# Using Accessible Data Sources to Determine Telecom Diffusion Capabilities of Developing Nations: A MENA Perspective

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***Abstract***

This paper suggests an approach for using convenient, available databases to discern and compare some of underlying characteristics of Information and Communications Technology (ICT) in developing nations—the poorer and less advanced countries—and uses a cluster of these countries, the Middle East and North Africa (MENA), as an example. Global telecommunications capacity is concentrated in a small number of countries, the so-called "developed nations." Much of the proliferation in bandwidth, hardware, and electronic commerce is focused on this elite group. The remaining countries, called "developing nations," represent more than 80 percent of the world's inhabitants but in aggregate have only a tiny fraction of the ICT power—an indication of a worldwide digital divide. How is a business or donor organization to assess the optimal countries for ICT funding and select investments that lead to social or financial gain? We describe a general developmental model of technology diffusion and then present several of the most practical statistics currently available for assessing and comparing developing nations in the context of ICT. Using these statistics we briefly examine the 20-nation MENA cluster, suggesting a process that can yield insights for businesses as well as non-governmental organizations (NGOs).

## *Overview: ICT in Developed and Developing Nations*

Most of the world's ICT resources are concentrated in the developed nations, about 20 wealthy countries, plus a small number of Asian nations that are nearly in the "developed" category. What about the other countries of the world—the developing nations? Will the increases in efficiency of telecom deployment allow them to leapfrog into prominence in the coming decades? The *United Nations Human Development Report* gave a vivid example of the chasm separating successful ICT nations and the rest of the world. After analyzing the existing bandwidth of two continents, the report concluded that in aggregate it was equivalent to the bandwidth of one Asian city: "Africa has less international bandwidth than Sao Paulo, Brazil. Latin America's bandwidth, in turn, is roughly equal to that of Seoul, South Korea" (UNDP, 2001, 13).

Stated another way, Africa and South America, representing over 70 countries and a quarter of the world's population, account for only a small percentage of global bandwidth. If large clusters of countries in Asia like Indonesia, Vietnam, Bangladesh, and all of the former Soviet Union (which spans 12 time zones) were added to the Africa/South America total, the result would change little. Roughly 180 countries of the world have 10 percent of the world telecommunications capacity (ITU, 2002). Western Europe, the United States and Canada, Japan, Australia and the so-called Asian Tigers (especially South Korea, Taiwan, and Hong Kong)—roughly one-sixth of the world's population—have the remainder. China, not considered a developed country, is also in this mix, especially in the context of Internet users, recently passing Japan for second place (after the United States) when Hong Kong is included. Hong Kong, one of the most significant global ICT users, is fre-

quently classified separately from China in many indices, even though it is part of China.

It is possible to view the causes of this global inequality in the factor endowment terms of economics, or through other theoretical constructs, but we prefer an approach that delineates specific issues associated with digital inequality: like bandwidth, type of user login procedure (home, office, etc.), level of user skills, purpose (economic, social, political, etc.), social support, etc. (Di Maggio et al).

There would have to be major infusions of bandwidth over the coming years to reduce the disparity. A glance at the planned international connections over the coming years indicates that the current concentrations are likely to continue. *Figure 1* describes estimates of international bandwidth through 2005. While South America shows greater planned increases than Africa, the two continents can hardly be considered significant participants in global telecommunications. Which developing nations, then, are the emerging front-runners? How can they be singled out for investors' or donors' interest? Is it possible to use relatively simple and unobtrusive techniques to examine these questions on a regional or individual basis? We have found that the best way to begin to answer these questions is to select a cluster of contiguous countries and review their vital signs—wealth, education, health, and well-being—in the context of ICT use.

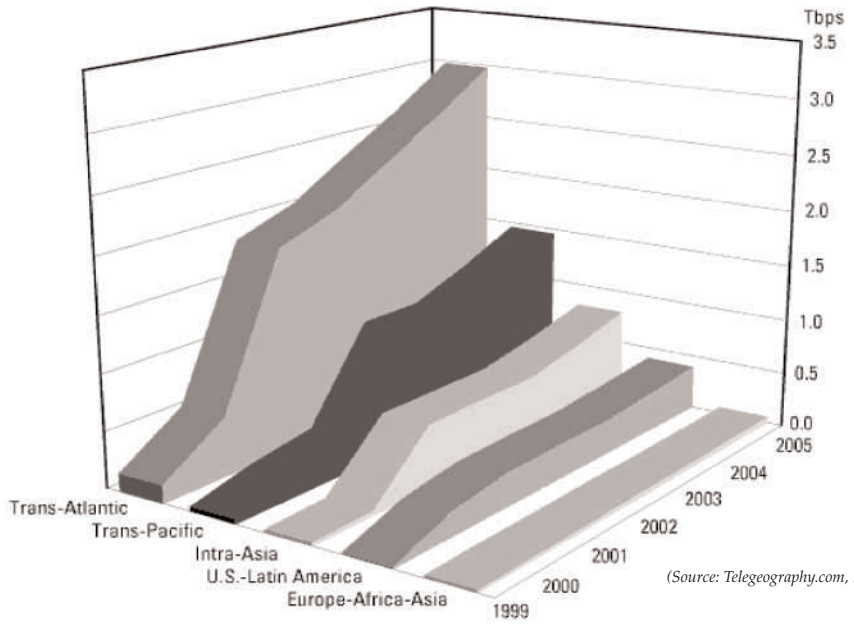
## *Technology-Diffusion Trajectories: S Curves Describing the ICT Development*

