in the east, many of which exceed 3,000 meters in height. The East Black Sea Mountains lie along Turkey's northern Black Sea coast. To the south, the Taurus range parallels the Mediterranean Sea.

Turkey is divided into an unusually large number (80) of first-tier administrative subdivisions, called provinces *(iller)*.

Networks in Turkey

A Brief History of Telecommunications

Until 1994, the postal and telecommunications services were provided by the Post, Telegraph, and Telephone (PTT) company, which was a state economic enterprise under the control of the Ministry of Transport and Telecommunications (MTT). In 1994, the parliament passed a law that split the post and telecommunications functions, incorporating the telecommunications division as Türk Telekom, a joint stock company whose shares are 100 percent owned by the government. Türk Telekom holds a monopoly on the provision of both domestic and international telecommunications lines and services.

The growth of networking in Turkey is closely associated with the expansion of telecommunications services, which began a rapid advance during the 1980s. From the installation of the first telephone exchange in Turkey in 1909 through 1980, telephone line density had grown to only approximately 2.5 lines per 100 inhabitants. There were nearly as many people waiting for telephone lines as there were lines (1.5 million), yet the number of lines was growing at the very modest rate of 50,000 lines per year. Over 72 percent of Turkey's 40,000 villages had no telephone service.[13]

The austerity program crafted by Turgut Ozal and later implemented by his administration during the 1980s placed a high value on expansion of telecommunications services, which the program's authors viewed as a vital foundation to support the expanded and vibrant economy envisioned. This emphasis on telecommunications was motivated from three principal quarters. First, the army, the second largest in NATO, demanded a strong telecommunications infrastructure. Second, the open economy espoused by Ozal and others required a quality telecommunications infrastructure. Third, during the early 1980s, the instability in Lebanon was causing many companies to look for safer havens in the Middle East. The lack of a good telecommunications infrastructure was a barrier to attracting these companies.[14]

A master plan for telecommunications was drawn up, emphasizing rapid expansion of the telecommunications network, development of new services, and the cultivation of a competitive telecommunications environment.[15]

The effects of the master plan and its implementation soon became evident. Between 1982 and 1986, the total capacity of telephone exchanges

increased by 83 percent. The number of telephone subscribers grew by 80 percent, and the number of villages having telephone service grew by 162 percent.[16] By 1988, all Turkish villages had telephone service.

The growth of data networks has been driven by many of the same factors that fueled the growth in telephone and broadcast communications networks. The economic policies crafted after the 1980 coup established the importance of creating an infrastructure to support the flow of information, both voice and data, throughout the economy. During this decade Türk Telekom built or oversaw the development of the first switched data network and the creation of TURPAK, an X.25 packet-switched network.[17] At the same time, Turkish universities were establishing a wide-area network to support data communications among Turkish universities and academic institutions in Europe. In 1986, Turkish universities established a BITNET ("Because It's Time" Network) connection between Ege University in Izmir and the European Academic and Research Network (EARN) via Pisa, Italy, through a 9,600 bps leased line.[18] The network was named the Turkish Network of Universities and Research Institutes (TÜVAKA).

The Origin of the Turkish Internet

The first activities to establish an IP-based network started in 1989. The group of network managers of TÜVAKA nodes first proposed such a network instead of BITNET during an Istanbul meeting. In 1993, the Middle East Technical University (METU) and Turkish Scientific and Technical Research Council (TÜBITAK) established a dedicated 64 Kbps Internet connection between METU and the U.S. National Science Foundation (NSF) with funding from Turkey's State Planning Organization. TÜBITAK is the organization principally responsible for funding scientific and technical research in Turkey, analogous to the United States' National Science Foundation. Unlike the NSF, however, it has its own research centers. The decision to connect to NSF rather than the Center for European Nuclear Research (CERN) was based on traffic analysis of the EARN/BITNET connection, which showed that about 80 percent of the traffic entering Turkey came from the United States, and most of the international traffic originating in Turkey also terminated in the United States. The connection with NSF marked the official birth of the Internet in Turkey. At the same time, METU and TÜBITAK also formed an informal organization known as TR-NET to promote the use of Internet technologies throughout Turkey.[19]

Users and user organizations could connect to TR-NET through leased lines, X.25 connections, and dial-up. In 1994, TÜBITAK and METU be-

gan issuing accounts. The number of users grew rapidly. By early 1995, the number of hosts had grown to nearly 3,000, and the total number of daily users was estimated to be 10,000–15,000. Of these users, more than 1,300 had individual connections; others accessed TR-NET through more than 100 connected institutions. Personal applications were being received at the rate of about 200 per month.[20] At these levels of usage, the international link to NSF was saturated; it was later upgraded to 128 Kbps.

It was clear that the informal association between TÜBITAK and METU was an insufficient foundation on which to build broader diffusion of the Internet in Turkey. Although TR-NET was charging institutions and individuals for their connections, these charges were low. Major funding for TR-NET's infrastructure came from the METU and TÜBITAK annual budgets.

Until 1995, Türk Telekom had taken a rather relaxed attitude toward the Internet, even though one might argue that the Internet represented a new form of communications that should be under Türk Telekom's jurisdiction. This attitude was in part a result of a lack of awareness on Türk Telekom's part of the significance of the Internet, and partly a function of the embryonic, experimental nature of the networks in Turkey. When TÜBITAK and METU approached Türk Telekom in 1995, however, the company began to take a more serious interest in the Internet. Questions were raised about the constitutionality of having organizations other than Türk Telekom provide services; moreover, the previous 15 years of telecommunications development had created a precedent of Türk Telekom expanding services into emerging areas.

In promoting the Internet, Türk Telekom had to balance multiple factors. One requirement was that the backbone should be provided under an arrangement that would preserve Türk Telekom's mandate to be the sole provider of communications services. At the same time, Türk Telekom did not have in-house the resources or expertise to manage a large Internet service provider operation to hundreds of thousands of end users. The model that emerged was one in which Türk Telekom owned the backbone; end users would be served by service provider organizations that would be required to connect to the backbone.

The prospects of finding the funds within its own budget to build a backbone were almost nonexistent, however. Because it is a government organization, Türk Telekom returns all of its annual revenue to the government. In turn, Türk Telekom receives an annual budget from the state treasury, as outlined by the State Planning Organization. The company is not permitted to borrow money or sell equity to finance investments as private companies do.[21] In 1995, the year following the introduction of a government austerity program, the prospects of coaxing funding for what

was still a technology virtually unknown to policy-makers, the press, and the general population were vanishingly small.

Given the circumstances, Türk Telekom fell back on the only alternative model it knew for financing new development: revenue sharing. Under a revenue-sharing model, Türk Telekom partners with an organization to undertake a development project. The partner provides all of the investment capital and often a portion of the expertise. Türk Telekom and the partner divide the revenue from the project in negotiated proportions. The revenue portion Türk Telekom receives is very attractive because it does not need to be passed along to the state treasury. Türk Telekom has control over these funds and, for the most part, spends them as it wishes.

On September 28, 1995, Türk Telekom announced a tender for the creation of an Internet backbone for Turkey. An auction followed in October and November, and the winner was announced at the annual Internet conference on November 16 the same year.[22] Initially, there were four bidders:

1. MCI, partnering with Likom, a Turkish software company, and Nurol
2. IBM
3. ITD Laserex, an Israeli company
4. a consortium consisting of GlobalOne (the international consortium between Sprint, Deutsche Telekom, and France Telecom), Satko, and METU

TURNET

The tender was to be awarded through a two-stage process. First, the participating companies would submit closed bids, which would be opened at the same time. Second, Türk Telekom would conduct an open auction, beginning with a revenue-sharing level equal to the most favorable bid. At the Internet conference at Bilkent, the consortium of GlobalOne, Satko, and METU was announced as the winner, with an offer of 70.2 percent. The TURNET contract was signed on March 1, 1996, for a seven-year term. Each year, Türk Telekom's share was to increase, reaching 79.6% at the end of the seventh year.[23] The consortium initially invested $1.5 million. TURNET began offering service in October 1996.

TURNET Topology

Once the award was made to the GlobalOne consortium, discussions began on topology. METU had been included in the consortium for its technical expertise. Not surprisingly, the topology proposed by METU in the spring of 1995[24] was chosen. The topology was simple, laid out as a tri-

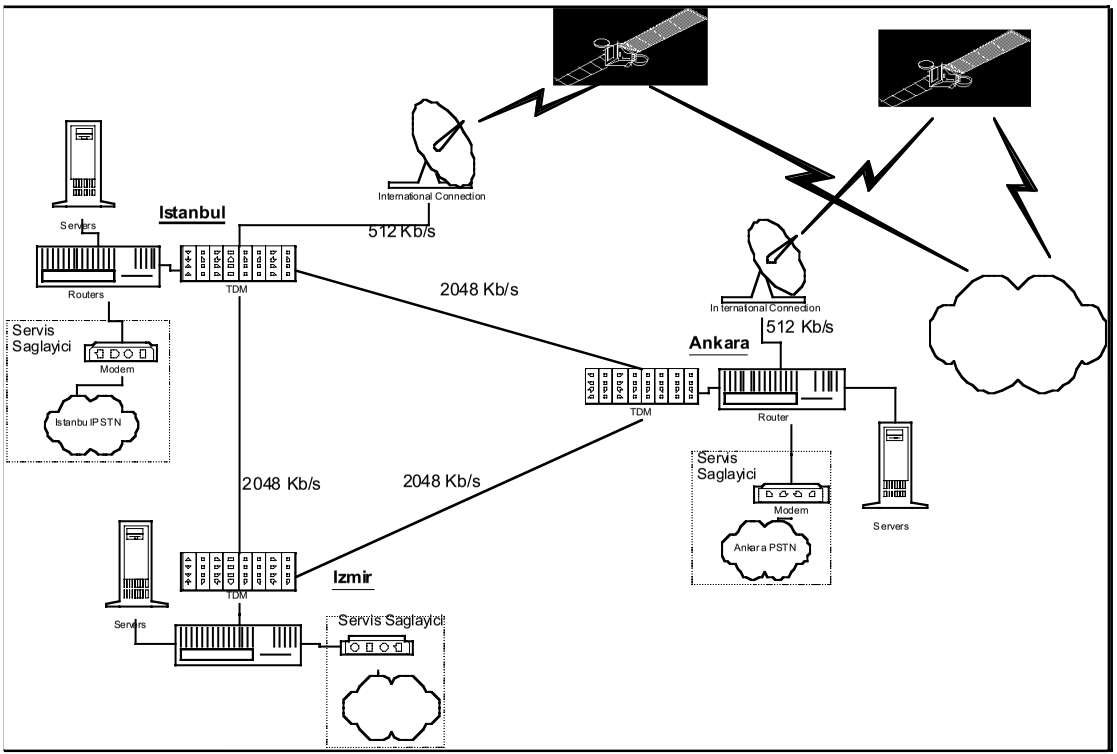

Figure 3. TURNET Topology (October 1996)

angle with corners in Istanbul, Ankara, and Izmir, as shown in Figure 3. The backbone itself consisted of three 2 Mbps links and two international connections, each 512 Kbps.

Between 1996 and 1999, the backbone was upgraded, but not significantly. In 1997, Ankara's link to Sprint was upgraded to 2 Mbps, and an additional 2 Mbps link to Sprint was established from Istanbul. A review of TURNET routers in September 1999 revealed the domestic and international backbone links and capacities shown in Figure 4. While the backbone links terminating in Izmir had the same capacity as they did in 1996 (even though traffic regularly reaches maximum capacity from about 9 a.m. until 4 p.m.), the capacity between Istanbul and Ankara was increased by 300 percent through the addition of two new frame relay lines, with 2 Mbps and 4 Mbps capacity. The international capacity has also increased substantially, so that now Istanbul and Ankara each have three 2 Mbps fiber-optic links to AT&T, Sprint, and MCI/Worldcom, all terminating in the United States.

Emergence of Internet Service Providers

Once TURNET went online in the fall of 1996, the Internet service provider (ISP) market exploded. Prior to TURNET, fewer than 10 companies offered Internet service. By the end of the first year of operation, the total number of ISPs leasing connections to TURNET was 69.

Between September 1997 and May 1999, the dynamism of the ISP market and some constraints were apparent. The aggregate capacity of connections to the backbone increased by 164 percent, but the number of ISPs increased by only 16 percent. Of the 69 ISPs in operation after TURNET's first year, 15 (22 percent) failed to survive until May 1999. During the same period, 26 new ISPs came into existence.

The barriers to entry for ISPs were low. There were no licensing fees to speak of. The costs are in hardware, connection fees, personnel, and operating costs. The technical barriers to entry were low in Turkey because of the requirement that all ISPs had to connect to TURNET. A new ISP did not need to acquire for itself an international connection; it merely needed to obtain a leased line from Türk Telekom to TURNET, a much simpler and cheaper proposition. Because the ISP market is unregulated, ISPs are free to offer whatever services they wish and charge whatever price they can. Competition for customers is intense and has led to some creative marketing strategies. For example, VestelNet, the ISP owned by a leading manufacturer of electronic equipment, in May 1999 began offering users a free personal computer when they sign up for three years of service at $30 per month. The company was signing up new users at the rate of 50,000 per month.

Figure 4. TURNET Backbone (September 1999)

Source: TURNET, <http://www.turnet.net.tr:/cgi-bin/port/mporttra.cgi> (September 3, 1999).

There remained two principal constraints on ISPs. First, the backbone capacity of TURNET did not increase at a rate commensurate with the growth in ISP connectivity. While the overall capacity of the backbone doubled from 1996 to 1999, the aggregate capacity of ISP connections tripled from 1997 to 1999.

Second, ISPs have been restricted in their ability to acquire additional infrastructure, particularly international connectivity. International connections had to be acquired through Türk Telekom. Türk Telekom had clear policies prohibiting a company from using the links to carry third-party data. At the outset of TURNET, ISPs had little choice but to rely on the international connectivity provided by TURNET. As Internet services became more popular, however, Türk Telekom eased some of these restrictions, permitting, for example, a designated set of so-called international business service providers to sell international connectivity. Today, all of the largest ISPs and several universities have their own international satellite links, in addition to their connection to TURNET. Some ISPs have direct international capacity that is nearly equivalent to TURNET's total international capacity.

The creation of the ISP market marked a significant shift in the way communications and related services are offered in Turkey. While the legal framework did not change substantially, policy and practice permitted, for almost the first time, private companies to offer communications services under something other than a revenue-sharing arrangement. ISPs paid a fixed monthly fee for their leased lines rather than a fraction of revenue, and Türk Telekom placed no restrictions on the kinds of services that could be offered or the prices that would be charged for these services.

Operational Issues

While the winning TURNET bid of 70 percent of revenue to Türk Telekom seemed incredibly favorable to the company, it turned out to be seriously flawed. First, any investment in the network had to be paid for by the winning consortium. Since the consortium was receiving only 30 percent of TURNET revenue, it could not spend a great deal on the network and still realize a profit. In practice, the financial arrangements created disincentives to investment, and under the terms of the agreement, Türk Telekom was not permitted to invest any money in TURNET. Second, Türk Telekom performed only routine operational management of the backbone and was forbidden to make investments in its expansion. As a result of the shortcomings of the legal and financial arrangement under which TURNET was organized, the capacity of TURNET did not keep up with demand. International links were completely saturated for most of the daytime hours.

0822 Service

The TURNET backbone provided local access to a very limited geographic area, albeit one that is home to nearly half of the country's population. The 0822 service was one of the indicators of the eagerness of policy-makers within Türk Telekom and the Ministry of Transport and Telecommunications to make the Internet accessible throughout the country. The number 0822 is an access code (similar to area codes in the United States). Internet service providers may be given an 0822 number that subscribers may use to establish a dial-up connection to their ISP. What is distinctive about this number is that the per-minute rates are lower than local telephone calls.[25] This is true even for long-distance calls from the far eastern portion of the country. Although the quality of connections is occasionally problematic, the 0822 access service provided for the first time, at Türk Telekom's expense, Internet access in all provinces and villages in the country.

TTNet

By 1997 the technical and operational shortcomings of TURNET had become severe enough that a significant change or upgrade had to be made to the network. In that year the government of Turkey changed, and a new minister, Necdet Menzir, was appointed to the Ministry of Transport and Telecommunications. At the encouragement of H. Tahir Dengiz, the undersecretary of MTT who is the leading Internet advocate within the ministry, he became the first MTT minister to take an active interest in the Internet. Recognizing the potential of the Internet, he accepted recommendations to invest heavily in infrastructure.

The question of how to fund development of a new national infrastructure was a pressing one. By 1997, awareness of the Internet in policy-making circles was substantially greater than in 1995. Efforts by leading advocates within Turkey had succeeded in convincing many policy-makers of the importance of the technology. They, the populace, and the press could not fail to see the attention being paid to the Internet in international circles. The new environment, coupled with the failure of the organizational arrangements on which TURNET was based, convinced Türk Telekom to seek direct funding for the new backbone. The government agreed to allocate $35 million for the purchase of equipment and expertise to build a national ATM (asynchronous transfer mode) network, called TTNet. The contract was awarded to Alcatel after a competitive bid.[26]

The proposed topology of TTNet is shown in Figure 5.

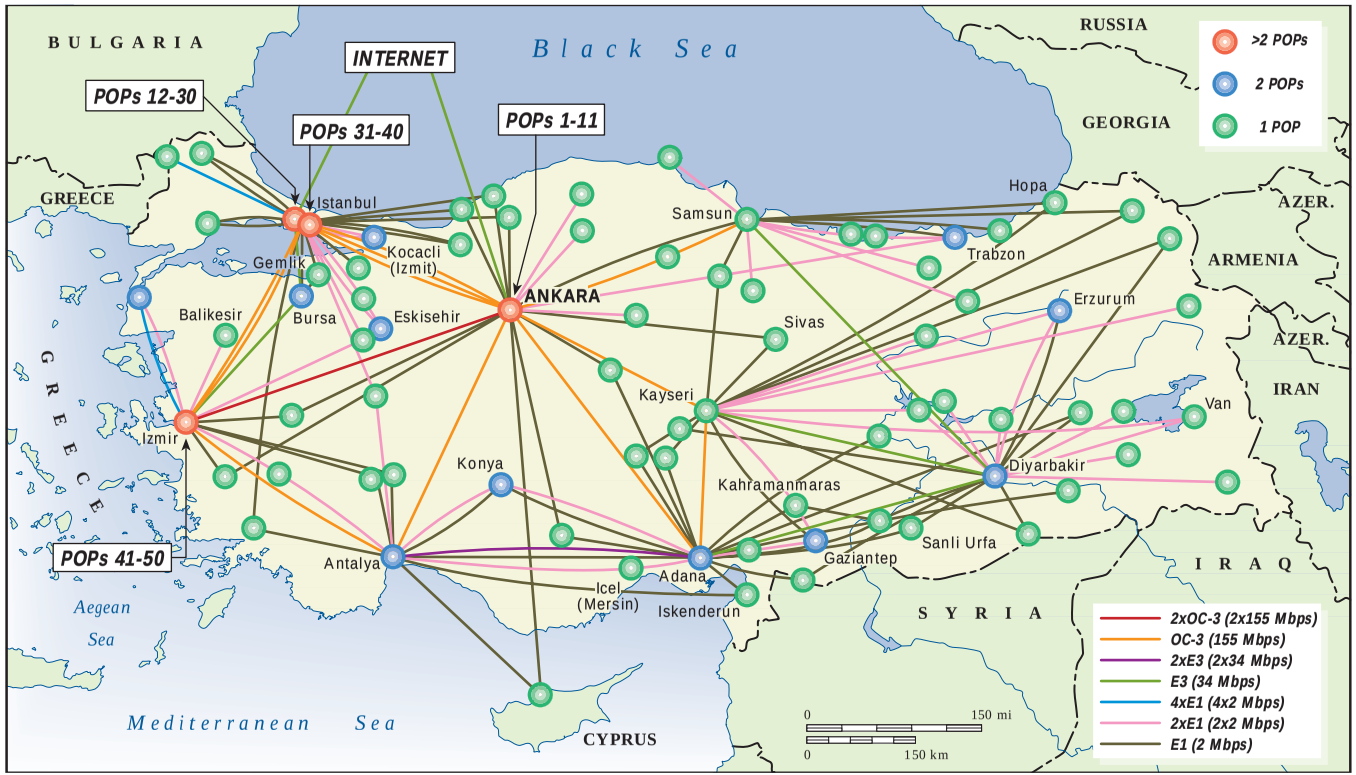

Figure 5. TTNet Topology

Source: TTNet Haberler-Duyurular, <http://www.telekom.gov.tr/ttnet/haber-port-son.html> (June 24, 1999).

TTNet is a quantum improvement over TURNET for four principal reasons. First, it offers a huge increase in both domestic and international capacity. The aggregate capacity around the Istanbul–Izmir–Ankara triangle is increasing by nearly two orders of magnitude. International capacity is increasing more than five times. Second, the geographic scope of the Internet is expanding far beyond the Istanbul–Izmir–Ankara triangle. While very basic dial-up connectivity at reasonable rates has been available nationwide for some time, TTNet will offer the first multi-Mbps access to the southern and eastern portions of the country. The availability of access through the backbone itself will reduce the load on intercity public switched telephone network (PSTN), further improving the quality and availability of the latter service. Third, because much of the backbone is based on a fiber, ATM network, TTNet provides a foundation for offering to customers various value-added services, including quality-of-service levels such as priority routing, security, etc. Fourth, because it offers much enhanced capacity, TTNet is likely to cause the demand for international satellite connections to decrease, causing price reductions.

The TTNet rollout has taken longer than anticipated. Through much of 1999, Türk Telekom announced that TTNet would begin offering services "next month."[27] By July and August, traffic finally began moving across some TTNet links in a trial capacity. By November 1999, only nodes at Istanbul and Ankara were reportedly functioning. While the network continues to expand, it has not reached the 140 points of presence envisioned.

ULAKNET

In 1995, as TURNET was being established, TÜBITAK decided to get out of the business of directly supporting the Internet in Turkey. However, a TÜBITAK working group recommended the development of a national education network. At the same time, TÜBITAK was being asked to assume responsibility for the Central Library managed by the Higher Education Council. By the mid-1990s, it was clear that a growing portion of scientific information was electronic, or would be in the future. TÜBITAK agreed to assume responsibility for the library, provided it also obtained responsibility for establishing a national educational network. On June 1, 1996, the National Institutional Network and Information Association (ULAKBIM) was created as a center of TÜBITAK.[28] ULAKBIM's mission is to give technical help for the national information system by creating connections between information centers.

Figure 6. ULAKNET Backbone

As soon as ULAKBIM was founded, work began on the creation of a national academic network, called the Ulusal Akademik Ag (Net)—ULAKNET.

ULAKNET Topology

ULAKNET's backbone topology looks a great deal like TURNET. It consists of a triangular loop linking Istanbul, Ankara, and Izmir, albeit of much higher E3 (34 Mbps) capacity. Each university connects to the backbone through one of these three points via a frame relay connection of between 64 Kbps and 2 Mbps.

ULAKNET is connected to the international Internet through three asymmetric connections that offer greater capacity for traffic to Turkey than for traffic from Turkey. The ULAKNET backbone and international connections are shown in Figure 6. Each of the international connections terminates in the United States.

Growth of ULAKNET

Once the first node (Ege University) was connected to the ULAKNET backbone on February 14, 1997, expansion of the network was rapid. ULAKBIM data indicate that the number of nodes connected to the network had grown to 120 by July 1999 and was anticipated to reach 160 by the year 2000.[29]

Analytic Framework Dimensions

Pervasiveness

Table 12 collects estimates of the numbers of subscribers and users. The figures from Çagiltay are based on an analysis of the domain name server at METU. The analysis calculates the number of computers connected to the Internet through an analysis of unique IP addresses and assumes that there are 10 users for each such computer. These are the largest figures quoted, and, as such, they represent something of an upper bound on the number of users. While all such figures are estimates and subject to critique, they show rapid growth of the Internet over the last year, pushing Turkey from a Level 2 *(Nascent)* to a Level 3 *(Established)* in 1999, shown in Table 13. Growth appears to have continued unabated in the year 2000, showing perhaps a 300–400 percent increase from mid-1999 to mid-2000 and another 300 percent increase by the end of 2000. At the time of this writing, there could be 2–2.5 million Turks using the Internet.

Table 12. Estimates of Numbers of Internet Users

Date	Subscribers	Users (% of population)
mid-1993		<1,000 (<0.0015%)[a]
mid-1994		10,000* (0.015%)[a]
early 1995		>15,000 (0.02%)[b]
mid-1995		35,000* (0.05%)[a]
mid-1996		100,000* (0.15%)[a]
mid-1997		250,000* (0.4%)[a]
mid-1998		150,000 (0.2%)[c]
late 1998		300,000 (0.5%)[d,e]
May 1999		700,000 (1.1%)[f]
July 1999	300,000	600,000-700,000 (1.0%)[g]
July 1999		850,000 (1.3%)[a]
April 2000		1.5 million (2.25%)[h]
July 2000	1,135,000[i]	
Dec. 2000 (est.)	3,200,000[i]	

Sources:

[a] K. Çagiltay, "Bilgisayar Sayisi" ("Quantity of Computers") (July 1999), <http://php.indiana.edu/~kursat/hosts/page3.html> (September 14, 1999).

[b] A. Özgit, K. Çagiltay, and E. Taner, "Turkish Internet (TR-NET): Policies for Organizational Framework and Funding" (April 30, 1995), <http://isoc.bilkent.edu.tr/HMP/PAPER/102/html/paper.htm> (May 29, 1999).

[c] "Turkey's Internet Links Ready to Expand," *Reuters News Service* (August 11, 1998).

[d] M. Akgül, "Turkish Internet: An Evaluation at 6 Years," <http://yardim.bilkent.edu.tr/turkce/Yazilar/cbt/yil6.htm> (July 7, 1999).

[e] Alcatel, "The Spacebus Family," <http://www.alcatel.com/telecom/space/products/bus/spbustab2.html> (August 26, 1999).

[f] K. Çagiltay, "Bilgisayar Sayisi" ("Quantity of Computers") (May 1999), <http://www.cc.metu.edu.tr/~kursat/hosts/page3.html> (July 8, 1999).

[g] H. Tanriöven, conversation with Peter Wolcott, July 16, 1999.

[h] M. Akgül, "Internet Haftasi Acis Konusmasi" (April 12, 2000), <http://internethaftasi.org.tr/akgul-2000.html> (May 18, 2000).

[i] K. Çagiltay, "Detayli Analizler" ("Detailed Analysis"), <http://php.indiana.edu/~kursat/hosts/detaylianalizer-eng.htm> (August 13, 2000).

* Based on a graph of the growth of number of computers connected to the Internet in Turkey, assuming the 10:1 ratio between the number of users and the number of computers connected. While this assumption is, in all likelihood, wrong, it establishes something of an upper bound on the number of users.

Table 13. Pervasiveness of the Internet in Turkey

Level 0	**Nonexistent:** 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	**Embryonic:** The ratio of users per capita is on the order of magnitude of less than 1 in 1,000 (less than 0.1%).
Level 2	**Nascent:** The ratio of Internet users per capita is on the order of magnitude of at least 1 in 1,000 (0.1% or greater).
Level 3	**Established:** The ratio of Internet users per capita is on the order of magnitude of at least 1 in 100 (1% or greater).
Level 4	**Common:** The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least 1 in 10 (10% or greater).

Geographic Dispersion

As currently defined in the analytic framework, geographic dispersion is a function of the fraction of first-tier political subdivisions with an Internet point of presence. Turkey is an unusual country in this regard because it has an unusually large number of first-tier political subdivisions (80 provinces) for a country of its geographic area and population. Nevertheless, Turkey is characterized by a rather dramatic jump from a very low degree of geographic dispersion to a very high degree, with a short transitional period consisting of an unusual means of achieving ready access throughout the country.

In 1993, METU and TÜBITAK connected to the Internet in Ankara. Through 1994, these organizations, through TR-NET, were the sole providers of Internet connectivity. All other nodes connected to them via leased lines. By 1995, access to TR-NET was also available through Istanbul Technical University. With the creation of TURNET, in 1996, the number of cities with Internet points of presence expanded to three, leaving Turkey between Level 1 *(Single Location)* and Level 2 *(Moderately Dispersed)* (see Table 14). By 1999, ISPs had expanded their coverage through leased lines to the backbone to a total of 19 cities.

In 1997 Türk Telekom began offering ISPs 0822 access numbers. Users could dial their ISP using this access code from anywhere in the country and

pay metered rates that were less than those for local telephone calls. While ISP POPs were located in only three cities, Internet access became available in small cities and villages at costs that were no greater than for users in the major cities. In effect, the Internet became readily available throughout the country. Thus, while actual ISP POPs exist in only a minority of Turkish provinces, Internet access is effectively nationwide. In 2000, the 0822 plan, which involved a single code for the entire country, was changed to a regional arrangement. In each of the seven regions, ISPs would be given a special access number by which users within that region could access them. To be reached, the ISP would have to have a point of presence within the region. Consequently, the Internet is reachable in all regions, but users in individual regions may not have the same choice of ISPs as earlier.

Table 14. Geographic Dispersion of the Internet in Turkey

Level 0	**Nonexistent:** The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country.
Level 1	**Single Location:** Internet points of presence are confined to one major population center.
Level 2	**Moderately Dispersed:** Internet points of presence are located in multiple first-tier political subdivisions of the country.
Level 3	**Highly Dispersed:** Internet points of presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	**Nationwide:** Internet points of presence are located in essentially all first-tier political subdivisions of the country. Rural access is publicly and commonly available.

Sectoral Absorption

The absorption of the Internet in various sectors of the Turkish economy is very uneven (see Table 15). In some subsectors, tertiary education in particular, nearly all institutions are connected. In other sectors, such as health care and government, Internet use is more the exception than the rule. The commercial sector lies between the extremes. While the Internet is not common among Turkish companies as a whole, it is penetrating this sector at a rapid rate. Figure 7 shows the number of domain names in each of the principal .tr subdomains for the months June 1999 through July 2000.

Overall, we estimate that sectoral absorption was at Level 1 *(Rare)* 1993–1995 and Level 2 *(Moderate)* since then (see Table 16). Rapid growth in Internet use in the commercial sector and the introduction of TTNet services to all areas of the country could result in Turkey's moving to Level 3 quite shortly.

Table 15. Absorption of the Internet in Sectors of the Turkish Economy

Sector	Minimal	Medium	Great Majority
Academic (primary and secondary schools, universities)	<10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Commercial (businesses with more than 100 employees)	<10% have Internet servers	10-90% have Internet servers	>90% have Internet servers
Health (hospitals and clinics)	<10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Public (top- and second-tier government entities)	<10% have Internet servers	10-90% have Internet servers	>90% have Internet servers

Table 16. Sectoral Absorption of the Internet in Turkey

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

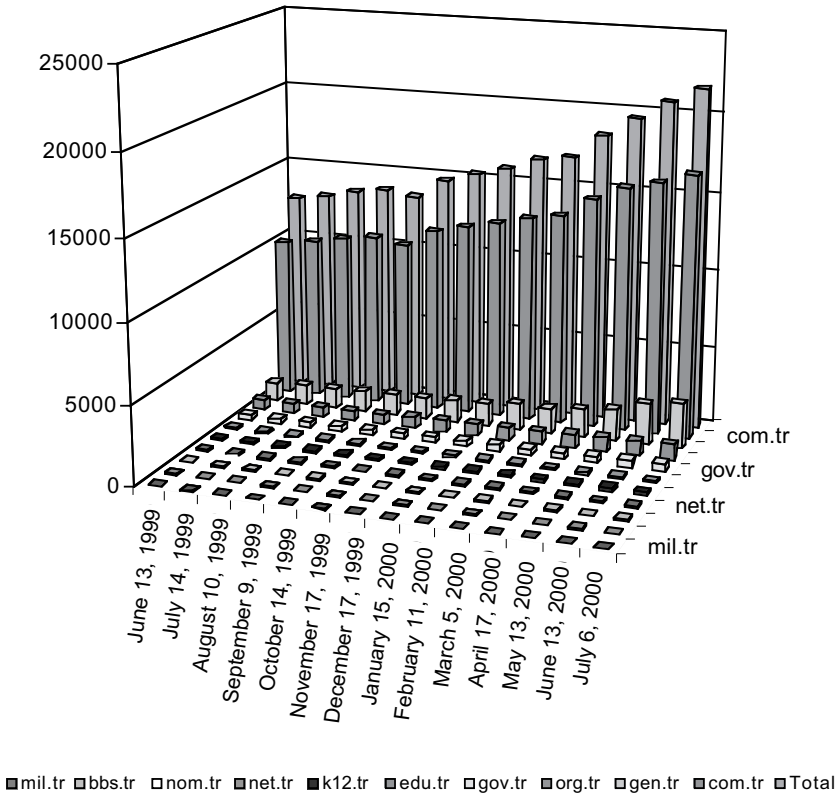

Figure 7. Number of Domain Names in Turkish Top-Level Subdomains (June 1999 through July 2000)

Source: K. Çagiltay, "Detayli Analizler" ("Detailed Analyses") (August 2000), <http://php.indiana.edu/~kursat/hosts/page6.html> (October 21, 2000).

Education

As in many countries, the academic community pioneered the Internet in Turkey. Thanks to sustained interest, activity, and support from both individual and organizational champions, the Internet has progressed steadily among Turkish universities. While more than 10 percent of universities were connected through TR-NET, ULAKNET has pushed the penetration of the Internet to nearly all universities, over 90 percent. As of June 1999, only seven universities out of 96 had not been connected.[30] This does not mean, however, that all campuses of each university have been connected.

The situation in K–12 education is quite different. First, there are 70,000 K–12 schools in Turkey, nearly three orders of magnitude more

than the number of universities. Connecting a substantial fraction of these schools to the Internet would be a major undertaking under the best of circumstances. In Turkey, efforts to bring the Internet to primary and secondary educational facilities are hampered by a number of factors: low wages make it difficult to attract technically skilled individuals into the teaching profession, and leased lines require good copper connections, which are lacking in many parts of the country.

By 1999, approximately 100 k12.tr domain names had been registered.[31]

The Ministry of Education has succeeded in obtaining World Bank funding to bring the Internet to K–12 schools, however.[32] The first phase of the project would bring 50,000 personal computers to 2,500 K–12 schools and connect them to the Internet. Subsequent phases would connect most of the remaining schools. Even with the necessary funding, achieving widespread absorption of the Internet in public schools is a colossal undertaking that goes far beyond providing hardware and software. To establish just one expert in each school would require nearly 70,000 trained or self-taught teachers.

While sectoral absorption at the university level would be ranked as *Great Majority*, Internet connectivity in K–12 is *Minimal*. While in absolute terms the K–12 situation dominates the sectoral absorption equation, we feel that the importance and progress of the university community justifies ranking sectoral absorption in Turkish education as *Medium*.

Commercial

The commercial sector now boasts one of the fastest-growing Internet communities in Turkey. Between 1995 and 1997 the number of com.tr domain names grew from fewer than 100 to more than 4,000, with a more than seven-fold increase between 1996 and 1997 as commercial ventures flocked to TURNET. Between 1997 and 1999, the number of commercial domain names rose to nearly 11,000.[33] While these numbers still represent only 10–20 percent of the commercial firms in Turkey, there is little doubt that the number will continue to grow rapidly.

Health Care

The Internet has made little penetration into the Turkish health-care system. Two hospitals in Istanbul, Florence Nightingale and American, are connected and have been pursuing some telemedicine applications. However, these are the exception. By one estimate, there is an upper bound of 50 health-care facilities in Turkey connected to the Internet. Overall, far fewer than 10 percent of health-care facilities are connected to the Internet. Health-care facilities do use computers, and many have local area networks. However, members of the health-care profession apparently perceive the Internet to have little value in their ability to provide care for the populace.

Public

The public sector has not been quick to assimilate the Internet, and the progress that has been made has usually come through the determined efforts of a few persistent individuals. For many public institutions, such as local and regional governments, the costs of leased-line connectivity to the remote TURNET backbone have greatly exceeded whatever small perceived benefit there may have been. The central government in Ankara has no such excuse. Here the slow absorption has to do with issues of the relationship between the government and the governed, the level of awareness of the Internet by politicians, the availability of skilled technical support, and other factors addressed below. At the same time, the number of central government ministries with at least one connection to the Internet has increased substantially within the last two years. Between 1996 and 1999, the number of .gov.tr domains grew from just under 50 to approximately 300. There are just a handful of .mil.tr domains.[34] While TÜBITAK was one of the initiators of the Internet in Turkey, use by government remains *Minimal* (<10% percent) to this day.

Connectivity Infrastructure

Connectivity infrastructure comprises four components: the aggregate bandwidth of the domestic backbone(s), the aggregate bandwidth of the international IP links, the number and type of interconnection exchanges, and the type and sophistication of local access methods being used. Table 17 also shows Turkey's ranking in late 1999.

Table 17. Connectivity Infrastructure of the Internet in Turkey

Level	Domestic Backbone	International Links	Internet Exchanges	Access Methods
0: Nonexistent	None	None	None	None
1: Thin	<3 Mbps	<129 Kbps	None	Modem
2: Expanded	3-200 Mbps	129 Kbps-45 Mbps	1	Modem 64 Kbps DDN 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

International connectivity has been the main bottleneck of the Turkish Internet since its inception. The costs of international connections and restrictions in the past on ISPs having direct international connections have kept aggregate bandwidth low. Only in the last two years has the aggregate bandwidth increased significantly. The expansion has come from three quarters: sharp increases associated with TTNet, upgrades to TURNET and ULAKNET, and growth in direct international lines leased by ISPs. The latter have almost come to dominate the equation in the last two years, accounting for more than half of the international connectivity in 1998 and over a third in 1999. Figure 8 shows the rapid recent growth in international connectivity. Nevertheless, Turkish international connectivity is still below OC-3 levels, although a third connection at E3 from TTNet to the Internet will make it slightly above. It is likely that in the year 2000 the aggregate international connectivity of Turkey will exceed 200 Mbps on the strength of TTNet connections and ISPs' direct leased lines. This would push Turkey into Level 3 *(Broad)* for this component of the connectivity infrastructure dimension.

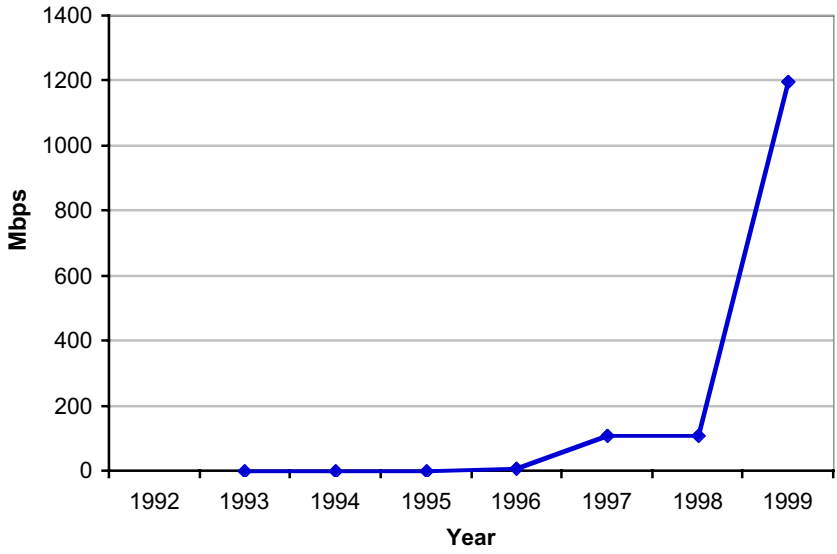

Figure 8. Aggregate International Bandwidth

Domestic Backbone

The growth in aggregate bandwidth of the domestic backbone is shown in Figure 9. The growth in backbone bandwidth has come almost exclusively from the introduction of new networks. Domestic bandwidth rose from 128 Kbps to over 6 Mbps when TURNET began offering service. When ULAKNET was introduced in 1997, backbone capacity jumped from 6 Mbps to 109 Mbps. Backbone capacity will take another huge jump as TTNet is rolled out. Once a backbone is installed, it is upgraded infrequently. TURNET's 2 Mbps triangle remained unchanged from 1996 until 1999. ULAKNET's domestic links are not likely to be upgraded in the near future since they are greatly underutilized.

The introduction of TURNET was enough to move Turkey from Level 1 *(Thin)* to Level 2 *(Expanded)* for the domestic backbone component of connectivity infrastructure. The introduction of TTNet is pushing it into Level 3 *(Broad)*.

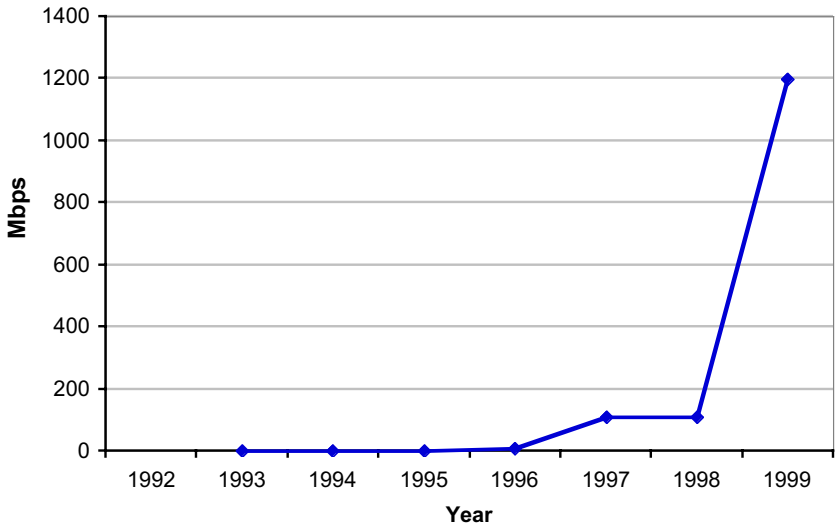

Figure 9. Aggregate Domestic Backbone Bandwidth

Internet Exchanges

Unlike some other countries, Turkey has never had a time when Internet service providers could only exchange traffic by routing traffic out of the country to the global Internet. However, the ISPs also have never had a

traditional Internet exchange point (IXP) for exchanging traffic. Rather, ISPs have exchanged traffic by connecting to the national backbone. Initially, TR-NET served in this capacity. TURNET became the government's official Internet backbone, and TTNet will continue this tradition. One of the factors motivating Türk Telekom to create TURNET was the desire to not have ISPs route internationally traffic that was both originated and terminated in Turkey.[35] ISPs that have leased their own satellite connections also have the option of exchanging traffic with other ISPs that share the connection. As long as each ISP has a connection to TURNET (soon TTNet), they are permitted to create separate exchanges amongst themselves. There have reportedly been efforts to create an IXP between ISPs, but these discussions have not been successful. Part of the reason has been that the low amount of inter-ISP traffic has not made the issue a terribly pressing one. If TTNet lives up to its promises, then the capacity for inter-ISP exchange should be sufficient, again easing the pressure on ISPs to create their own.

We rate Turkey at Level 2 *(Expanded)* for the IXP component of connectivity infrastructure, which it has been since the inception of TURNET in 1996.

Access Methods

Turkey has been at least at Level 2 *(Expanded)* with regard to access methods since the first Internet links went live. The initial link between METU and TÜBITAK was a 64 Kbps link. While Türk Telekom has not always provided leased lines in a timely manner, it has offered 64 Kbps service and better for many years. By the time TURNET began offering service, ISPs like SuperOnline were leasing 1 Mbps lines. The ability to access the Internet via modem, or via a leased line with greater than 64 Kbps, rates as Level 3 (*Broad*) in this component of the connectivity infrastructure dimension.

The more interesting question, perhaps, is whether or not less than 90 percent of Internet access is via modem. At present, few ISPs and few points of presence offer high-speed Internet access services such as ISDN or xDSL. Of the approximately 140 TTNet points of presence, only nine are scheduled to offer ISDN service, and none of these is outside of Istanbul, Izmir, and Ankara. Only 26 will offer asynchronous digital subscriber line (ADSL) service.

While a very small fraction of users accessing the Internet from home use anything other than modems, a significant fraction of Internet users do not access the Internet from home. Students have access through their universities. Internet cafés that attract large numbers of customers have

begun accessing ISPs through leased lines, although most Internet cafés still access their ISPs using dial-up connections.

Connectivity Infrastructure Rating

Table 18 shows changes in the connectivity infrastructure as reflected in the Levels (0-4) of the analytic framework. The data show steady improvement, with relatively slower improvement in the areas of international connectivity and Internet exchanges. The former has been a perennial bottleneck of the Turkish Internet. The latter reflects the role of the telecommunications monopoly in providing the backbone shared by all ISPs.

Table 18. Evolution of Connectivity Infrastructure in Turkey

	1992	1993	1994	1995	1996	1997	1998	1999
International Connectivity	0	1	1	1	1	2	2	2
Domestic Backbone	0	1	1	1	2	2	2	3
Internet Exchanges	0	1	1	1	2	2	2	2
Access Methods	0	2	2	2	3	3	3	3
Overall	**0**	**1**	**1**	**1**	**2**	**2**	**2**	**2.5**

Organizational Infrastructure

The organizational infrastructure existing today in Turkey reflects a somewhat unusual mixture of free market and monopolistic policies. At one extreme, the basic telecommunications regime established by the Turkish constitution mandates that communications services should be provided by government employees, i.e., by a government monopoly. At the other extreme, the ISP market today is highly dynamic and competitive. In the middle is Türk Telekom, a government-owned joint stock company struggling to define its role while being pushed from all directions by a host of stakeholders with often conflicting demands. During the mid-1990s, Turkey moved quickly from Level 1 *(Single)*

Table 19. Organizational Infrastructure of the Internet in Turkey

Level 0	**None:** The Internet is not present in this country.
Level 1	**Single:** A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	**Controlled:** There are only a few ISPs because the market is closely controlled through maintenance of 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	**Competitive:** The Internet market is competitive, and there are many ISPs due to the existence of low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	**Robust:** 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.

through Level 2 *(Controlled)* to Level 3 *(Competitive)*, where it stands today (see Table 19).

Bending the Rules

During the first two years of its existence, the Internet existed as a non-commercial entity. Until 1995 the Internet was viewed by Türk Telekom as something of an experimental technology rather than a commercial source of communications services. Provision of domestic and international links for Internet purposes was a complete monopoly.

In 1995, however, as efforts to establish TURNET moved forward, the issue of who could provide Internet services had to be resolved. Under a strict interpretation of the constitutional guidelines no commercial ISPs could exist. One of the more interesting aspects of the Internet in Turkey is the lengths to which the government has gone to enable the Internet to flourish, without completely running afoul of the constitution.

In the years that followed, however, Türk Telekom relaxed some of these proscriptions, albeit often in a way that preserved some semblance of monopoly. For example, with TURNET, Türk Telekom encouraged the creation of commercial, independent ISPs as long as they connected to TURNET. Türk Telekom also began permitting private companies to offer international satellite lines to ISPs and other companies, the so-called international business services companies, provided they were licensed to do so by Türk Telekom and paid Türk Telekom a percentage of the proceeds. The most curious semantic twist was a redefinition of the services ISPs were providing. The argument was made that ISPs were not providing fundamental communications services at all, but rather were providing some value-added services (computer applications). Even voice over Internet, which is permitted in Turkey, is considered data communications, rather than voice, and thus a value-added service.

In short, Turkey has employed in no small measure a sleight of hand to permit the Internet to flourish. As one official put it, "So as to not cut the Internet in Turkey, we are not seeing them [the ISPs]"!

Future

One obvious solution to the dilemma of government provision of a largely unregulated service would be to change the constitution. However, there does not appear to be the political will in Turkey to do this. Such a change would require the support of two-thirds of the parliament.

By 2005 at the latest, Türk Telekom will be privatized, however. Turkey has signed the World Trade Organization agreement, which mandates the privatization of telecommunications by the year 2005.[36] In the meantime, although ISPs and others love to complain about Türk Telekom, the relationship between the government monopoly and the ISPs is a positive and mutually beneficial one that has done a great deal to promote the Internet in Turkey.

Sophistication of Use

The data on pervasiveness and sectoral absorption indicate that the vast majority of Turkish citizens and companies are not using the Internet. For those that are, however, during the last year or two a few companies have made use of the Internet in ways that are transforming their businesses and personal interactions, although not necessarily in ways that advance the state of the art worldwide. At the same time, the number of companies and individuals who have made the Internet part of their daily activities in some fashion has grown to the point where such users are no longer considered novelties. The rapid expansion of the Internet user community

Table 20. Sophistication of Use of the Internet in Turkey

Level 0	**None:** The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	**Minimal:** The small user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	**Conventional:** 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 for or straightforward enhancement of an existing process (e.g., email vs. post). This is the first level at which we can say that the Internet has "taken hold" in a country.
Level 3	**Transforming:** 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	**Innovating:** 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.

means, however, that there continue to be many users who have only begun to use the technologies.

Overall, Turkey's user community is probably at Level 2 *(Conventional)*, with a few but growing number of users at Level 3 *(Transforming)*. The Internet has clearly "taken hold," but the number of companies or individuals using the Internet to change significantly their processes and practices remains small (see Table 20).

For individuals, anecdotal evidence suggests that the principal uses of the Internet are (1) games, (2) Internet chat, and (3) Web surfing (especially pornography). Each of these reflects a user community that is comfortable with the medium, yet not one that is using the Internet to create new and enduring social networks, for example. ICQ is used by some, but it is eclipsed by the tremendous popularity of online chat.

Most of the companies using the Internet are establishing a rudimentary presence on the Web and perhaps beginning to learn about electronic

commerce. The set of companies making transformative use of the Internet is, at present, rather circumscribed. In conversations with industry observers in Turkey, the same examples of leading Internet use are repeated again and again. They include:

- *Banks.* Since 1997, banks have been offering so-called "Internet branches" where customers can carry out many of the kinds of transactions they would normally do in a physical branch office. Banks have strong incentives to move customers from the branches to the Internet: First, they can cut costs. A transaction carried out in a branch costs 18 times more than one carried out on the Internet. Second, by reducing the number of customers in the branches, queues are shortened and quality of service improves. Third, branch employees can spend more time providing customized service to the most profitable customers, improving profitability. To encourage customers to use the Internet, banks are waiving the customary transaction fees. Such efforts have encouraged many users and business to use the Internet for the first time. Banks are also using the Web to accept loan and other applications.
- *Miğros Supermarket.* Miğros allows you to place your supermarket order over the Internet. If you place an order of more than 10 million TL ($23 in July 1999), the store will deliver your order at no extra charge.
- *SuperOnline.* As part of its effort to create a portal that will draw customers repeatedly, SuperOnline has placed a financial simulation game on its website. The simulation permits people to invest "virtual money" in the financial markets and track the value of the "portfolio."
- *Newspapers.* Nearly all Turkish newspapers provide content on the Internet, playing a particularly important role in informing Turks living abroad.
- Some ISPs are partnering with cellular phone companies to provide integrated services, such as the ability to send a webpage to a pager.

Analytic Framework Dimensions

Figure 10 illustrates the changes in the Internet dimensions since 1992, the year before the Internet was first established. The figure shows only years in which developments resulted in a change in value in at least one dimension.

Particularly noteworthy are the dramatic jump in geographic dispersion, the significant gains in pervasiveness and organizational infrastructure, and steady improvement of the connectivity infrastructure.

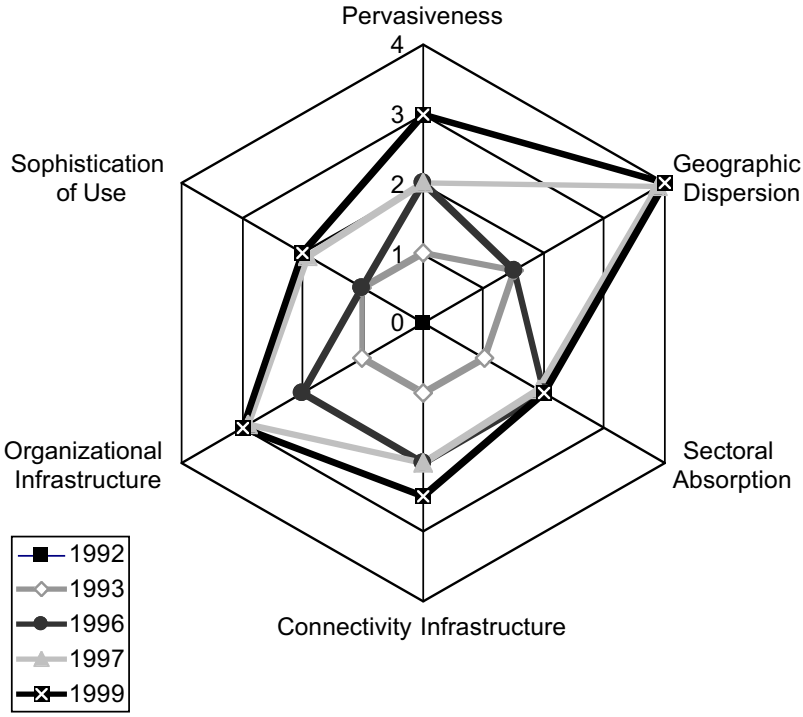

Figure 10. Internet Diffusion Dimensions in Turkey

4. The Internet in Pakistan

Introduction

History

The Islamic Republic of Pakistan, shown in Figure 11, was formed in 1947 by the partitioning of British India into India and Pakistan. The partition line was drawn through the formerly unified Punjab, with portions of Jammu and Kashmir in each new country. Immediately following partition, 12–14 million refugees crossed the dividing line, seeking safety with their co-religionists. In 1947 and 1948, efforts by the Muslim leader of the predominantly Hindu Junagadh and the Hindu ruler of the predominantly Muslim Kashmir to join Pakistan and India respectively led to the first war between these two states. An inability to resolve the dispute over the Kashmir region led to a second war in 1965 and a third armed conflict May–June 1999. The conflict with India has been one of the defining features of Pakistan's modern history, affecting Pakistan's foreign policy and economy.

In addition to conflicts with India, Pakistan suffered a brutal civil war in 1971 that preceded the independence of Bangladesh, formerly East Pakistan.

While war and continuing conflict with India has been one defining quality of modern Pakistan, political instability has been a second. With the end of the civil war, the military ruler of Pakistan, General Agha Muhammad Yahya Khan, turned power over to Zulfikar Ali Bhutto, a foreign minister under a previous regime. Bhutto nationalized the basic industries, insurance companies, domestically owned banks, and schools and colleges. He also instituted land reforms that benefited tenants and middle-class farmers.

Figure 11. The Islamic Republic of Pakistan

Against a backdrop of claims of election fraud, General Muhammad Zia Ul-Haq staged a successful coup on July 5, 1977. Zia was the first leader to turn the country away from secularism. He supplanted the civil code with Islamic law, the *sharia*, and started the trend toward orthodoxy. Following his death in a plane crash in 1988, Benazir Bhutto, daughter of the former prime minister, was appointed prime minister after her party, the Pakistan People's Party (PPP), won a general election in November. She was dismissed on corruption charges in 1990 and re-elected in 1993. The Bhutto government was again dismissed on charges of corruption in 1996. Elections in February 1997 brought to power Nawaz Sharif and his Pakistan Muslim League. Sharif himself was ousted in a coup in October 1999.

Politics

Pakistan is a democratic Islamic republic with a parliamentary system of government. The bicameral parliament of Majlis-e-Shoora consists of the

Senate (87 seats; members are indirectly elected by provincial assemblies to serve six-year terms) and the National Assembly (217 seats, of which 10 represent non-Muslims; members are elected by popular vote to serve five-year terms). The president is elected by parliament for a five-year term.[37]

When Mohammed Nawaz Sharif became prime minister in 1997, he combined measures designed to bring economic liberalization, stability, and growth with those to solidify his own position. Among his first measures was the Pakistan 2010 Programme (described below). This program laid out a number of measures designed to cure some of the fundamental ailments of Pakistan and its economy: corruption, a depressed economy, low per capita income, low investment, violence, and political instability. Some early measures included broad reforms of the tax and tariffs laws, reducing and streamlining them in an effort to stimulate economic growth.[38]

On the political side, he weakened the presidency with a constitutional amendment that stripped the president of his power to dismiss the National Assembly, ousted a chief justice of the Supreme Court, and reversed the traditional balance of power between the military and civilian government. He carried out a campaign of intimidation against the press and sought (unsuccessfully) to push through parliament a bill making Islamic Law the supreme authority in Pakistan. *The Economist* wrote:

> Pakistan has been run by such dreadful governments for so long that it seems barely worth remarking on any deterioration. But whereas previous governments were chaotic in their awfulness, this one has turned out to be systematic. Over the past two years Nawaz Sharif, the prime minister, has been picking off individuals and institutions that he believes pose any threat to his own power. He has seen off a president and the chief of the army staff, and is now trying to push through a constitutional amendment that would give him sweeping powers to ignore Pakistan's legislature and provincial governments in the name of Islamisation.[39]

Sharif was not able to deliver on his promises or hold onto his control. While the explosions of nuclear weapons in May 1998 provided a morale boost to much of the country, they did nothing to address structural weaknesses and, in light of world reaction, ultimately harmed the economy. Reports of political, legislative, judicial, and financial crises quickly sapped the enthusiasm over Pakistan's response to Indian tests. Murders and other forms of lawlessness in Karachi and elsewhere created a climate little conducive to investment and trade.[40] In May 1999, Pakistan-backed guerrillas

invaded Indian Kashmir, only to retreat a few weeks later. The dissolution of a battlefield victory into a diplomatic loss left many in the army and the country disillusioned with Sharif.[41] Given the history of Pakistan's prime ministers, his ouster in a coup in October 1999 was not particularly startling.

Economy

Since Pakistan was founded in 1947, the economy has been characterized by periods of relative hopefulness and growth that are usually overshadowed by longer periods of stagnation or decline precipitated by economic shocks and sustained by systemic weaknesses. The 1960s were years of considerable growth. The real GDP grew by an average of 6.8 percent per year at a time when major advances were taking place in the agricultural and industrial sectors. During these years Pakistan pursued an import-substitution, highly protectionist policy. The Green Revolution fueled the growth of the agricultural sector.

During the 1970s, Pakistan experienced a series of disruptions to its economy: The country engaged in a civil war in which India intervened in 1971; land reforms created considerable uncertainty; instability was a dominant characteristic of the political scene; a cotton virus severely impacted Pakistan's largest export commodity; nationalization in 1972 shattered investor confidence; and oil prices increased five-fold in 1973. These and other factors contributed to a prolonged recession for most of the decade.

During the 1980s, policy changes favoring gradual decontrol, deregulation, and denationalization began to pay dividends, and, with the improving global economy, Pakistan experienced growth rates comparable to those of the 1960s. However, most of this growth was due to increases in factor inputs (labor and capital) rather than from improvements in productivity.[42] The real GDP grew at an annual rate of 6.5 percent, helped by 4.1 percent growth in agriculture and 8.2 percent growth in large-scale manufacturing.

During the 1990s, the economy again has experienced substantial deceleration (see Table 21). Between 1991 and 1997, the real GDP growth rate declined to 4.7 percent per annum. According to the Pakistan 2010 Programme, the factors that have been most responsible for the worsening economic landscape are: political instability (between 1988 and 1996 Pakistan saw the dismissal of three elected governments and four caretaker regimes); worsening of law and order in major growth areas of the country; setbacks to the cotton crop and consequential increases in cotton prices that adversely affected textile and related industries; inadequate power supply along with frequent breakdowns of power units around industrial areas; emergence of significant infrastructural bottlenecks in power, transport, and other sectors; and insufficient industrial investment.[43]

Table 21. Pakistan in Statistics

Population	139 million (Jan. 1998 est.)[a] 130.6 million (1998 est.)[b]
Population growth rate	2.7–3.0% (July 1999 est.)
GDP	$59 billion (1998–1999 est.)
GDP per capita	$441 (1998–1999 est.)
Inflation rate	13.9%
Literacy	45% (unofficial: 35%)
Telephones	3.2 million (1997 est.) 4 million (1999 est.)
Teledensity	1.78 per 100 people (1997)[c] 2.25 per 100 people (1999) 3.49 per 100 people (2000 est.)

Sources: M. Ali, "Pakistan: Telecommunications & Politics," *Middle East Communications* (November 1997): 13–18; Central Intelligence Agency, "Pakistan," in *The World Factbook* (Washington, D.C.: CIA, 1999), <http://www.odci.gov/cia/publications/factbook/geos/pk.html> (October 16, 1999); Bureau of South Asian Affairs, *Pakistan: Background Notes* (Washington, D.C.: U.S. Department of State, March 2000), <http://www.tradeport.org/ts/countries/pakistan/bnotes.html> (October 14, 2000).

[a] U.S. Department of State, *Country Commercial Guides FY 1999: Pakistan* (Washington, D.C.: U.S. Department of State, 1999), <http://www.state.gov/www/about_state/business/com_guides/1999/sa/pakistan99_10.html> (October 16, 1999).

[b] "India and Pakistan: Not Cricket," *The Economist* (May 22, 1999): 3–5.

[c] "In Brief: Pakistan," *Middle East Communications* (July 1997): 8.

Geography and Demographics

Pakistan is a country of the Southern Asian littoral of 803,940 square kilometers on the northeastern tip of the Northern Arabian Sea. It has 1,046 kilometers of coastline and shares land borders with Iran (909 kilometers) to the west, Afghanistan (2,430 kilometers) to the north, China (523 kilometers) to the northeast, and India (2,912 kilometers) to the east.

The climate and terrain of Pakistan are both varied and difficult. In the east is the flat Indus plain, and mountains rise in the north and northwest, tapering off to the Balochistan plateau in the west. As a result the climate is mostly hot, dry desert, with a more temperate climate in the northwest and arctic conditions in the Hindu Kush and Karakoram mountains of the north.

Pakistan's natural resources include extensive natural gas reserves, limited petroleum, poor quality coal, iron ore, copper, salt, and limestone. About 23 percent of the country's land is arable, and agricultural enter-

prise occupies about 46 percent of the 36 million-strong labor force. Frequent natural disasters, principally earthquakes and flooding along the Indus River after heavy rains, hamper the government's attempts to develop a sustainable infrastructure.

The capital of Pakistan is Islamabad. The country is divided into four provinces, plus the autonomous Tribal Areas Territory, the Islamabad Capital Territory, and two Federally Administered Regions. The Pakistani-administered portion of the disputed Jammu and Kashmir region is known as Azad Jammu, and Kashmir is officially "independent," according to Pakistani government policy, which does not recognize the 1947 UN partition of Kashmir.

According to 1999 estimates, the population of Pakistan is about 138 million people, with an annual growth rate of 2.18 percent. The major ethnic groups in Pakistan include Punjabi, Sindhi, Pashtun (Pathan), Baloch, and Muhajir (Muslim immigrants from India at the time of partition in 1947 and their descendents). Although the official language is Urdu, it is considered their first language by only about 7 percent of the population. English is the second official language, and is the lingua franca of Pakistani elite and most government ministries. Other languages widely used include Punjabi, Sindhi, Pashtu, and Balochi. The population is 97 percent Muslim (Sunni 77 percent, Shi'a 20 percent); the remainder is predominantly Christian or Hindu. About 33 percent of the population is literate.

Networks in Pakistan

A Brief History of Telecommunications

Until 1990, telecommunications services in Pakistan were provided by the Telephone & Telegraph (T&T) Department of the Ministry of Communications, which oversaw on the order of 800,000 telephone lines throughout the country. Like many such providers in other countries, the T&T had limited autonomy to plan, execute, and finance expansion of telecommunications services or networks.

During the 1980s, global trends toward deregulation, privatization, and open markets combined with substantial technological innovations in telecommunications and data networks to push the issue of telecommunications infrastructure to the forefront of many countries' policy-making efforts. These trends, coupled with the often not-so-subtle encouragement of international financial institutions, led policy-makers in many developing countries to consider the importance of a sound telecommunications infrastructure to the future health and growth of their economies.

Pakistani policy-makers realized the value of an expanded and competitive telecommunications sector and passed the *Pakistan Telecommunications Corporation Act, 1991*. This act restructured the T&T Department into a state-owned corporation, the Pakistan Telecommunication Corporation (PTC), with operational and financial autonomy. Some of the stated goals of the measure were:

- promotion and rapid development, modernization, and diversification of telecommunications services;
- improvement in performance quality of service and operational efficiency of the telecommunications sector, especially with regard to basic services;
- privatization of the PTC to help inject private sector capital and skills into its operation;
- encouragement of increasing private sector participation in telecommunication development;
- facilitation of new investment and competition in telecommunications by enabling a legal and regulatory framework;
- redefinition of the role of government from an operator to that of a regulator.[44]

One of the very significant results of this reform was the introduction of private operators to provide value-added services. Between 1991 and 1996, the year of the next major restructuring of the telecommunications market, a number of private companies received licenses for various services, including data communications. In 1994, 15 companies were given licenses to operate domestic data networks, with international links through PTC, servicing primarily the business, industry, education, and government sectors.

Concurrently, the Pakistani government carried out a huge expansion of the telecommunications system by PTC, which quadrupled the number of lines (to 3.2 million) by 1997.[45]

The *Pakistan Telecommunication (Re-organization) Act, 1996 (PTA 1996)* introduced a new telecommunications regime through the creation of the Pakistan Telecommunication Authority, two new corporations out of the Pakistan Telecommunication Corporation, and a Frequency Allocation Board.[46] The functions of the Pakistan Telecommunication Authority (PTA) were to:

- regulate the establishment, operation, and maintenance of telecommunication systems and the provision of telecommunication services in Pakistan;

- receive and expeditiously dispose of applications for the use of radio-frequency spectrum;
- promote and protect the interests of users of telecommunication services in Pakistan;
- promote the availability of a wide range of high quality, efficient, cost effective, and competitive telecommunication services throughout Pakistan;
- promote rapid modernization of telecommunication systems and telecommunication services;
- investigate and adjudicate on complaints and other claims made against licensees arising out of alleged contraventions of the provisions of [the PTA 1996], the rules made, and the licenses issued thereunder and take action accordingly;
- make recommendations to the Federal Government on policies with respect to international telecommunications, provision of support for participation in international meetings, and agreements to be executed in relation to the routing of international traffic and accounting settlements; and
- perform such functions as the Federal Government may, from time to time, assign to it.[47]

The *PTA 1996* also broke the Pakistan Telecommunication Corporation into two companies. The new Pakistan Telecommunication Company Limited (PTCL) received 95 percent of PTC's infrastructure, assets, resources, and employees. PTCL received a license from the PTA to provide "basic telephone service," which the *PTA 1996* defined as:

1. two-way live voice telephone service, in digital form or otherwise, over any public fixed switched network or between base stations or switches or modes of any public mobile switched network;
2. real-time transmission or reception of facsimile images over a public fixed switched network;
3. international telephony service; and
4. the lease of circuits for the provision of the services specified in (1), (2), and (3).[48]

A second company, the National Telecommunication Corporation (NTC), received 5 percent of PTC's infrastructure, assets, resources, and employees, and received a license from PTA to provide "telecommunications services within Pakistan on a non-exclusive basis only to the armed forces, defense projects, Federal Government, Provincial Governments, or such other Governmental agencies or Governmental institutions as the Federal Government may determine; and . . . the National Telecommunication Corporation shall not sell its capacity on the telecommunication system to any person other than such Government agencies or the [PTCL]."[49]

The licensing of PTCL to be the sole provider of basic telephone service and the creation of the PTA as the licensing authority with a clear mandate to encourage provision of non-basic telephone services opened the door for the creation of the Internet service provider market.

Growth of Telephone Subscriber Lines

In spite of a poor economy, Pakistan has continued to make telecommunications a high priority for government spending. The Public Sector Development Programme (PSDP) for 1999–2000 prioritized infrastructure development and the telecommunications sector, to the tune of Rs 110 billion through 2000. Overall, the growth of telecommunications lines and services has been a rather bright spot in a dreary economic landscape.[50] By June 1998, Pakistan had an estimated 2.75 million phone lines. By mid-1999, the number of telephone lines in Pakistan was expected to reach nearly 4 million.[51]

The Origin of the Internet in Pakistan

In 1991, two Pakistani computer enthusiasts established a UUCP (Unix-to-Unix CoPy) email connection to the global Internet from the IMRAN.AR.PK host. Located in New York City, this node would batch email traffic and, through an international phone call to Lahore, exchange email with domestic servers.[52]

Following the introduction of the Mosaic web browser in 1993, the Internet in the United States surged in size and popularity, with the commercial sector experiencing the greatest rates of growth. By 1995, Pakistani policy-makers had begun to appreciate the potential of the medium for economic development. The IMRAN service proved sufficiently useful that in 1995 the Pakistani government solicited proposals for establishing a public email service.[53] Sixteen companies were awarded licenses for email and Internet services in February 1996.

The Emergence of Internet Service Providers

Some of the licensees began offering service even before the regulatory regime and their licenses were finalized. Digicom launched the first online Internet service, in Karachi, in 1995. This service was connected to the global Internet by a 64 Kbps line. In 1996, the PakNet data network, operated by PTCL, was upgraded to provide Internet services as well. PakNet was connected to the global Internet via a total of 512 Kbps. By mid-1997, nine ISPs were operational, offering services in five cities to approximately 25,000 subscribers.[54] PTCL also offered Internet service in 10 cities to approximately 8,500 subscribers.

A multitude of Internet service providers emerged quickly following the introduction of Internet service in 1995. The *Pakistan Telecommunication Act, 1996* stated that "No licenses to provide basic telephone service shall be issued by the [Pakistan Telecommunication] Authority for a period of seven years from the effective date referred to in section 35 [October 13, 1996] vesting property in the [Pakistan Telecommunication] Company other than to the National Telecommunication Corporation and the [Pakistan Telecommunication] Company."[55] While it makes no direct mention of the Internet, *PTA 1996* does not prohibit the licensing of private companies to provide a host of value-added services, including Internet services.

By mid-1999, licenses to provide Internet service had been issued to approximately 100 organizations, of which 50 were operating.[56] *NetMag*, an online magazine devoted to the Internet in Pakistan (http://netmag.com.pk), listed 27 ISPs in its May–June 1999 issue. In its September–October 1999 issue, it listed 40, a 50 percent increase in four months. Since October, this number appears to have stabilized, however, reflecting a saturation of the ISP market, growing difficulty of startups to compete with established ISPs, or both.

Internet Infrastructure Project

The most significant technical development affecting the Internet in Pakistan has been the Internet Infrastructure Project, initiated in 1998. This project, phased over three years (1998–2000) and costing Rs 700 million, is designed to accommodate 500,000 customers in 90 cities, including all district towns.[57]

In August 1998, the board of directors of PTCL approved the investment of over Rs 3 billion ($56 million) for an expansion program of a number of telecommunications services, including the Internet. The plan involved the creation of three wholly owned subsidiaries, one of which, Pak Internet Limited, was developed exclusively to provide Internet ser-

vices. Rs 1 billion would be spent on creating the three subsidiaries, and Rs 2 billion would be used to provide 750,000 new telephone lines over an 18-month period ending in February or March 2000.[58]

In April 1999, the Planning Commission announced that the Public Sector Development Programme (PSDP) for 1999–2000 would include provisions for adding 300,000 new Internet connections.[59]

Phase 1 of the project was completed in August 1999, with testing carrying through the end of September.[60] This phase involved the addition of 50,000 Internet connections;[61] Internet service providers and dial-up users in Karachi, Lahore, and Rawalpindi/Islamabad were connected to the new infrastructure in August, and those in Peshawar and Quetta were connected in September.

Government Initiatives Impacting the Internet

Pakistan 2010 Programme

The Pakistan 2010 Programme was established by Prime Minister Mohammed Nawaz Sharif in 1997 to bring about "the Quaid's glorious vision." The vision is based on four goals:

1. justice for all Pakistanis, including women, minorities, and other vulnerable groups;
2. tolerance of opinion, belief, custom, values, behavior, life style, and knowledge;
3. knowledge for production and competition and for its own sake; and
4. entrepreneurship, not in the sense of an ability to exploit others, but rather as a behaviour that innovates, produces, and serves society.[62]

Economic prosperity is essential to this vision. Good governance is essential to economic prosperity. Therefore, the principal goals of the Pakistan 2010 Programme were to establish good governance, double per capita income, and ensure equitable access to economic opportunity and quality social services.

According to policy-makers, economic prosperity also could not be built on the "old paradigm" of infrastructure creation but had to be built on the new paradigm of "knowledge creation and its utilization." Among the major Pakistan 2010 goals is the promotion of science and technology.[63] The Pakistan 2010 Programme establishes the shift from material-based to knowledge-based production as one of the six key steps that define the program's Action Plan.

> A second shift is from material-based toward knowledge-based production. The international context has changed dramatically over the last fifty years, and comparative advantage has shifted from those with access to raw material to those with access to knowledge. Pakistan must be prepared to operate in the new scenario. To this end, policy must guide investment into high-tech areas, through support for information technology, technical education, incentives for knowledge production, provision of free and open access to information, opening up credit markets to knowledge industries, and generally creating and enabling [an] environment for research and technology development. Accordingly, Pakistan 2010 includes a concerted programme for upgrading the science and technology infrastructure in the country.[64]

The multiple objectives are intertwined. The shift to knowledge-based production requires investment. Investment requires the creation of a positive investment climate. A positive investment climate requires the development of "a sound and credible financial system, adequate ready credit availability, a simple and transparent regulatory system (through autonomous statutory bodies wherever possible), a transparent and effective tax and tariff system, a stable policy regime, a reliable certification system, a planning system oriented toward indicative planning to assist investors in forecasting future economic trends, collaborative policy making, and revamped SROs."[65]

Privatization of Pakistan Telecommunication Company Limited

In 1991, the Pakistani government established the Privatization Commission with the goals of reducing the government's debt and generating resources to reduce loan liabilities. In 1994, a decision was made to privatize PTCL by selling a 26 percent stake in the company.[66] By 1997, the company still was not privatized, but the government borrowed Rs 250 million against the company's future earnings through the sale of bonds.[67] The government of Pakistan continued to be unable to find a suitable investor. In May 1997, privatization was postponed.[68] A few weeks later, Prime Minister Sharif mandated the sale of the company within a year.[69] No investor was forthcoming. Government changeovers, differing views on how to sell the company's assets, and financial crises in the international markets have all been identified as factors contributing to the delay. By early 1999, the deadline for a sale had been pushed back to July 1999.[70] Goldman Sachs was hired to formulate a strategy for privatizing

PTCL, including a plan for road shows and seminars for the sale of the 26 percent.[71] Following a visit to Pakistan in early 1999, Goldman Sachs set a new deadline of February 2000 for the sale of the company.[72]

The prolonged effort to privatize PTCL revealed a conflict between privatization and the goal of encouraging fledgling Internet services. In order to make PTCL attractive to investors and minimize the government's budget deficit, the regulatory authorities in 1998 gave approval for a number of measures to enhance PTCL's revenue stream.[73] These included the right to increase the telephone tariffs by Rs 55 per month and limit local calls to five minutes. While the announcement of these rate increases was accompanied by an announcement of a 15 percent reduction of nationwide calls and decreased connection charges, the latter were more than offset by a Central Excise Duty of 15 percent. Each of these measures increased the cost burden on users of local telephone service. Typical Internet access is characterized by much longer than average local telephone calls.

Analytic Framework Dimensions

Pervasiveness

The Internet user community in Pakistan has grown steadily since service was first offered in 1995. Table 22 illustrates the growth in Internet subscribers and users. Khan estimates that the number of users is approximately four times the number of subscribers.[74]

If Khan's estimate is correct, and the percent of the population using the Internet is four times greater than the percentages shown in Table 22, then Pakistan passed from Level 1 *(Embryonic)* to Level 2 *(Nascent)* in late 1997 at the earliest. If estimates that the number of Internet subscribers will increase by a factor of five by 2003 are correct, then it is possible that Pakistan could reach Level 3 *(Established)* by that year. In conversations held in November 1999, representatives of ZoooomNet stated that the number of subscribers had grown from 70,000 in 1998 to 250,000 in the fourth quarter of 1999.[75] As Table 22 shows, published reports have rather different estimates of the number of Internet users and subscribers in the year 2000. It is possible that the number of "users" according to the *Inter Press Service* and *The News International Internet Edition* actually refers to the number of subscribers or reflects old data, or both. The significantly greater figures from the *Business Recorder* come from the Centre for Research and Development at Iqra University. A 100 percent increase in the number of subscribers between November 1999 and July 2000 would not be unprecedented, but such figures provide only a single

Table 22. Number of Internet Subscribers and Users in Pakistan

Date	Number of Subscribers	Number of Users
1995	1,500 **(.001%)**[a]	
1997	2,000-3,000 per ISP (18,000-27,000) **(.013-.02%)**[b]	
Nov. 1997	25,000 (ISPs) + 8,500 (PTCL) **(.024%)**[c]	
Nov. 1997		45,000 **(.032%)**[d]
Dec. 1997	20,000-40,000 **(.014-.029%)**	Approx. 120,000+ **(.087%)**[e]
Aug. 1998	50,000 **(.035%)**[f]	
Sept. 1998	50,000 **(.035%)**[g]	
1998	70,000 **(.049%)**[a]	
Feb. 1999	60,000 **(.045%)**[h]	
Aug. 1999	80,000 **(.042%)**[i]	
Nov. 1999	250,000 **(.17%)**[a]	
April 2000		160,000 **(.11%)**[j]
July 2000		175,000 **(.12%)**[k]
July 2000	500,000 **(.34%)**	700,000 **(.48%)**[l]
2003 (est.)	400,000 **(.25%)**[f]	

Sources:

[a] A. Mehta, communication with ZoooomNet representative, November 1999.

[b] S. Jalal, "Competition Hots (sic) Up in Pakistan's Internet Market," *Middle East Communications* (June 1997): 10.

[c] M. Ali, "Pakistan: Telecommunications & Politics," *Middle East Communications* (November 1997): 13-18.

[d] "PTA Chairman: Fiber Optic Link with CARS Planned," *Islamabad The News* (November 9, 1997): 8 (FBIS-NES-97-313).

[e] U. A. Khan, "The ?? of Business on the Internet" (December) <http://wavetec.com/talk/sld001.htm> (June 2, 1999).

[f] "PTC to Invest $280 Million a Year in New Lines," *Middle East Economic Digest* (August 21, 1998): 27-28.

[g] "PTC Pledges Further Investment," *Middle East Communications* (September 1998): 6.

[h] "State Telecom PTCL to Provide 140,000 New Internet Connections by May 1999," *IT Pakistan* 1, no. 2 (February 19, 1999), <http://www.parep.org.sg/ITPAK.htm> (November 2, 1999).

[i] A. Mehta, "The Internet in Pakistan," email communication, September 2, 1999.

[j] "Internet Rate Cut May Not Benefit Users," *The News International Internet Edition* (April 26, 2000), <http://www.jang.com.pk/thenews/apr2000-daily/26-04-2000/business/b10.htm> (August 3, 2000).

[k] "Development—Pakistan: Protest Against Internet Policing," *Inter Press Service* (July 20, 2000).

[l] S. H. A. Zaidi, "Promoting Information Technology in Pakistan," *Business Recorder* (July 29, 2000), <http://www.brecorder.com/story/S0011/S1103/S1103101.htm> (August 3, 2000).

data point that must be verified. While it would not be surprising if all of these figures are inflated, they point to very rapid growth of the user base in Pakistan at present, with some possibility that Pakistan could reach Level 3 *(Established)* as early as the year 2000 (see Table 23).

Table 23. Pervasiveness of the Internet in Pakistan

Level 0	**Nonexistent:** 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	**Embryonic:** The ratio of users per capita is on the order of magnitude of less than 1 in 1,000 (less than 0.1%).
Level 2	**Nascent:** The ratio of Internet users per capita is on the order of magnitude of at least 1 in 1,000 (0.1% or greater).
Level 3	**Established:** The ratio of Internet users per capita is on the order of magnitude of at least 1 in 100 (1% or greater).
Level 4	**Common:** The Internet is pervasive. The ratio of Internet users per capita is on the order of magnitude of at least 1 in 10 (10% or greater).

Geographic Dispersion

As currently defined in the analytic framework, geographic dispersion is a function of the fraction of first-tier political subdivisions with an Internet point of presence. Pakistan is divided into four provinces (Balochistan, North-West Frontier, Punjab, Sind), one territory (Administered Tribal Area), and one capital territory (Islamabad Capital Territory). A review of ISP websites during the summer and fall of 1999 showed advertised presence as shown in Table 24. The numbers are not exact; many ISPs did not indicate the cities in which they had POPs; others may not have provided complete listings. According to some sources, 30 cities in Pakistan had ISP points of presence at that time.[76]

A geographic representation of this data is shown in Figure 12. This figure shows that POPs are now found in all four Pakistani provinces. The location of ISPs reflects the underlying geographic influence that shapes not only the geographic dispersion of the Internet but the socio-economic structure of the country itself. Most of Pakistan's people, in-

Table 24. ISP Concentration in Pakistani Cities

City	No. ISPs	Province
Karachi	21	Sind
Lahore	15	Punjab
Islamabad	8	Islamabad Capital Territory
Rawalpindi	4	Punjab
Hyderabad	4	Sind
Sialkot	3	Punjab
Faisalabad	3	Punjab
Peshawar	3	North-West Frontier
Gujranwala	2	Punjab
Multan	2	Punjab
Rahimyar Khan	2	Punjab
Bahawalpur	1	Punjab
Sukkur	1	Sind
Gujrat	1	Punjab
Sahiwal	1	Punjab
Sheikhupura	1	Punjab
Mardan	1	North-West Frontier
Quetta	1	Balochistan

dustry, and power lie within the Indus River valley and the fertile basin of its tributaries rather than in the mountains and plateaus of the western and northeastern portions of the country. Although Internet points of presence are found in all provinces, rural access is by no means publicly and commonly available. As a result, Pakistan cannot have a rating higher than 3 *(Highly Dispersed)* for geographic dispersion, as indicated in Table 25.

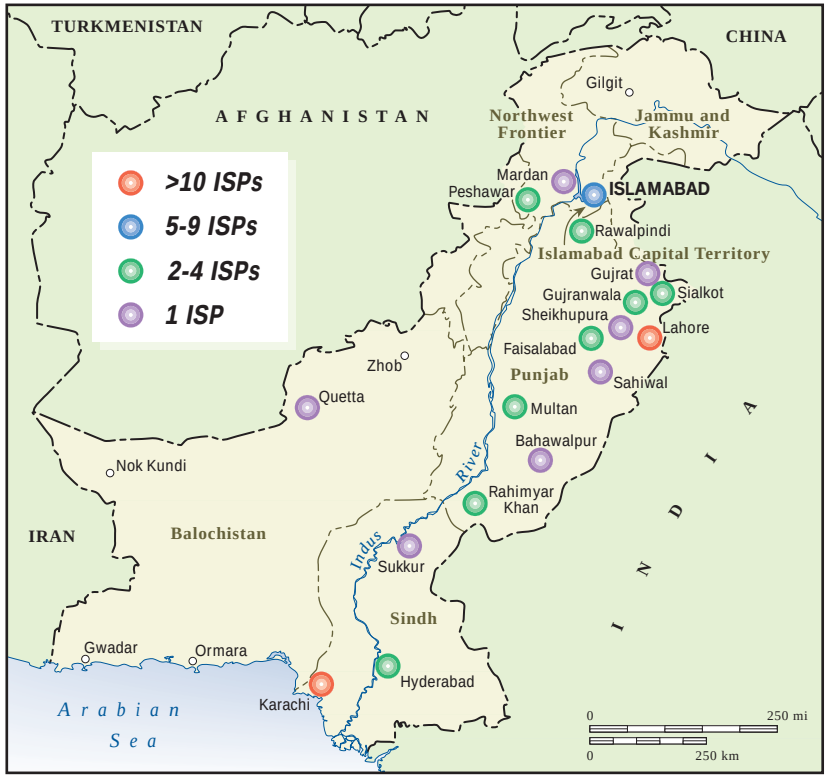

Figure 12. ISP Concentration in Pakistani Cities (1999)

Table 25. Geographic Dispersion of the Internet in Pakistan

Level 0	**Nonexistent:** The Internet does not exist in a viable form in this country. No computers with international IP connections are located within the country.
Level 1	**Single Location:** Internet points of presence are confined to one major population center.
Level 2	**Moderately Dispersed:** Internet points of presence are located in multiple first-tier political subdivisions of the country.
Level 3	**Highly Dispersed:** Internet points of presence are located in at least 50% of the first-tier political subdivisions of the country.
Level 4	**Nationwide:** Internet points of presence are located in essentially all first-tier political subdivisions of the country. Rural access is publicly and commonly available.

Sectoral Absorption

The ratings shown in Table 26 put Pakistan at the low end of Level 2 *(Moderate)* for sectoral absorption (see Table 27). Currently, numerous plans exist that, if brought to fruition, will change the sectoral absorption substantially, making Pakistan a firm Level 2 or possibly even a Level 3. Table 26 indicates that the commercial and public sectors are the most promising candidates for a *Medium* sectoral absorption in the near term. While most universities are likely to gain Internet access, a substantial effort will be required to bring a significant fraction of primary and secondary schools online.

Table 26.
Absorption of the Internet in Sectors of the Pakistan Economy

Sector	Minimal	Medium	Great Majority
Academic (primary and secondary schools, universities)	<10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Commercial (businesses with more than 100 employees)	<10% have Internet servers	10-90% have Internet servers	>90% have Internet servers
Health (hospitals and clinics)	<10% have leased-line Internet connectivity	10-90% have leased-line Internet connectivity	>90% have leased-line Internet connectivity
Public (top- and second-tier government entities)	<10% have Internet servers	10-90% have Internet servers	>90% have Internet servers

Education

While most colleges have dial-up access, according to one source less than 0.5 percent have leased-line connectivity.[77] Connectivity among K–12 schools is very low. However, this may change. Ahsan Iqbal, deputy chief of the Planning Commission, told a workshop on Private Sector Reforms in Islamabad on June 9, 1999, that by the year 2005 every high school student in Pakistan would have a computer.[78]

Table 27. Sectoral Absorption of the Internet in Pakistan

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

Health Care

The PTA website lists only five health-care facilities. According to representatives of ZoooomNet, only the Aga Khan Hospital in Karachi has leased-line connectivity.[79] While this is enough to establish that at least one health-care facility has Internet connectivity, it is a vanishingly small percentage of the health-care facilities that service the country.

Commercial

The commercial sector is difficult to evaluate. While the PTA website listed 115 commercial organizations evaluated for the survey of sophistication of use, the actual number of commercial organizations using the Internet is larger. We do not, however, have a precise count of the number of .com.pk domains that have been registered. The Internet Software Consortium July 1999 Internet Domain Survey (formerly done by Network Wizards) counts 523 Level 2 domains under the .pk domain (e.g., netmag.com.pk). If the collection of organizations on the PTA website has the same distribution of organizations among the .com, .gov, etc. domains (certainly not guaranteed), then one would conclude that 58 percent of the Pakistani domains are commercial. If that is the case, then approximately 300 commercial organizations have their own domain names under the .pk domain.

The specific numbers here are probably incorrect, being based on some shaky assumptions. However, even if all 523 hosts were commercial, this still probably does not represent 10 percent of the Pakistani companies with more than 100 employees.

What makes Pakistan a bit unusual, however, is that according to Hassan, most businesses are jointly owned by families but managed individually. As families grow, they spin off new business units to give to the younger generation rather than allowing businesses to grow. In addition,

Pakistani laws have, to an extent, favored small firms over large.[80] As a result, the number of large companies is likely to be much smaller relative to the population than would be the case in developed countries. Representatives of ZoooomNet claim that over 50 percent of Pakistani companies with more than 100 employees have leased-line Internet connectivity.[81] Additional research is required to reconcile this figure with the Network Wizards data. However, it is likely that sectoral absorption among commercial organizations will cross the 10 percent boundary soon, if it hasn't already.

Public

According to some observers, most central government ministries do have leased-line connectivity to the Internet. Moreover, there are indicators that the usage of computer networks could increase substantially in the near future. These indicators include plans not only for new installations of networks but also, and perhaps more significantly, for the expanded use and dissemination of government information by electronic means.

On March 19, 1999, the interior minister of Pakistan unveiled plans to link all district headquarters with provincial capitals and the federal capital networks. Part of this plan included the creation of a computer-based national registration system that would support the issuance of identity cards, new passports, and residency cards for overseas Pakistanis.[82] According to Ahsan Iqbal, deputy chief of the Planning Commission, the Pakistani federal government will spend $20 million on computerization in the 12-month period from July 1999 to July 2000.[83]

Perhaps the provinces most actively pursuing computerization are Punjab and Sind. In 1999 each established IT Promotion Boards to formulate and implement strategies to maximize the use of computers in every provincial government department.[84] Punjab has been working on a website on which to make available to the populace the laws and rules and regulations of all provincial departments as well as any updates.[85] The province also plans to spend over $8 million in 1999–2000 to computerize land records in all the 34 revenue districts of Punjab.[86] In September 1999, plans were announced to link all of the departments. A pilot project, already underway, is linking the Governor House, the Chief Minister House, and all provincial department heads.[87]

Connectivity Infrastructure

Pakistan's ratings in the four components of the connectivity infrastructure dimension are shown in Table 28.

Table 28. Connectivity Infrastructure of the Internet in Pakistan

Level	Domestic Backbone	International Links	Internet Exchanges	Access Methods
0: Nonexistent	None	None	None	None
1: Thin	<3 Mbps	<129 Kbps	None	Modem
2: Expanded	3-200 Mbps	129 Kbps-45 Mbps	1	Modem 64 Kbps DDN 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 Connectivity

Pakistani ISPs must currently connect to the global Internet through an international leased line to a global carrier, typically UUNET, Teleglobe, or SINGNET. Some other ISPs use MCI or Sprint. These carriers do not have a network access point (NAP) within Pakistan, so connections must be made via two half-circuits, with the Pakistani half-circuit provided by PTCL.[88] Of the international circuits, 70 percent terminate in Karachi, and 30 percent terminate in Islamabad.[89]

Due to the high cost of international bandwidth, ISPs typically have no more than a 2 Mbps (E1) connection, and most have less than 1 Mbps.[90] While the total international bandwidth to and from Pakistan was estimated (July 1998) to be approximately 620 Mbps not including bandwidth PTCL leased on See-Me-We 3,[91] the ISPs use only a small fraction of this, perhaps 5 percent. According to ZoooomNet representatives, the total international IP bandwidth from Pakistan was 32 Mbps in 1999.[92]

Domestic Backbone

There does not exist a proper Internet backbone in Pakistan. Since there is not even a network access point of the international carriers, traffic from one ISP to another must leave the country, usually to the United States or Canada, and return.[93] The creation of such a backbone was a strong recommendation in a study by Shah.[94]

According to some observers, one of the reasons for the lack of a domestic backbone has been the lack of an organizational entity around which to arrange it. The Internet Service Providers Association of Pakistan (ISPAK) was supposed to have played a role in providing a unified voice for Internet service providers in their negotiations with the Pakistan Telecommunication Authority. However, this objective has not, apparently, been realized.

One of the more enigmatic developments has been the announcement by PTCL of a major effort to establish such a backbone. Press reports of the last year have reported the completion of the first phase of a large Internet expansion project called the National Internet Backbone (NIBB).[95] The objective is to provide a total of 300,000 new Internet connections, with 50,000 becoming available by September/October 1999.

When asked about this project, the editor of the leading Internet magazine in Pakistan *(NetMag)* replied, "You know how things work here in Pakistan, we have heard that PTCL is putting something of that sort together but how and when it is going to do that is still a mystery to me too."[96]

While there does not exist a domestic backbone shared by multiple ISPs, the aggregate capacity of the links between Karachi and Islamabad of those ISPs with POPs in those cities is almost certainly more than 2 Mbps.

Internet Exchanges

There are currently no Internet exchange points in Pakistan. While the Internet Service Providers Association of Pakistan has been serving as a forum for such discussions, and plans for the creation of an Internet exchange point are underway, these plans have not yet resulted in the creation of an IXP.

Access Methods

The access methods available to subscribers in Pakistan are shown in Table 29. As the table shows, subscribers who do not have a continuous connection to an Internet service provider almost always use dial-up connections; high-speed Internet access is available in only very limited forms.

Modems up to 33.3 Kbps offer 22–25 Kbps access via Pakistani telephone lines; 56 Kbps modems are of little additional benefit because the quality of telephone lines is low, and the international lines of the ISPs have such limited capacity that they are the bottleneck, rather than the local loop. Furthermore, ISPs typically oversubscribe their networks.[97]

Companies in Pakistan also favor dial-up connections. In a survey conducted in 1998, Shah found that 58 percent of companies responding used dial-up connections; 28 percent used a 64 Kbps shared channel; 7 percent used a 64 Kbps clear channel; and 7 percent leased a 256 Kbps clear channel.[98] Although they have a low call completion rate and bandwidth effec-

Table 29. Internet Access Methods in Pakistan

Service	Availability	Performance	Pros	Cons
Dial-up	Wherever there are telephone lines	56/33.6/19.2/ 9.6 Kbps	Cheap, easy to install, and available in most places	Quality of lines reduces data rates well below theoretical
ISDN	Very limited	128 Kbps —basic rate	Enhanced capacity and functionality	Costly, relatively slow
Satellite	Nationwide	400 Kbps downstream/ 33.6 Kbps upstream	Good down-stream speed; available to anyone with clear view of southern sky	Discouraged by PTCL; costly compared with alternatives
Cable	Not available	1-5 Mbps downstream/ 33.6-2.5 Mbps upstream		
xDSL	Extremely limited	144 Kbps-8 Kbps/64 Kbps-8 Mbps	Fast connect that does not tie up a phone line	Almost nonexistent in Pakistan; costly

Source: S. I. A. Shah, "Data Communication Services: Their Impact on the Pakistani Software Industry," abridged version of the report on "Data Communications Services: Their Impact on the Pakistani Software Industry," a Small and Medium Enterprise Development Authority Funded Report.

tively restricted to 32 Kbps, dial-up connections are found by most companies to be more cost effective than the alternatives. Overall, the bottleneck in connecting to the Internet is not the local loop. Increasing bandwidth at the user end is not likely to improve performance until the capacity of the backbone increases. Only one ISP, Cybernet, offered ISDN access in 1999.[99]

Organizational Infrastructure

Regulatory Regime

The *Pakistan Telecommunication (Re-organization) Act, 1996* continued the monopoly over basic domestic and international telecommunications services that had been put in place earlier. Internet service providers must

obtain their domestic leased lines and the international half-circuit to a foreign carrier from PTCL.

The government of Pakistan has deregulated and privatized the provision of certain telecommunications services and the manufacture of certain telecommunications equipment. Table 30 lists the services, the number of licensees, and related data, presumably as of early 1999. Of the 45 licensees of data network services, 18 are providers of data network services who are also licensed to offer Internet services, and 27 are licensed as electronic information service providers.

The data network operation figures of Table 30 were obtained from the PTCL and PTA webpages in October 1999. Aside from pointing out that the PTCL has not done a good job of keeping its website updated, the data also show the rapid growth in data network operation services, especially within electronic information services/email (Internet services). Although less than half of the companies granted licenses are offering services, the 40 active ISPs (October 1999) have created a very competi-

Table 30.
Privatized and Deregulated Telecommunications Services in Pakistan

Service	Licensees (PTCL webpage)	Licensees (PTA webpage)
Data Network Operation		
Data	18	29
Information Services	27	88
Cellular mobile phone system	3	4
Radio paging system	1*	3
Trunked radio	11	11
Card pay phone	7	10
Satellite services		3
Telephony services		2**

Sources: "Existing Private Sector Licensed Services," Pakistan Telecommunications Corporation, <http://www.ptc.pk/invst1.html> (May 26, 1999); "List of Licensees," Pakistan Telecommunication Authority, <http://www.pta.gov.pk/industry/pta%20costumers.htm> (October 16, 1999).

* Eleven other licensees are unable to begin offering radio paging service because of litigation.

** The two licensees for telephony services are the PTCL and the National Telecommunication Corporation.

tive market. According to some industry observers, 150 licenses have been granted, and 30 more are being processed.[100]

The ISP market has become highly competitive, fueled in no small part by measures such as an ongoing ISP survey conducted by *NetMag* magazine, one of the leading Internet-focused periodicals in Pakistan. This survey (http://www.netmag.com.pk/) not only posts data regarding connection prices and locations but also solicits input from readers regarding the quality of the ISPs and tabulates and posts this information on its website.

While the survey is certainly not scientific and, in all likelihood, does not prevent ISPs from seeding the survey with positive comments about themselves or negative comments about their competitors, the existence of the survey indicates a heated competition among what is likely more ISPs than the existing market can support.

Industry Associations

The Internet Service Providers Association of Pakistan (ISPAK) was founded in 1998 to act "as a catalyst for opening newer and better avenues for growth of Internet in Pakistan."[101] Its aims include:

- Present a united forum for presenting the issues and points of view of the ISPs and their users to the Government, PTA and PTCL. For this purpose, ISPAK will hold meetings to arrive at a consensus on different issues.
- Present a joint forum for getting optimal pricing and technical solutions from PTCL regarding domestic leased fiber capacity, local dial-in lines, delivery of International circuit and any other areas requiring interface with PTCL.
- Co-operate in all technical, administrative and financial aspects to work towards creating local interconnect between all the ISPs of the country. Currently, any transaction of data that takes place between any two ISPs is routed to the International service provider of the sender and then to that of the intended recipient.
- Private Peering arrangements will be made in order to provide for alternate routes in case of failures so that the end users of the member ISPs do not suffer because of individual link failures.

- The ISPAK will come up with a complete plan for implementing a true Pakistani Internet backbone in the private sector. This will include the administration of the Pakistan TLD in Pakistan via a neutral body.[102]

While these points and the others that appear in the organization's aims and objectives appear to be very sound and worthwhile, in the nearly two years since it was created it is not clear that the organization has come very close to achieving these goals. While it did play a significant role in getting the charges for local phone access to ISPs changed, it has clearly not been successful in establishing a national backbone or even Internet exchange points between its members.

Organizational Infrastructure Rating

In light of the discussion above, we rate Pakistan at a Level 2 *(Controlled)* on the organizational infrastructure dimension (see Table 31). While there are more than a few ISPs at present, the monopoly control over domestic

Table 31. Organizational Infrastructure of the Internet in Pakistan

Level 0	**None:** The Internet is not present in this country.
Level 1	**Single:** A single ISP has a monopoly in the Internet service provision market. This ISP is generally owned or significantly controlled by the government.
Level 2	**Controlled:** There are only a few ISPs because the market is closely controlled through maintenance of 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	**Competitive:** The Internet market is competitive, and there are many ISPs due to the existence of low barriers to market entry. The provision of international links is a monopoly, but the provision of domestic infrastructure is open to competition, or vice versa.
Level 4	**Robust:** 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.

and international basic telecommunications services prevents the rating from rising to a Level 3 *(Competitive).*

Sophistication of Use

A preliminary assessment of the sophistication of use by Pakistani organizations was undertaken during September 1999. Not a statistically robust survey, the study provides results that would have to be verified through a more stringent methodology. Nevertheless, it may provide some baseline data.

The Pakistan Telecommunication Authority website contains links to websites of more than 200 organizations. These organizations cover a broad spectrum of sectors of the Pakistani economy. We grouped them into five categories: health, education, government, commercial, and other. The "other" category includes a number of nonprofit organizations with religious or national orientation. The websites of these organizations were evaluated against the five levels of sophistication of use, shown in Table 32.

Table 32. Sophistication of Use of the Internet in Pakistan

Level 0	**None:** The Internet is not used, except by a very small fraction of the population that logs into foreign services.
Level 1	**Minimal:** The small user community struggles to employ the Internet in conventional, mainstream applications.
Level 2	**Conventional:** 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 for or straightforward enhancement of an existing process (e.g., email vs. post). This is the first level at which we can say that the Internet has "taken hold" in a country.
Level 3	**Transforming:** 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	**Innovating:** 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.

Table 32 shows examples of uses of the Internet that would be typical of a ranking at the level indicated. It is not necessary, however, for an organization to exhibit *all* of the uses before being ranked in that category. Indeed, one of the limitations of the survey is that all the information is drawn from a company's webpage. It is possible that there exist companies with rather unsophisticated publicly accessible websites that may make more sophisticated use of the Internet internally.

Figure 13 contains the results of the survey. By definition, there were no Level 0 organizations included in the survey since such organizations do not have websites. In most sectors, most organizations are at Level 1, meaning that their websites are little more than an electronic "shingle" providing the most basic information about the organization. Interestingly, the education and government sectors appear to have fewer Level 1 organizations than Level 2 organizations. At Level 2, organizations are providing more than basic identifying information. Often they are using

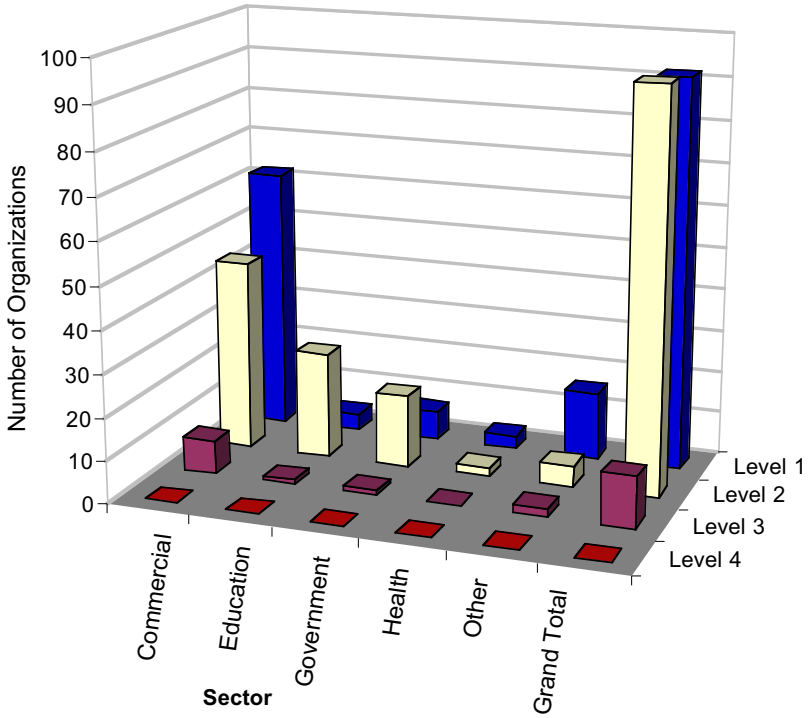

Figure 13. Sophistication of Use of Pakistani Organizations

the website as a mechanism for information dissemination. The fact that education and government sectors have relatively more organizations in this category than in Level 1 may reflect the fact that information dissemination is closer to their core mission than to that of the commercial and health-care sectors. Alternatively, the commercial sector may be experiencing a rapid increase in the use of the Web. The high proportion of companies with Level 1 sophistication of use may reflect a large number of "newbies." The educational and government organizations may simply have been using the Web for a longer period of time.

The small number of organizations at Level 3 sophistication of use indicates that, among other things, electronic commerce (at least, the business-to-customer variety) is not widely supported in Pakistan. Of the 12 organizations ranked at Level 3, one was a government institution (the PTCL), one was an educational institution (the National College of Business Administration & Economics, which has an online registration system), two were from the "other" category, and eight were commercial organizations. Of the latter, a number were ISPs. The other category of most sophisticated users is the newspaper industry. The *Business Recorder*, Pakistan's national financial daily publication, uses the Internet not only to disseminate news but also to sell classified advertisements. *IMRAMM-NEWS* and *Information Times* boast online auctions, site search engines, and so forth.

We did not find in this sample any companies at Level 4. Level 4 companies must be engaged in uses that are innovative, not just new to a particular company or industry.

Overall, we place sophistication of use in Pakistan at a Level 2 in the analytic framework. It is likely that the number of Level 3 organizations will increase substantially in the near future. If electronic commerce becomes an accepted way of conducting business in Pakistan, the number will grow dramatically. If electronic commerce does not, it will grow much more slowly.

Voice over Internet is prohibited in Pakistan.[103] While ISPs inform their customers of this, they typically do not close the ports that enable such transmission. Consequently, voice over Internet is popular.[104] The PTA has tried to enforce this restriction. During 1999, ZoooomNet and AK Net were (temporarily) shut down for violations.[105]

Analytic Framework Dimensions

Figure 14 shows the growth of the Pakistani Internet along the six dimensions. The extent and sophistication of Internet use continue to expand, and the growth of the ISP market in recent years has been substantial.

However, developments in the regulatory regimes and networking infrastructure have been slower, which is likely to hinder more rapid development in all dimensions. Organizational use, while growing, remains low.

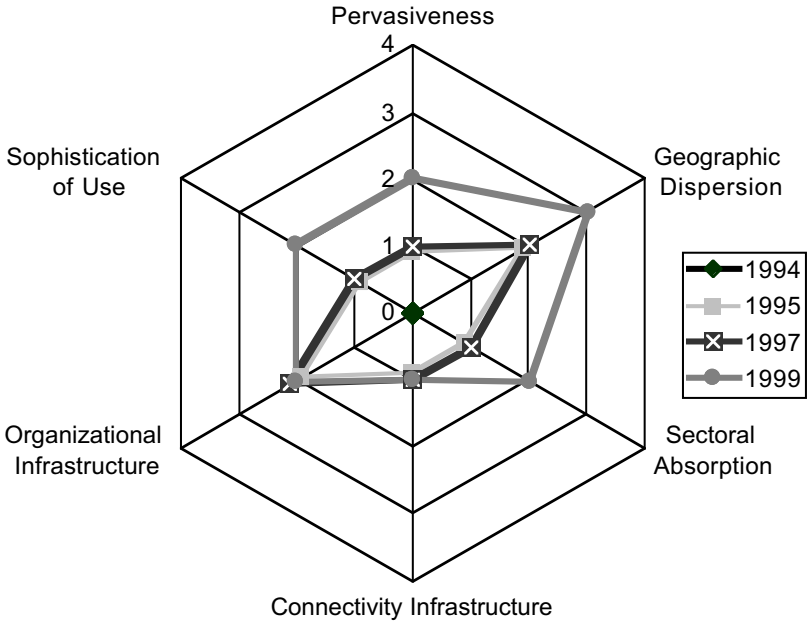

Figure 14. Internet Diffusion Dimensions in Pakistan

5. The Internet in Turkey and Pakistan: A Comparison

The preceding chapters have traced the development of the Internet in Turkey and in Pakistan. This chapter highlights the similarities and differences in the two countries' Internet experiences and suggests an explanation by applying the analytic framework developed in chapter 2.

The State of the Internet in Turkey and in Pakistan

Table 33 provides some comparative statistics of the Internet in the two countries, and Figure 15 compares the Internet's state along the dimen-

Table 33. Internet Statistics in Turkey and Pakistan (late 1999)

	Turkey	Pakistan
Number of users (2000)	2-2.5 million	500,000-700,000
Number of users (% population) (2000)	3-3.75%	0.34-0.48%
ISPs (1999)	80	40
Provinces with POPs (1999)	19 (24%)	4 (100%)
Domestic backbone (aggregate) (1999)	1200 Mbps	N/A
Per capita backbone (bps) (1999)	18.28	0
International bandwidth (1999)	139 Mbps	32 Mbps
Per capita int'l bandwidth (bps) (1999)	2.12	0.23

sions of the analytic framework used in this study. With each level representing a substantial increase over the next lower level, Figure 15 shows that the Internet is considerably better developed in Turkey than in Pakistan along all dimensions, except for sophistication of use, where the two countries rate at the same level. Although the two countries rate the same in the sectoral absorption dimension, Turkey is a strong Level 2 about to become a Level 3, while Pakistan is a weak Level 2. Turkey has five times more Internet users (per capita); has much better access to the Internet—in smaller cities and rural areas in particular; has a greater fraction of commercial, government, educational, and health institutions using the Internet; has much higher domestic and international bandwidth; and has a somewhat more robust and liberalized regime offering basic telecommunications and Internet services to the ISPs and the user community.

While these differences are significant, substantial macro-similarities exist as well, particularly in the dynamic of the Internet in recent years.

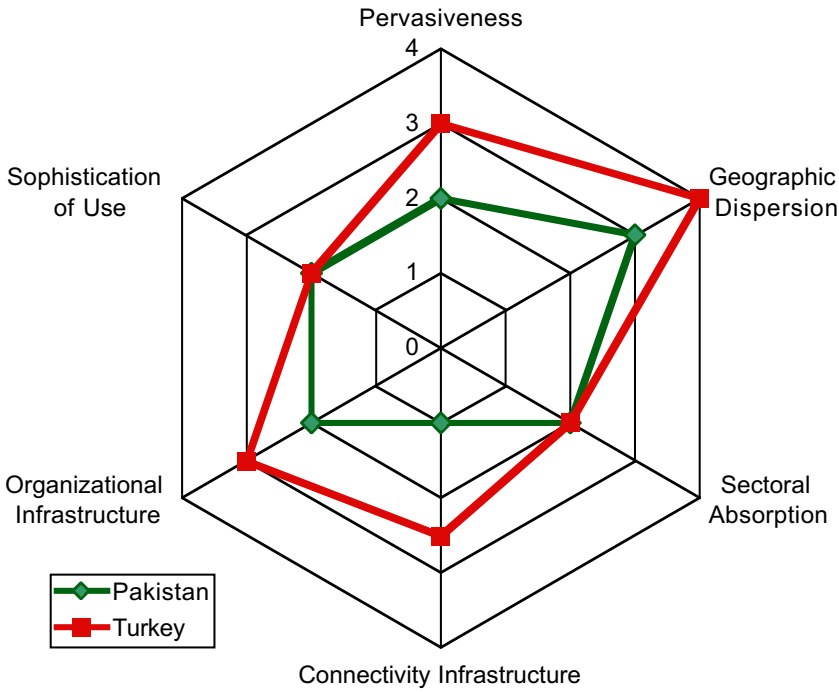

Figure 15. The Internet in Turkey and in Pakistan (late 1999)

First, both countries have seen dramatic increases in the number of individuals and organizations using the Internet. In the last two years of the 1990s, the user population increased 5–10 times in the two countries. Second, in both countries the proliferation of ISPs began with great speed following changes in policy and the regulatory framework that permitted the creation and operation of private ISPs. Third, the underlying telecommunications and networking infrastructure supporting the Internet has expanded dramatically in both extent and capacity. Fourth, in each country government policy-makers have been generally supportive of the Internet, to the extent that they pay attention to it at all.

A comparison of the determinants of Internet diffusion of the analytic framework yields additional similarities and differences.

Determinants of Internet Diffusion

Access to the Internet

Access to the Internet (or to the Internet backbone for ISPs) is not possible without communications lines of sufficient quality to carry a connection (or a suitable wireless substitute), access to an Internet service provider (or backbone), and the hardware and software necessary to establish the connection.

Individual Access to the Internet

The vast majority of Internet users in Turkey and Pakistan access the Internet over dial-up connections. Consequently, the extent of basic telecommunications service is a significant determinant of the pool of potential users. Turkey here has a substantial edge over Pakistan. Not only is the number of main lines per capita considerably greater in Turkey (24 percent) than in Pakistan (3 percent), but rural service is more widespread. Since 1988, all Turkish villages and cities have had telephone service. Pakistan is still reaching for this goal.

In both countries the areas in which Internet service is available have expanded considerably. Although Turkish ISPs had, in 1999, POPs in fewer than 20 cities, Türk Telekom has, since 1997, offered a special access code (0822) for access to Internet service providers that has brought reasonably priced Internet access to the entire country. In 1999, Pakistani ISPs operated in 17–30 cities. However, users outside these cities have had to pay hefty long-distance charges, making access in practice limited to the larger urban centers.

A third component, access to personal computers, has improved in both countries recently, although most of the population continues to be

unable to afford them. In each country, dropping PC prices and a proliferation of Internet cafés have dropped this barrier. In Turkey, some ISPs are offering free hardware in exchange for a multiyear Internet access contract. In Pakistan in 1998, the government removed all import duties on personal computers, bringing the legal prices much more in line with international prices.

ISP Access to the Internet Backbone

ISPs access the Internet through leased-line connections to a national backbone or via international lines to a global carrier. Of the two countries, only Turkey has a national backbone. In cities housing a backbone node, the barriers to ISPs have been low. While the number of such cities is growing, ISPs' ability to establish points of presence outside of these cities has been limited by the cost and difficulty of acquiring the necessary leased lines.

There is no Internet backbone in Pakistan, other than the lines that individual ISPs lease from PTCL to carry their own traffic. To connect to the global Internet, ISPs must lease rather pricey international circuits. Getting such leased lines might not take place as quickly as some would like, but the technical barriers are low, at least to the major cities. The primary barriers to ISPs are financial.

In January 2000, PTCL floated a tender for the creation of two network access points in Islamabad and Karachi through which it would be able to block voice over IP traffic and pornography.[106] For such monitoring to work, all ISPs would have to route their international traffic through one of these two points. While this policy has generated a great deal of discussion, one possible benefit could be the creation of what amounts to an Internet exchange point between Pakistani ISPs. No longer would inter-ISP traffic have to travel outside of the country.

Cost of Internet Access

The cost of Internet access has a fundamental impact on market size and ISPs' ability to offer service profitably. Decreases in ISP access costs have been a major factor fueling the expansion of the Internet in both Turkey and Pakistan. Between 1997 and 1999, prices of basic leased connectivity costs dropped in both countries, but by substantially more in Turkey (50-90 percent) than in Pakistan (25-32 percent).[107] These price reductions enabled ISPs operating in highly competitive environments in both countries to reduce subscription fees.

Not only have costs been dropping more rapidly in Turkey, absolute costs are lower there as well. Table 34 shows the cost of domestic and international 1 Mbps connections to the Internet. These figures are illus-

trative of cost differences in the two countries for a variety of basic telecommunications services.

Table 34.
Monthly Connectivity Cost for 1 Mbps Internet Connection (1999)

	Domestic		International (half-circuit)
Turkey	TURNET $10,350	TTNet $2,391	$15,280-$33,700
Pakistan	$33,750		$30,047

Sources: "Lease Channel Tariffs," Türk Telekom, <http://www.ttnet.net.tr/tarifeler/kiralik.htm> (September 9, 1999); "PTCL Leased Data Circuit Rates," *NetMag,* no. 5 (January-February 1999); "TTNet Tariffs," Türk Telekom, <http://www.telekom.gov.tr/ttnet/tarife3.htm> (September 9, 1999); "TURNET's New Price List," Türk Telekom, <http://www.turnet.net.tr/ucret.htm> (September 2, 1999); "PTCL Lowers Connectivity Charges," *IT Pakistan* 1, no. 12 (July 9, 1999): 1.

The connectivity cost is a major component of the costs that ISPs pass along to subscribers in the form of subscription rates. Here also, Turkish users enjoy substantially lower rates than their Pakistani counterparts. In 1998, ISPs were typically charging $40–50 per month for unlimited connect time. A survey of ISPs conducted during the summer of 1999 showed monthly connect fees ranging from $10 per month (with a two-year contract) to $32 per month. The average monthly fee was approximately $21. In contrast, most Internet service subscription fees in Pakistan were, and continue to be, based on usage. In 1997, average ISP charges were approximately $1.80 per hour during daytime hours and $0.80 per hour for off-peak periods. In late 1999, the Internet service providers were competing intensively on price, but a fixed rate for unlimited access was *not* universal. Of the nearly 30 ISPs posting rates on the Web, nine offered unlimited access at rates ranging Rs 1,500–2,500 per month ($30–48 per month). All ISPs offered a variety of tariff packages based on hourly rates. Hourly rates ranged Rs 20–65 per hour (approximately $0.38–$1.26 per hour); the greater the number of hours in the "package" the lower the hourly rate.

End users face additional costs that can greatly increase the cost of Internet access. In both Pakistan and Turkey, local as well as long distance calls are billed on a metered basis. Pakistani users face charges of nearly $0.60 (including tax) per hour for local calls. While the cost of long-distance calls has decreased, it is still prohibitive for most citizens consid-

ering accessing the Internet from outside the major cities. In Turkey, the 0822 access code enables users to connect to their ISPs at rates that are comparable to local calls, regardless of where they are in the country.

In both countries, telecommunications services are provided by the national telecommunications provider (or, in the case of Turkey, a limited number of licensed providers of international connectivity). Türk Telekom and PTCL have been the target of privatization efforts by their governments for several years, and they have a strong interest in maintaining healthy balance sheets. While each has dropped prices in recent years, Türk Telekom has dropped prices farther and faster than PTCL. One possible reason for this difference could be the basic philosophies and relative strengths of the two companies within the economic/political environment in their countries. Türk Telekom has a tradition of universal service and development of new communications technologies. Although it is a monopoly and its prices are not subject to market pressures as in a competitive economy, pressure for price reductions has come through other quarters. The drop in prices in 1998 was, in part, a result of such a recommendation by the Internet Executive Council;[108] it reflected a desire of Türk Telekom's parent ministry to encourage Internet growth. As usage of the Internet in Turkey increases, the political pressure that can be brought to bear by the public, the press, the ISPs, and the major investors in those ISPs increases. In Pakistan, telephone service has been viewed not as a basic necessity but as a luxury, and has had a tariff structure reflecting this philosophy. Initial installation costs have been high. Local telephone calls are metered. PTCL is a strong institution, under relatively less political pressure to decrease prices, especially if reductions would have an impact on its balance sheet that would hinder privatization efforts. In short, while Türk Telekom has had a generally supportive attitude toward Internet service providers and users, PTCL has been more antagonistic.

Ease of Use

The web browser was designed to be easy to use, and the experience of millions of individuals throughout the world is that with minimal training a literate individual can use the Internet for at least electronic mail and Web surfing. Nevertheless, Turkey and Pakistan differ in the extent to which even a browser interface presents a barrier.

Turkey has a high level of literacy (82 percent), so the technical demands of Internet use are not a significant barrier. However, only a small percentage of Turks can speak or read English. Consequently, the ability of Turks to use the Internet productively is shaped in part by the amount of interesting Turkish-language content. Fortunately, the volume of Internet

content in Turkish is growing. Companies like SuperOnline have made a priority of creating a "Turkish Internet" with content tailored to the Turkish-speaking population.[109] According to the Ministry of Transport and Telecommunications Master Plan for Information Technology (TUENA), in 1998 80 percent of webpages in Turkey were in Turkish.[110]

Pakistan has a much lower rate of literacy (35–45 percent). Of those who can read, two-thirds read only Urdu and one-third can read English (although most prefer Urdu).[111]

Perceived Value of the Internet

Individuals', organizations', and government policy-makers' perceived value of the Internet has a profound impact on the Internet's development. The net perceived value reflects a balance, or tension, between many hopes, desires, imperatives, worries, and concerns. Without a net positive perceived value, individuals and organizations are unlikely to embrace the Internet; policy-makers are unlikely to promote and support it.

Although it is very difficult to quantify the perceived value within a country, anecdotal evidence suggests that the popularity of the Internet has grown dramatically in both Turkey and Pakistan in recent years. At the same time, both countries have reasons to be concerned about the impact of the Internet on domestic security and culture. Pornography, un-Islamic information such as how to commit suicide, and proselytizing by other religions are easily disseminated over the Internet. Terrorists and antigovernment activists could use the Internet to organize their supporters, plan their activities, and carry out propaganda campaigns. Foreign antagonists in Greece and India possibly could use the Internet for purposes ranging from direct information dissemination to Turkish and Pakistani citizens to more destructive cyber attacks on prominent websites and important computer installations. Each country has established media and commercial conglomerates that could also perceive the Internet as a threat to their control over public opinion and the economy.

Examples of each of these uses of the Internet can be found. Groups fighting for Kurdish, Kashmiri, and Cypriot interests have websites promoting their viewpoints and providing a cyber presence for their causes. The Insurgency Online Project at York University maintains a directory of electronic oppositions at http://www.yorku.ca/research/ionline/elop.html. Some of the insurgency organizations and their URLs are found in Table 35.

The Internet may also play a role in planning protests or other activities. For example, following the arrest of Kurdish leader Abdullah Ocalan in February 1999, Kurds organized protests in 20 European cities within

Table 35. Internet Presence of Opposition Organizations Supporting Kurdish, Kashmiri, or Cypriot Causes

Kurdistan	
Kurdistan Workers Party (PKK)	http://www.pkk.org/
Kurdish Struggle	http://www.kurdstruggle.org/
Kurdish Information Network	http://www.xs4all.nl/~tank/kurdish/htdocs/
Kurdish National Liberation Movements	http://www.xs4all.nl/~tank/kurdish/htdocs/lib/
Patriotic Union of Kurdistan	http://www.puk.org/
Revolutionary People's Liberation Party Front (DHKP-C)—Kurdish	http://www.ozgurluk.org/dhkc/
Ozgurluk	http://www.ozgurluk.org/
Kashmir	
Jammu Kashmir Liberation Front	http://shell.comsats.net.pk/~jklf/index.html
Kashmiri American Council	http://www.erols.com/gfai/index.html
Kashmir Council for Human Rights	http://www.ummah.org.uk/kashmir/kchr/
The truth about Kashmir (Indian Army perspective)	http://www.armyinkashmir.org/
Jammu and Kashmir (pro-Indian Kashmiris)	http://www.jammu-kashmir.com/
Cyprus	
Cyprus-Net	http://www.kypros.org/
Diaspora	http://www.diaspora-net.org/
Lobby for Cyprus	http://www.lobbyforcyprus.org/
Cyprus X'File	http://www.cyprusxfile.com/main.html

Note: The organizations promoting Cypriot interests are not included on the Insurgency Online website.

two hours.[112] While it is likely that broadcast media such as the Kurdish television channel MED TV in London played a larger role than the Internet in getting people into the streets, the Internet probably played a significant role in organizing the demonstrations.

The Internet has also seen numerous examples of website defacement supporting one cause or another. The Pakistan Hakerz Club, Gforce Pakistan, and m0s have been particularly active, defacing hundreds of websites worldwide with pro-Kashmiri, anti-Indian statements.[113] While examples may be found, hacks by other groups with an interest in the conflicts of Turkey or Pakistan are less numerous. The pro-Kurdish Kalamata hacked the Greek Ministry of Foreign Affairs for its role in the Ocalan arrest; Stonehenge Crew has touted Greek superiority on a number of (non-Turkish) sites. These and other examples of defaced webpages may be found on the websites of http://www.attrition.org and http://www.projectgamma.com, which track defacings throughout the world.

While concerns over the Internet have surfaced in both Turkey and Pakistan, in neither country have these concerns coalesced (so far) into a force that has significantly impeded or altered the development of the Internet. On the contrary, it appears that whatever barriers have been put in place (or, at least, not removed) have centered on economic issues, such as the desire to maintain the well-being of the national telecommunications provider. At present, the balance of interests in Turkey and Pakistan tend rather strongly toward favoring the expansion of the Internet. However, the basic reality is that the vast majority of citizens and politicians do not interact with the Internet regularly and do not view it as a priority item.

Individuals' Perceived Value of the Internet

Why are individuals in Turkey and Pakistan drawn to the Internet? While no formal surveys have been conducted, individuals intimately involved with Internet cafés, ISPs, and other facets of Internet use in Turkey suggest that chat and pornography are two of the dominant uses. One of the most popular applications of the Internet in Pakistan is Internet chat. According to one source, nearly 90 percent of Pakistani users consider using Internet chat to be their primary motivation for using the Internet.[114] In both countries, the Internet has become an important source of information for expatriate communities about their home countries. The Internet played a particularly important role in this regard during the October 1999 coup. Reportedly, on October 13, 1999, the website of *Dawn*, a leading Pakistani periodical, was accessed by nearly 124,000 distinct individuals. In contrast, only 75,000 accessed the website 18 months earlier during the nuclear tests.[115]

While the Internet has become fashionable within certain segments of both the Pakistani and the Turkish populations, for the vast majority of each country's population the Internet remains of little concern. Given the state of the two countries' economies, most individuals are much more concerned with the day-to-day issues of making a living and providing for their families.

At the same time, the ISPs and companies like banks are working very hard, particularly in Turkey, to increase the perceived value of the Internet by exploring new content and services. For example, one of SuperOnline's major strategies at the moment is to create Turkish content that will make the Internet a part of the daily life of individuals. The content includes local travel, cinema, news, and investment features. SuperOnline supports an investment simulation game in which users can track the progress of fictitious portfolios against actual stock prices.[116] Garanti Bank took the unusual step of establishing its own Internet service provider operation to offer lower ISP subscription rates to its account holders.[117]

Organizations' Perceived Value of the Internet

Among organizational users, the perceived value varies from sector to sector. In the Turkish commercial sector, interest in the World Wide Web and electronic commerce is growing rapidly. One ISP reports that the web-hosting business is growing by 25 percent per year.[118] As the number of companies using the Internet grows, Internet use increasingly becomes an obligatory accessory, even if the company has not examined in detail the most appropriate use of the medium. Here also, the Internet has become fashionable.

While overall awareness of the Internet among Pakistani organizations is probably low, awareness is being heightened through the marketing efforts of individual ISPs, and through events such as national IT summits and international conferences. On October 16–17, 1999, an international conference on "E-Commerce: Preparing for the Challenges" was organized in Karachi.[119]

Policy-Makers' Perceived Value of the Internet

How is the Internet perceived from the perspective of government entities that are responsible for such matters as government administration, policy-making, or national security? Both countries are characterized by governments that are, on the whole, rather disinterested in or ignorant of the Internet, but which have strong support for the telecommunications infrastructure and pockets of serious interest (including high-level ones) in the Internet itself.

While there are groups in Turkey examining various aspects of electronic commerce, including privacy and security matters, the Turkish parliament has not passed legislation that deals specifically with the Internet.

Whether by default or design or both, the current approach is to cope with Internet-related issues as much as possible within the context of existing laws. For example, only Internet cafés that serve alcohol are to be prohibited in proximity to mosques. The publication of pornography on the Internet is illegal not because there is a law specifically against Internet pornography, but because the law already limits the sale of pornographic material in print.

Politically, the Internet is not a significant issue in Turkey and is not viewed as a major factor shaping public opinion. Turkish public opinion is strongly shaped by the handful of corporations that own the principal media outlets. Although these companies are also investing substantial funds in developing a presence on the Internet, the sense among politicians is that the Internet is not a threat as an alternative information source. As one individual put it, "No one is going to start a revolution via email." While this sentiment may change with a growing Internet user population, the Internet and, in particular, the negative aspects of the Internet have relatively low visibility.

In the national security area, three major viewpoints seem to be at work: First, telecommunications is viewed as a means of enhancing national security. Second, the Internet has some qualities that affect national security negatively. Third, one should control what one can but not try too hard to control what one can't. When the Internet first began to take root in Turkey, the national security community, aware of some of the possible uses of the network for terrorist and other socially harmful activities, investigated whether it should, or could, control its development and use. At one point the Interior Ministry tried to shut down Internet cafés because of the potential for users to access information on pornography, terrorist propaganda and expertise (like building bombs), and drug dealing. A small number of members of the Turkish parliament, perhaps 10 out of 550, were promoting the idea of creating a closed Turkish Internet, with strict controls over the flow of information to and from the international Internet. In the end, such measures lacked public support and the support of key individuals in the Ministry of Transport and Telecommunications; the Council of National Security realized that it did not have the human resources necessary. The national security community decided to let the Internet flourish with intervention only when necessary to enforce existing laws.

Discussions on the extent to which the Internet might be controlled continue, however. A draft bill, "Bill on the National Information Security Organization and Its Duties," was crafted by the Ministry of Defense. The bill would create a supervisory committee dominated by the national security community and obligate any Internet-related company to turn over to

the national security community any information it demands, including email, at any level of security requested. There is no mention in the bill of gateways, filters, or other related technologies.[120] In some respects, these measures are an extension of existing prohibitions regulating journalistic treatment of subjects such as the Kurdistan Workers Party (PKK). However, the language of the bill is loose enough that some observers fear it gives the national security community the freedom to pursue broader forms of censorship and monitoring of the population. This bill appears to have stalled out in the legislative process and is undergoing revision.

In Pakistan, interest in promoting the Internet was moderate to high at the highest levels of government. Faroq Leghari, president of Pakistan through 1997, was personally interested in information technology issues, including the Internet, and he appointed a presidential commission to study the issue in the mid-1990s. His successor, President Muhammad Rafiq Tarar, was not as interested, but the former prime minister, Muhammad Nawaz Sharif, and other ministers continued to support the Internet's expansion.[121] In a statement made on Communications Technology Day (June 12, 1999), Sharif underscored his view of the importance of the communications infrastructure:

> I envision Pakistan as a country where an overall progress will be doubly enhanced with effective and modern means of communications. We already have made great advances in roads by spreading a network of Motorways in the country supported with a modern and reliable telecommunication network. The Ports & Shipping day and night are serving the economic needs of the country. Today and tomorrow's progress hinges on the E-Commerce and Information Technology.[122]

While concerns about pornography and other socially objectionable content exist, the Pakistani government has not actively tried to control access to content.[123]

Strong telecommunications has been seen as a necessary condition for a strong software export and IT industry, which in turn has consistently been a priority of the Pakistani government. We have mentioned a variety of measures, including tariff reduction on leased lines, that favor companies involved in such industries.

Telecommunications Providers' Perceived Value of the Internet

Until 1995, Türk Telekom and the Ministry of Transport and Telecommunications paid little attention to the Internet. Although it has sometimes been viewed as a barrier to the growth of the Internet in Turkey,

there is little question that Türk Telekom is eager to see an expansion of the Internet in Turkey and is even willing to tolerate some inconsistencies between the law and existing practice to see it thrive. Certainly Türk Telekom does not have the kind of hostile relationship with users and Internet service providers that other countries' monopolies have.

The perceived value of the Internet by PTCL must be inferred from its actions. Overall, PTCL appears to view the Internet as an encroachment on its traditional activities, rather than as an opportunity to be embraced. This attitude arises from at least four quarters. First, the telecommunications acts of the 1990s establish PTCL as the exclusive provider of basic telecommunications services to nongovernmental entities within Pakistan. Although the Internet is not considered a basic service, some aspects of Internet use—voice over Internet in particular—are, and are points of direct contention between the PTCL and the ISPs. Second, PTCL behaves toward its customer base in a manner typical of monopolies throughout the world. It is sluggish, has a poor attitude toward customer service, and is not quick to embrace change. Third, PTCL is undergoing a protracted effort to privatize the corporation. Fourth, PTCL has had a strong interest in building the infrastructure necessary to support provision of basic services. These investments are seen both as a means of improving the company's position in the eyes of foreign investors and as a necessary condition for the support of Pakistan's software industry.

There have been reports that the PTCL will establish two national access points (NAP) in Karachi and Islamabad through which to monitor Internet traffic for voice over IP traffic, which is prohibited.[124] While the motive is, ostensibly, to identify and block voice over IP and pornography, there is no technical reason why the gateways could not filter other kinds of traffic.

Resources

The resources needed to expand Internet use at the organizational, local, and national levels fall into five broad categories: financial, informational, human, technological or capital, and material.

Technological Resources

Technological resources are, in the case of the Internet, the hardware and software components that constitute the infrastructure: routers, cables, switches, and so forth with the software to make it function. The availability of the necessary hardware and software is not a limiting factor in either Turkey or Pakistan. ISPs in both countries use technology purchased from well-known vendors like Cisco Systems, Sun Microsystems, and many others.

Human Resources

In contrast, the scarcity of human resources *is* a limiting factor in both Turkey and Pakistan. Shortages are found everywhere, from commercial companies seeking to establish websites and get involved with electronic commerce to the national telecommunications companies' working to hire network-savvy employees to schools trying to connect to the Internet. Government organizations are particularly disadvantaged because they are legally limited in the amount of money (inadequate) that they can pay employees. The lack of adequate human resources has been cited by several leading proponents of the Internet as *the* most critical problem limiting growth of the Internet in Turkey.[125] In Pakistan, the IT industry as a whole suffers from a shortage of skilled IT professionals. According to Hassan, this state of affairs is a result not only of a failure of government to provide sufficient education (since most technical institutions are run by the government) but also of a lack of interest and understanding by the private sector.[126] Furthermore, due to the rapid growth of demand for skilled IT professionals in other countries, the United States in particular, experienced IT professionals are migrating away from Pakistan.[127] Turkey, in contrast, has not experienced a significant "Brain Drain." Turkish students studying abroad usually return to Turkey to live.

Informational Resources

Informational resources consist largely of the documentation relevant to all the tasks that are part of building and maintaining an infrastructure. Increasingly available on the Internet or from vendors, necessary information regarding Internet technologies is not lacking and thus is not a major issue.

Financial Resources

Financial resources may come through government allocations, domestic private investment, or foreign investment. "Fluidity of resources" refers to the ease with which resources can flow from where they are to where they are needed.

Both Turkey and Pakistan have invested substantially in the expansion of the telecommunications infrastructure. However, each country is burdened by federal debt and a negative balance of payments that redirects much of the telecommunications providers' revenue to the general budget. In spite of efforts to attract foreign capital, neither country enjoys high levels of foreign investment.

One of the principal sources of financial resources for Internet-related development throughout the world is private capital, including venture capital and foreign investment. Both sources are in short supply in Turkey. Because of high rates of inflation and high levels of national debt, the

government pays high rates of interest on securities to attract investment. This investment opportunity decreases the attractiveness of riskier startup ventures. Organizations that do have a great deal of money, such as the major Turkish holding companies, prefer to create their own companies rather than invest in other companies.

Although Turkey's foreign investment policies have created a streamlined, transparent foreign investment climate, among the most liberal within the OECD nations, foreign investment remains relatively scarce in Turkey.[128] However, investments are subject to the political uncertainties, bureaucratic red tape, and occasionally unclear legal environment of Turkey. In the telecommunications arena, the government is trying to sell Türk Telekom to a strategic partner, but the uncertain investment and regulatory climate in Turkey makes this very difficult.[129]

In Pakistan, the poor economic climate has had a strong negative impact. The suffering financial sector is burdened with many nonperforming loans. Reduced business activity has dragged down PTCL revenues. Economic downturns have resulted in lower tariff and taxes revenue than would otherwise be the case.

The demographics of Pakistani industry may also play a role. According to Hassan, most businesses are jointly owned by families but managed individually. As families grow, they spin off new business units to give to the younger generation rather than allowing businesses to grow. Pakistani laws have, to an extent, favored small firms over large. As a consequence, most companies are not large enough to be able to afford significant, long-term investment in information technologies.[130]

Since the late 1980s, Pakistan has taken great strides to improve the climate for foreign investment, at least on paper. Pakistan's legal framework does not discriminate against foreign investors. The *Foreign Private Investment (Promotion and Protection) Act, 1976* states explicitly that foreign investment shall not be subject to more taxation on income than investment made in similar circumstances by Pakistani citizens. Prior to 1997, however, direct foreign investment was limited to the manufacturing sector. A new investment policy, announced in November 1997, opened the agriculture, services, infrastructure, and social sectors to foreign investment as well. In addition, particular benefits were given to investments in valued-added or export industries, high technology, priority industries, and agro-based industries.[131] In spite of these legal benefits, however, foreign investment in Pakistan has been relatively low. Total foreign private direct investment reached a high-water mark in 1995–1996 with $1.1 billion. This figure dropped to $699 million in 1996–1997 and to $547 million for the 10 months July 1997–April 1998.[132] Possible reasons include inadequate infrastructure, perceptions of political instability, law

and order difficulties, policy inconsistencies, resistance to the open economic environment by bureaucrats, the lack of effective protection of intellectual property rights, and endemic corruption.[133] Another factor inhibiting investment in Pakistan is the lack of a legal and fiscal framework for the creation of venture capital funds.[134] Following Pakistan's nuclear tests in May 1998, foreign investors withdrew $175 million.[135]

Material Resources

One of the few material resources on which the Internet depends is electrical power. In many countries, including Turkey, electrical power is sufficiently stable and universally available that it ceases to be an issue. This is not the case in Pakistan. In 1997, only 31 percent of households had electricity.[136]

Legal and Regulatory Framework

IP Address and Domain Name Allocation

Although many aspects of the Internet are inherently distributed, the whole system depends on coordinated approaches to assigning Internet Protocol (IP) addresses and domain names, and managing the association between the two. Both Turkey and Pakistan have the necessary mechanisms for allocating IP addresses and domain names. In Turkey, the Middle East Technical University (METU) was given responsibility for Turkey's domain name service (DNS), including the responsibility of allocating domain names under the .tr domain. It continues to maintain the DNS. Allocation of IP addresses is somewhat less coordinated but has taken place in a manner that has been free of serious difficulty. METU does allocate some IP addresses, but in principle any organization is free to obtain an IP address directly from Réseaux IP Européens (RIPE) or any other comparable authority. ISPs have been given blocks of IP addresses over which they have responsibility.

Since 1992, before the first Internet connection to Pakistan was established, the Pakistan Network Information Center (PKNIC) has had responsibility for the maintenance and administration of the registry service for .pk domains. The organization is also responsible for the technical operation and maintenance of the root services for the .pk DNS.[137] PKNIC does not provide IP address allocations. These are provided by ISPs or directly to an organization through the Internet Network Information Center (INTERNIC) or Asia-Pacific Network Information Center (APNIC).

Provision of Telecommunications Services

The Turkish constitution mandates that the Turkish government alone provide basic communications services. Consequently, most wireline and a good deal of wireless infrastructure is created by Türk Telekom. While

Türk Telekom has licensed a small number of companies (which compete against each other) to provide international satellite connectivity, domestic telephone and leased-line services are provided exclusively by this monopoly provider.

However, companies are permitted to build infrastructure for their own use. SuperOnline is one ISP that has been building its own infrastructure. By the end of 1999, it had planned to have ATM capacity into over 19 nodes.[138]

The *Pakistan Telecommunication (Re-organization) Act, 1996* established that the Pakistan Telecommunication Authority should be the authority regulating telecommunications services in Pakistan. This body was required by the act to provide a license for basic telecommunications services to the Pakistan Telecommunication Company Limited and the National Telecommunication Corporation. Individual citizens and private sector companies, including ISPs, must rely on PTCL for the leased, data, and dial-up lines on which the Internet depends.

Licensing of ISPs

The licensing of ISPs is, legally speaking, a large gray area in Turkey. While some countries use the lack of a firmly established legal framework as a tool to inhibit ISP proliferation, Turkey has taken the opposite approach. The Turkish government has encouraged the proliferation of ISPs under these uncertain conditions, preferring to overlook inconsistencies or irregularities in the legal framework for the sake of promoting a vigorous ISP market. While it is likely that some sort of licensing arrangement will be established, currently no ISPs are formally licensed.

The Pakistan Telecommunication Authority is the licensing authority for Internet services. Two kinds of companies could (in 1997) offer Internet service. Companies that already had a license to operate a data network were permitted to offer Internet service as well. In addition, companies wanting to offer only Internet access could obtain an Electronic Information Service license.[139]

Internet-Specific Legislation

Neither Turkey nor Pakistan has been particularly active in developing Internet-specific legislation. To date, Turkey has not established a framework of "cyber law" oriented toward the Internet. In part, this is a reflection of the relatively low priority that the Internet has on the agenda of the Turkish parliament and the rather chaotic state of that body. The most generous rationalization is that Turkey is taking a conservative approach, watching cyber law developments in other countries, and planning its legal moves carefully. A less generous interpretation is that the country can't pass controversial legislation.

During August 1999, an IT Summit was held in Pakistan, presided over by President Muhammad Rafique Tarar. A working group recommended that new legislation on freedom of information at the federal and provincial levels be passed as a top priority to enable "e-government" and good governance.[140]

Ability to Execute

The ability to execute reflects an ability to develop a sound strategy and a suitable design given the opportunities and constraints, as well as the ability to manage plans through to completion. The ability to execute may be compromised by political infighting or instability, red tape, historical legacies (e.g., existing but inadequate infrastructure or legacy hardware/software systems), or simply a mismatch between the scope of the project and the organizations' expertise. With respect to the Internet, we are particularly interested in the ability to execute of three kinds of players: telecommunications service providers, the government, and ISPs. Neither country has exhibited a strong ability to get things done. Both governments in particular rate low on this determinant, but Pakistan's government has been especially dismal.

Telecommunications Services Providers

Türk Telekom's ability to execute must be rated as *Moderate*. While the projects that it has undertaken have been generally successful, the company has frequently had difficulty carrying out the project in a timely fashion. A number of factors diminish Türk Telekom's ability to execute: the generally chaotic state of the Turkish government makes continuity of management and vision difficult; the wage ceilings limit Türk Telekom's ability to hire and retain skilled individuals; and, as a state monopoly, Türk Telekom is highly bureaucratic, with a lax attitude toward customer service.[141]

PTCL's ability to execute also appears to be *Moderate*. While customers of PTCL experience many of the same difficulties dealing with the companies as do customers of monopoly PTTs in other countries, PTCL has made steady progress in expanding its infrastructure and services.

Government

The Turkish government is not a model of efficiency. Political parties in continuous flux, a host of powerful special interests, and an entrenched bureaucracy make the organization and execution of new initiatives difficult. The interaction of these forces pushes public policy in directions that can often not be predicted.

There are bright spots in the formulation of Internet-related policy in Turkey. The Internet Executive Council (IEC), which met for the first time

in January 1998, provides a forum in which all the leading Internet-related voices can discuss and work through difficult issues affecting them all. The IEC has membership from government ministries, commercial organizations, and academia. Reports are that discussion is substantial, open, and effective. The IEC has made recommendations that have been acted on and had a positive impact on the Turkish Internet.

Another positive measure taken by the government is the development of TUENA, the Turkish Information Master Plan. The effort to formulate a master plan was carried out by the TUENA project office, established in 1997 within TÜBITAK under the coordination and responsibility of the Ministry of Transport and Telecommunications. "The basic vision is to maximize social and economic benefits of the information infrastructure, while optimising local value-added by informatics industries including telecommunication and informatics equipment manufacturers, software and communication service industries and content industries with a view to raise their global competitiveness in order to capture a bigger share of the world informatics market and to become an important regional actor."[142]

The introduction to the Pakistan 2010 Programme makes a telling commentary on Pakistan's general ability to execute:

> To achieve [the goals of the Programme] requires a broader definition of development not as "catching up" (which focuses almost exclusively on physical capital), but as "making things work" with a primary, though not exclusive, emphasis on social and human capital. Pakistan remained under developed not because the endowment of physical capital was low, but because we had a low capacity to operate and maintain that capital effectively; not for want of institutions, but by a dearth of standards of behavior that enable institutions [to] perform effectively; not because we did not have sound policies, but because we lacked the ability to implement those policies effectively; not for want of laws, but because of the absence of norms of conduct that prevent the misuse of laws.[143]

In light of this general difficulty with "making things work," the Pakistan Programme 2010 placed a good deal of emphasis on establishing good governance. The Sharif government did little, however, to establish "good governance."

Economic management in Pakistan has been characterized by instability and corruption. By some estimates, 30–40 percent of the original

cost of projects ends up in the pockets of contractors and officials in the shape of kickbacks and commissions.[144] While the October 1999 coup illustrated that the Sharif government had not succeeded in reversing these qualities, Sharif did, at some level, recognize the problem. "In the past, governments introduced minute and unanticipated changes in tax and tariff rates, exemptions, controlled prices, or credit variables, frequently and at will. The result was that on the one hand the unpredictability discouraged long term investment, and on the other hand the policy stance encouraged diversion of private sector resources into lobbying and influence peddling."[145]

Internet Service Providers

As in any open market with many players and relatively low barriers to entry, the ability of Turkish ISPs to formulate and execute a successful business plan covers the spectrum from very good to dismal. Since TURNET was established, many ISPs have been created and have experimented with a variety of business plans ranging from the full-service provider model to a highly niche-oriented one. Some ISPs have failed, some have been purchased by other ISPs, and some have succeeded. What is important is not that any particular ISP has or has not an ability to execute, but that collectively the ISP market has enough dynamic and robustness that *some* ISPs will be able to take advantage of any market opportunity that presents itself. Overall, the Turkish ISP market has a rather strong ability to execute.

In Pakistan, the number of ISPs has grown significantly in recent years, and many of them have succeeded in expanding service beyond one or two cities. One reason to question their ability to execute is the lack of peering agreements or an Internet exchange point among ISPs. The Internet Service Providers Association of Pakistan was formed in part to facilitate the creation of such an IXP or peering arrangements but has apparently been unsuccessful. It is not clear to what extent the fault lies with the ISPs themselves or with factors beyond the ISPs' control.

Geography

Turkey is a country of modest size, with a well-proportioned, integrated landmass. While parts of the country are hot, dry, and barren, the terrain does not pose any unusual costs or difficulties to the establishment of infrastructure.

The Indus River runs from north to south nearly the entire length of Pakistan. Within its river valley lie most of the people, power, and, correspondingly, telecommunications infrastructure. The ISPs also have their POPs within the major cities of this valley. In contrast, the rest of Paki-

stan, to the west and to the northeast, is filled with inhospitable mountains or desert plateaus.

Demand for Capacity

Since TURNET was established, there has always been greater demand for capacity, especially international capacity, than supply. Demand pull has been a constant force for greater expansion of the Internet in Turkey. The E3 (34 Mbps) lines connecting TTNet to the outside world were saturated almost as soon as they went into service.

The current bottleneck of the Pakistani Internet is not the local loop but the domestic and international leased circuits that connect an ISP's POPs or connect it to the global Internet. Currently, demand on these circuits exceeds capacity.[146]

Culture of Entrepreneurship

While the Internet service provider market is quite dynamic, there are so far very few examples in Turkey of Internet-related activities that are involved in the creation of distinctly new products or services reflecting strong innovative activity. One possible explanation for this is what appears to be a rather low culture of entrepreneurship. In countries like the United States and Israel, startup companies abound, following a now-familiar life cycle: The founding individuals develop a bright idea, create a rudimentary product, attract venture capital, establish a company to commercialize the product, sell the company or hold an initial public offering (IPO), repeat the process. The wild success stories inspire many to look for, and develop, new, exciting ideas.

In Turkey the startup life cycle typically gets short-circuited. First, there are very few success stories along these lines in Turkey, so a young person sees little in his or her experience to inspire him/her to start a new company. Second, some have indicated that as a whole Turks do not have a risk-taking mentality in which failure is an acceptable outcome. Third, there is little venture capital to fund startups. Given the inflation rate and the enormous debt the Turkish government carries, the interest rates on government securities are quite high. Money in Turkey is more likely to be attracted to well-paying, safe investments than to highly speculative ventures. Fourth, it is virtually impossible to survive as a software company in Turkey. Software piracy is rampant.

According to Hassan, the Pakistani economy is characterized by many, many, small family-owned companies, and policies favor small businesses.[147] As a result, a greater percentage of the Pakistani people are likely to have experience managing their own businesses than in

other countries with comparable demographics. The proliferation of ISPs reflects no shortage of individuals and organizations willing to enter a new market. However, the financial structures needed to support a truly vibrant entrepreneurial culture, venture capital markets in particular, appear to be lacking.[148]

Forces for Change

While much of the motivation for change in Internet development and use may come from high perceived value of the medium, some motivation comes from external forces for change. While the two—perceived value and forces for change—are closely related, it is nevertheless helpful to identify some of the principal forces or agents that are playing a role in driving the development of the Internet in Turkey and in Pakistan. Such forces can be categorized into agents of change, competitive forces, and external mandates.

Agents of Change

One of the changes in the Internet landscape in Turkey is the growing number of individuals and organizations who are actively promoting the Internet. Among the most persistent proponents have been academics such as Mustafa Akgül at Bilkent University and Atilla Özgit at Middle East Technical University, who were driving forces not only for the establishment of the Internet in Turkey but also for its promotion in the years since.

Within the government, A. Tahir Dengiz, deputy undersecretary of the Ministry of Transport and Telecommunications, has been the leading activist. An avid Internet user, he has been the force behind the creation of the Internet Executive Committee and many of the initiatives the ministry has taken with respect to the Internet.

Among commercial entities, the principal drivers of changes are the Internet service providers. Seeking to expand their markets, ISPs are vigorously promoting the Internet through any means they can think of.

Turkish banks in particular see opportunities in the electronic commerce arena and have organized programs to educate businesses about the value of e-commerce and the steps they might take to conduct business on the Internet.[149] Banks' efforts to reduce their costs and improve their quality of service and profitability by encouraging Internet banking have been discussed earlier.

Some holding companies and media groups, attracted by the attention the Internet has received elsewhere in the world, are beginning to push change through financial levers.

In contrast, the agents of change in Pakistan are less evident and less effective. Unlike in Turkey, in Pakistan the academic community had very

little involvement with the creation of the first nodes and continues to play a very minor role.

While the Information Technology Commission in Pakistan was created in 1997 with high expectations, its website, www.itcomm.gov.pk, is not inspiring. The following quote illustrates a good intention:

> Information Technology is the fastest growing area in today's world and the Government of Pakistan has prioritized its energy and resources towards ensuring that the Government is fully equipped with all the relevant IT tools required to enter the 21st Century. This web site has been developed in the same spirit.[150]

However, the website does not appear to have been significantly updated or added to since its creation. There are few indications of any concrete results of the commission's efforts. According to one source, the IT Commission has been renamed the IT Working Group and is currently based at the Sustainable Development Policy Institute, a victim of the frequent changes in the ruling party.[151]

Competitive Forces

Since the 1980s Turkey has taken many steps to open its economy and make it more competitive. While certainly the number of organizations viewing the Internet as a key component of a competitive strategy is still small, it is growing. Among the noncommercial sectors of society, however, competitive forces are not strongly felt.

Under the current economic climate in Pakistan, the use of the Internet as a point of competitive advantage makes little sense for most businesses, except, perhaps, those in the software business. The vast majority of the Pakistani populace is unfamiliar with the Internet. Given the current political and economic climate in Pakistan, most organizations probably have greater concerns than how the Internet might assist their marketing efforts. However, for those organizations that have dealings with the global community, the Internet is much more likely to be an essential business tool.

External Mandates

At present, there are few formal mandates, government or otherwise, pushing the use of the Internet in Turkey or in Pakistan. At the provincial level in Pakistan, Sind and Punjab provinces have programs to bring all provincial government agencies online.

Enablers of Change

Enablers of change are those elements that help a change take hold in a community. While forces for change push change into a community, the enablers of change are those conditions that enable a community to embrace the change and that affect that rate of change. One of the more significant enablers includes what Nelson calls the "National Innovation Systems," which encompasses the educational system and organizations involved in research and development.[152] Other factors may include historical strengths (e.g., Israeli expertise in security issues), the legal framework for creating of new companies, and cultural elements that may influence a society's willingness to embrace new technologies. Neither Turkey nor Pakistan has particularly strong enablers of change.

In Turkey, the educational system is good, but it is not producing enough technically skilled graduates. Turkey has few inherent technology strengths. While creating a new company is not difficult, companies of all kinds may struggle at times with bureaucracy and political change. The Turkish people are very social and are quick to embrace technologies that support social interaction. Overall, Turkey may be compared, perhaps, to soil that is suitable for farming but not as fertile as some.

In Pakistan, the educational system has pockets of excellence (e.g., Lahore University of Management Science—LUMS) but lacks the breadth and depth to produce the quality and volume of graduates needed for broad-based adoption of the Internet. Pakistan has few inherent technology strengths, although the software industry has been growing. While creating a new company is not difficult, struggles with bureaucracy and political change are a constant part of the landscape.

Government Policy and the Determinants of Internet Diffusion

Table 36 compares some of the ways in which Turkish and Pakistani governments have promoted the Internet through a positive influence on the determinants discussed above.

The table underscores the contention that neither country's government has been completely inactive or hostile with regard to matters affecting the Internet. Key investments in communications infrastructure and the opening of the Internet services market to private companies rank high among their positive contributions.

Table 36. Measures Taken by Turkish and Pakistani Governments to Promote the Internet

Determinant	Measures Taken by Turkish Government	Measures Taken by Pakistani Government
Access	Creation of TURNET, creation of TTNet, improvement of telephone system	Building of fiber cables, reduction of import duties on PCs
Perceived Value	Evangelism by National Security Council, MTT, prime minister, etc.	Promotion of use of Internet in government by federal and provincial governments
Ease of Use of the Internet	Creation of Turkish language content on government webpages	
Cost of Internet Access	Reduction of tariffs	Reduction in leased-line charges, exemption of Internet access from multimetering
Adequacy and Fluidity of Resources	Investment in TTNet, investment in telephone infrastructure	Investment in telecommunications infrastructure, expansion of IT training in schools
Regulatory and Legal Framework	Permission given for provision of Internet services	Pakistan Telecommunication Act, 1996; licensing of ISPs
Ability to Execute	Creation of Internet Executive Council	
Geography	N/A	N/A
Demand for Capacity	Minimal	Minimal
Culture of Entrepreneurship	Creation of conditions to attract foreign investment and venture capital	
Forces for Change	Cultivation of champions of the Internet in policy-making circles (e.g., IEC)	Creation of IT Commission, etc.; programs to connect governmental departments
Enablers of Change		Expansion of IT education

Internet Diffusion Determinants in Comparison

Table 37 summarizes in rough form this chapter's discussion. A check mark indicates which country has a stronger rating in the determinant indicated. When neither country has a large advantage with respect to the other, no check mark is given. While there are a number of determinants in which neither country has an advantage relative to the other, such as perceived value, demand, and culture of entrepreneurship, there is no determinant in which Pakistan rates stronger than Turkey. Consequently, it should come as little surprise that the state of the Internet is stronger in Turkey than in Pakistan.

Table 37. Relative Advantage in Determinants between Turkey and Pakistan

Turkey	Pakistan	Determinants / Dimensions	Pervasiveness	Geographic Dispersion	Sectoral Absorption	Connectivity Infrastructure	Organizational Infrastructure	Sophistication of Use
✔		Access to Internet	X	X	X		X	X
		Perceived Value	X	X	X	X	X	X
✔		Ease of Use of the Internet	X		X		X	X
✔		Cost of Internet Access	X		X	X	X	
✔		Adequacy and Fluidity of Resources		X	X	X	X	X
✔		Regulatory and Legal Framework		X	X	X	X	X
✔		Ability to Execute		X		X		
		Geography		X				
		Demand for Capacity				X		
		Culture of Entrepreneurship						X
✔		Forces for Change	X	X	X	X	X	X
		Enablers of Change	X		X		X	X

6. Conclusions

The preceding chapters have tried to capture the details and general features of the development of the Internet in two countries that, while not closely related historically, have significant cultural, political, economic, and technical parallels. Turkey and Pakistan's Internet experiences have considerable commonality, yet significant differences, making them useful cases for exploring the complex set of factors that promote and inhibit the spread of this technology. While a study of two countries cannot easily prove causal relationships, it does suggest factors that correlate, which should be the subject of further research on other countries' Internet experiences.

The Internet: Considerable Similarities

The most significant shared characteristic of the Internet in the two countries is that, as in many countries throughout the world, the Internet has grown dramatically within the last half decade. Turkey's over two million users and Pakistan's 500,000–700,000 users (both figures mid-2000) reflect an order of magnitude increase in user population in just three years. Supporting and encouraging this growth has been a highly competitive and expanding community of commercial Internet service providers offering steadily improving service and pricing. These, in turn, have benefited from long-term efforts to expand and improve the national telecommunications systems through the laying of fiber-optic cable, digital switches, and multiple times more main lines. While not as dramatic, the Internet's absorption into various sectors of the nations' economies (health, education, commercial, government) is evident, as is a growing sophisti-

cation of use by these organizations as electronic commerce and other uses grow in prevalence and popularity.

The similarities are not uniformly positive, however. The vast majority of each country's population has never experienced the Internet. Only in 1999 did the fraction of Turkey's population that used the Internet cross the 1 percent threshold. By the end of 1999, less than one-half of 1 percent of Pakistan's population used the Internet. The aggregate costs of Internet service, telephone service, and PC purchase or lease are unaffordable to most. The fraction of organizations using the Internet also is small, particularly in the health-care and government sectors. Neither country has laws or financial vehicles that are particularly well positioned to support electronic commerce. The highly dynamic and volatile phenomenon of "dot-com" startups, which has captivated investors in the United States and Europe in recent years, is hardly seen in Turkey and Pakistan. Each country suffers from domestic and international infrastructures that regularly are fully saturated with Internet traffic. Capacity is expanding more slowly and with more problems than users would like.

The Internet: Significant Differences

At the same time, the state of the Internet is in many respects significantly different in the two countries. Turkey's per capita usage of the Internet is over six times greater than Pakistan's. While Turkey is rolling out the second generation of a national backbone, Pakistan has only recently been talking about the creation of a national Internet backbone—but has shown little progress toward implementing it. While Internet access is possible at reasonable rates from every village in Turkey, access in Pakistan is limited to major cities. Some Turkish corporations, banks and media in particular, are strongly embracing and promoting the Internet within the context of new business models. In Pakistan, such a phenomenon is much less widespread.

Accounting for the Similarities and Differences

Chapter 5 presented a detailed comparison of many factors, or determinants, that our analytic framework suggests contribute to shaping the evolution of the Internet within a country. The purpose of this section is not to repeat that discussion but to highlight what seem to be some of the most significant factors contributing to the similarities and differences, and suggest measures that might be taken to promote the Internet in the future.

The analysis presented in this study suggests that although many factors play important roles, three of the most dominant factors shaping the Internet are the state of the overall economy, the state of the telecommunications infrastructure, and the often complicated triangular relationship between the government, the telecommunications services provider(s), and the Internet service providers.

Table 38 shows selected parameters reflecting the state of the two countries' economies and telecommunications infrastructures.

Table 38. Economic and Telecommunications Indicators of Turkey and Pakistan

	Turkey	Pakistan
GDP	$200 billion (1999 est.)	$59 billion (1998-1999)
Per capita GDP	$3,200 (1999 est.)	$441 (1998-1999)
Trade	Exports (1999): $26 billion Imports (1999): $40.2 billion	Exports (FY 1998-1999): $7.8 billion Imports (FY 1998-1999): $9.4 billion
Literacy rates	82%	45% (unofficial est. as low as 35%)
Telephone density	2.5% (1980) 24% (1998)	.72% (1990) 2% (1999)

Sources: Bureau of European Affairs, *Turkey: Background Notes* (Washington, D.C.: U.S. Department of State, February 1999), <http://www.tradeport.org/ts/countries/turkey/bnotes.html> (June 23, 1999); Bureau of South Asian Affairs, *Pakistan: Background Notes* (Washington, D.C.: U.S. Department of State, March 2000), <http://www.tradeport.org/ts/countries/pakistan/bnotes.html> (October 14, 2000).

The basic state of the economy establishes the fundamental environment within which Internet growth and activity occurs. It has a powerful impact on a host of factors shaping the Internet, including the affordability of services and the availability of resources needed to expand infrastructure and promote innovative or entrepreneurial Internet-related activity. While neither country has a stellar economy, Pakistan is much more hindered by its economic troubles than is Turkey. Unfortunately for these and other countries, "improving the economy" is one of the most necessary, yet difficult, tasks facing any government.

The Internet in both Turkey and Pakistan has benefited considerably from substantial expansion of these countries' telecommunications infrastructures in the last decade or two. Clearly, however, Turkey's telecommunications infrastructure has far greater scope and penetration than does Pakistan's, which partly explains the differences between the two countries in the geographic dispersion and connectivity infrastructure dimensions.

While these two elements, the economy and the basic telecommunications infrastructure, set a basic landscape for the Internet, they do not help us understand why the Internet has "taken off" as it has in these countries. One of the more interesting aspects of Internet evolution has been the effect of the relationships between three major groups of players: the ISPs, the government, and the telecommunications service providers.

Within both Turkey and Pakistan, policy-makers as a whole have been rather indifferent to the Internet, having more pressing economic and political issues to deal with. As the Internet has gained prominence worldwide, however, interest and support among policy-makers has grown. Each country has a number of policy-makers, some with cabinet level rank, who have been strong proponents. We have not observed any organized, significant opposition to the Internet by interest groups within either country. Opposition that showed some early signs of emerging, such as within the national security community in Turkey, recognized that it lacked the resources to control the phenomenon effectively and yielded. Thus, the balance of interests within the governments has been, on the whole, positive, which has helped the Internet's growth.

In both countries a turning point in Internet evolution came when policy-makers permitted the creation of privately owned Internet service providers. This event occurred at approximately the same time, 1995–1996, in both Turkey and Pakistan. Most policy-makers in both countries cared little about the Internet in these years, but those who did were supportive of the new phenomenon. Pakistan's government passed the *Pakistan Telecommunication (Re-organization) Act, 1996*, which permitted the licensing of non-basic services such as email and Internet connectivity by private firms. In Turkey, the encouragement of the Internet was a bit more interesting. Here, the government did not pass any special legislation, but rather "looked the other way" when the creation of private ISPs seemed to violate the government's constitutional mandate to be the sole provider of communications services. The creation of private ISPs introduced a highly competitive, dynamic Internet services market, which has been one of the major drivers of Internet expansion.

The relationship between the ISPs and the telecommunications service providers, on the other hand, is one of the key differences between

Turkey and Pakistan. While Türk Telekom was somewhat hostile toward the prospect of ISPs in the early days of the Turkish Internet, by 1996 it had positioned itself not as a direct competitor but as a provider of infrastructure that the ISPs would use. Türk Telekom was one of the major proponents of the creation of TURNET, the first Turkish backbone, to which all ISPs would connect. This backbone was a strong catalyst for the development of the ISP market, for it greatly reduced barriers to entry. Türk Telekom does provide Internet service to end users but is not one of the more popular ISPs. While Türk Telekom is not as responsive or as willing to drop prices as ISPs would like, their relationship has been, on the whole, rather supportive and mutually beneficial.

In contrast, PTCL and the Pakistani ISPs have a much more confrontational relationship. PTCL views the ISPs not so much as customers for high-capacity services but as competitors of its own ISP, PakNet. At the same time, PTCL has been acutely interested in maintaining its margins on basic services. It has therefore kept tariffs for both leased and local service higher than it might, has dropped prices more slowly than Türk Telekom, and has not had the same drive toward providing universal service. Significantly, Pakistan has no counterpart to the regional access codes that in Turkey provide access to ISPs from anywhere in the country at low rates.

While both countries' ISPs must rely on their national telecom provider for leased lines, PTCL has not provided a national backbone in the way Türk Telekom has. This difference has had a profound impact on the two countries' Internets. While PTCL has made some pronouncements about the creation of such a backbone, progress is slow and, at the dawn of the 21st century, late. That PTCL has played a more aggressive role vis-à-vis the ISPs than has Türk Telekom is not necessarily a bad thing, however. PTCL has responded to the competition to expand its infrastructure and bring its own ISP service to a point where it is now considered one of the better ISPs in the country.

For all the differences, one of the striking similarities is the eagerness of many citizens to begin using the Internet, once service is available at reasonable costs. In both countries, hundreds of thousands of people are drawn to the Internet for socializing and entertainment, in the first place, and information in the second. Both countries have significant segments of the population eager to experience and participate in the global community. Both countries also have large populations of students and expatriates who frequently access the websites of the national and local newspapers to follow news in the mother country. While expansion of commercial use of the Internet is somewhat more difficult to assess, growth is being driven by both push and pull forces.

The View of the Internet: A "Balance of Tensions"

Like any technology, the Internet has a social context. It has the potential, some of which has been realized, for ushering in a broad spectrum of social, political, and economic change, both for good and for ill. Many commentators write of the Internet's potential to transcend national boundaries to advance relationships and understanding between individuals of diverse backgrounds, beliefs, and nationalities. The Internet has been touted as a vehicle for expanding the global economy and bringing modernization and economic expansion to underdeveloped regions. The personal yet global quality of the network may empower individuals and interest groups and enable the circumvention of restrictive censorship and social controls of oppressive governments. Others worry about the Internet's ability to facilitate international information warfare, terrorism, and drug trafficking and to promote all manner of economic and social crime and unrest.

The perception of whether the impact of the Internet is a benefit or a threat varies considerably from one individual to another and from one country to another. If government policy has a significant impact on the Internet, as we believe it has, then one would expect to see variations in the rate and extent of absorption of the Internet, depending on whether the perceived value among policy-makers, the so-called "balance of tensions,"[153] is predominantly positive, negative, or equally balanced. While the perceived value is just one of many determining factors, the experiences of such countries as China, Saudi Arabia, Qatar, Iraq, Finland, etc. illustrate the range of this determinant and the influence it can have.[154]

On the surface, Turkey and Pakistan have good reason to be concerned about the Internet. As overwhelmingly Muslim countries, they might fear the influence of pornography, un-Islamic information, proselytizing by other religions, and so forth. Each country has serious problems with terrorism and dissent and could fear the Internet-enabled ability of terrorists to organize, propagandize, and otherwise threaten established interests. The nations could worry about the ability of Greece and India, their long-standing antagonists, to communicate directly with Turkish and Pakistani citizens. The established media and commercial conglomerates in both countries could also perceive a threat from the Internet as an information source that would undermine their traditional influence over public opinion.

Such concerns are not unfounded. In chapter 5 we documented some of the cyber activity of hackers and insurgency groups that could be viewed as a threat to established Turkish and Pakistani interests.

While there are countries that have taken strong measures to counter the perceived negative effects and threats of the Internet, Turkey and Paki-

stan are not among them. In both countries, the positive perceptions of the Internet as an enabler of economic development and integration have dominated policy-making in this area. The beneficiaries of Internet growth, the ISPs and the commercial interests that are gaining from information dissemination and electronic commerce–related investment and transactions, are increasingly exercising lobbying power to promote support of the Internet. At this point, the window of opportunity for a concerted opposition to dramatically curtail the spread of the Internet is closing.

Opportunities for the Future

Much of the growth of the Internet in Turkey and Pakistan is likely to be driven by demand of individuals and organizations and the efforts of ISPs to expand the customer base. In both countries the Internet has become established, having reached a critical mass in which future growth is a function of time as much as anything.

At the same time, there is more that these governments might do to promote the Internet and relieve some of the limiting factors to future growth. Several of these possibilities are listed in Table 39. Some of these are exceedingly difficult and long-term (e.g., "stabilize the economy," "improve the educational system"). But others of potentially high impact are much easier. Among the latter are measures to reduce tariffs for domestic and international leased and dial-up connections.

Many of the measures listed here are similar, and they span the spectrum from very difficult to relatively easy. Spending a sum of money is easy; bringing about a shift in popular opinion is more difficult. High-impact measures are those that are likely to have a strong and relatively quick impact on one or more of the Internet dimensions. Each measure can also be classified according to whether it is easy or difficult to implement.

In each country, measures that are likely to have a high impact and are relatively easy to implement should be given highest priority. These include:

- dropping rates for domestic and, in particular, international connectivity;[155]
- promoting legislation establishing a proper framework for electronic commerce; and
- continued investment in infrastructure.

Somewhat more difficult to implement because of the scope of the problem or the legislative and political tangles involved will be an expan-

Table 39. Measures the Turkish and Pakistani Governments Might Take to Promote the Internet

Determinant	Measures That Might Be Taken by Turkish Government	Measures That Might Be Taken by Pakistani Government
Access	Tolerate private-sector investment in infrastructure; subsidize access to schools, public institutions; improve economy	Construct true national backbone; provide hardware/ software to educational institutions
Perceived Value	Enact policies promoting open and transparent governance processes	Enact policies promoting open and transparent governance processes
Ease of Use of the Internet	Promote local language content	Promote literacy programs; promote local language content
Cost of Internet Access	Reduce international connection rates	Reduce leased-line charges, especially international
Adequacy and Fluidity of Resources	Expand education in computing; continue investment in infrastructure; improve investment climate and support for venture capital markets	Improve investment climate; create financial system supporting of venture capital; expand and stabilize power grid
Regulatory and Legal Framework	Permit greater competition in provision of all services; promote changes in legislation to facilitate e-commerce	Pass e-commerce legislation; open up domestic and international basic services to competition; remove prohibition on voice over Internet
Ability to Execute	Modify civil service laws to make government jobs more competitive and efficient	Stabilize government; reduce corruption
Demand for Capacity	Additional demand from government unnecessary (commercial and personal demand already exceeds capacity)	Additional demand from government unnecessary (commercial and personal demand already exceeds capacity)
Culture of Entrepreneurship	Stabilize economy to make investment in private sector more attractive	Improve investment climate; enact legislation more conducive to venture capital
Forces for Change	Encourage promotion of Internet within parliament, including change to constitution	Provide continuity of champions of Internet, technology in government offices
Enablers of Change	Cultivate technology curriculum in education; smooth process of new company creation; reduce bureaucracy and red tape	Continue to expand IT education; promote benefits of technology; reduce bureaucracy and red tape

sion of IT education and the promotion of a competitive environment for all communications services, including basic ones.

While there are a great many similarities in the kinds of measures governments of the two countries could take (Table 39), there is considerable difference in degree, with Pakistan generally facing the more difficult task. One major difference, however, is Pakistan's need to create a national backbone to support ISPs, a measure Turkey undertook four years ago.

The future of the Internet in both countries is promising. Growth, expansion, and increased sophistication will continue. Whether and how quickly the Internet will reach its potential and keep pace with other countries, however, depends strongly on measures taken by the governments and the national telecommunications carriers to remove some of the limiting factors.

Notes

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Glossary

ADSL	asynchronous digital subscriber line
ANAP	Motherland Party
APNIC	Asia-Pacific Network Information Center
ARPANET	Advanced Research Projects Agency Network
ATM	asynchronous transfer mode
BITNET	“Because It’s Time” Network
CERN	Center for European Nuclear Research
CHP	Republican People’s Party
CNS	Council of National Security
DNS	domain name service
DSL	digital subscriber line
EARN	European Academic and Research Network
GDP	gross domestic product
IEC	Internet Executive Council
INTERNIC	Internet Network Information Center
IP	Internet Protocol
ISDN	integrated services digital network
ISP	Internet service provider
ISPAK	The Internet Service Providers Association of Pakistan
IXP	Internet exchange point
JP	Justice Party
LUMS	Lahore University of Management Science
METU	Middle East Technical University
MTT	Ministry of Transport and Telecommunications
NAP	network access point
NATO	North Atlantic Treaty Organization

NSF	National Science Foundation
NTC	National Telecommunication Corporation
OECD	Organization for Economic Cooperation and Development
PKK	Kurdistan Workers Party
PKNIC	Pakistan Network Information Center
PPP	Pakistan People's Party
PSDP	Public Sector Development Programme
PSTN	public switched telephone network
PTA	Pakistan Telecommunication Authority
PTC	Pakistan Telecommunication Corporation
PTCL	Pakistan Telecommunication Company Limited
PTT	Post, Telegraph, and Telephone company
RIPE	Réseaux IP Européens
RP	Welfare Party
T&T	Telephone & Telegraph Department
TLD	top-level domain
TÜBITAK	Turkish Scientific and Technical Research Council
WTO	World Trade Organization