Before describing the indicators that can help delineate high and low achievers among developing nations it is helpful to take a macrolevel view of the adoption process for ICT applications. How do individual nations deploy new technology? From richest to poorest, each has a unique approach. Everett Rogers and others who study the diffusion of innovation have found that many applications like agriculture, education, transportation, and computing can be described by an S curve, characterized by slow initial progress, followed by a spurt of growth and ending with a moderate deceleration of the process (Rogers). The S curves for selected telecommunications technologies in the United States are shown in *Figure 2.* It depicts seven different trajectories, from more than a century of telephony diffusion to less than a decade for the Internet. There are three aspects of the S curve results that can be useful in the analysis of ICT projections for developing nations: initiation time, intensity of adoption, and the level of adoption.

The time of initiation is important because it gives a baseline for examining the pace of development. In the United States, for example, where the telephone was invented, the date of first use is earlier than for other nations. For a poor country, the date of initiation of telephone service could lag wealthy countries by 50 years or more. The intensity of initial adoption is also of interest. In some nations, the first years of use of a technology, like television in the late 1940s or cell phones in the first years of the 21st century, is represented by a steep, almost vertical movement from no adoption to nearly complete absorption in a few years. The other developed nations are characterized by technology curves that look similar to the U.S. example, with differences reflecting national policies or economic fluctuations. World War II's aftermath delayed television adoption in Western Europe and Japan, but their S curves gradually followed an upward pattern. In France the nationwide use of Minitel, an Internet precursor, in the 1980s led to earlier acceleration in networking than in the United States.

**FIGURE 1**

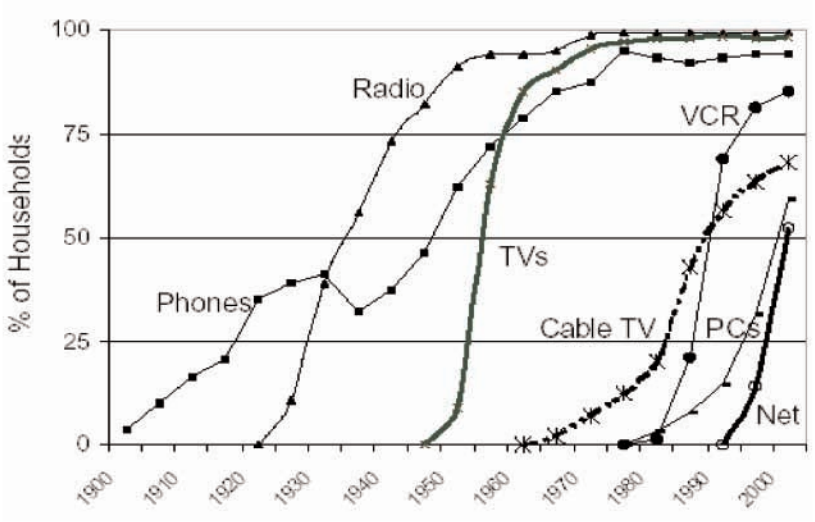
**Worldwide Bandwidth Projections through 2005 (by Region, in Terabits per Second)**




*(Source: Telegeography.com, Retrieved February 14, 2004)*

**FIGURE 2**

**S Curves for Seven United States Technology Trajectories**




*(Source: U.S. Census Bureau: Statistical Abstract of the U.S. 1999; Historical Statistics of the U.S.)*

A third significant characteristic of telecom technology curves is the level of adoption—that is, the percentage of the population actually utilizing the technology over a time period. *Figure 2* shows adoption levels rising toward nearly 100 percent use in the United States, a characteristic shared with the developed nations. Most developing nations, by contrast, have relatively low utilization percentages. There are several notable exceptions to this in two Asian nations that are still considered to be in the "developing" category. South Korea leads the world in cell-phone use per capita, and China (including Hong Kong) has the second-highest number of Internet users in the world, ahead of Japan and behind only the United States. While China's penetration percentages are not at developed-nation levels, the Internet numbers are exceptional and considerably ahead of India, the only other country with a population of over a billion persons.

## *Examples of Data on Total Users and Usage Ratios Maintained by the ITU*

Many of the statistics that are considered valuable to businesses, NGOs and multilateral agencies such as the World Bank and the United Nations Development Programme (UNDP) are simple totals or ratios of technology users to total users. Such numbers are widely available and have the advantage of being consistently compiled over a number of years. Returning to the earlier example, China is second only to the United States in total Internet users with 62 million. (The U.S. figure is 115 million, and Japan, in third place, has 57 million.) After adjustments for its large population, however, China is in the middle ranks, with 460 users per 10,000. The United States has 5,513 and Japan 4,488 users per 10,000, for comparison (ITU, 2002). Below we include examples of popular ITU totals and usage ratios with a brief description of the sources and depth of the data, plus a link to recent years' numbers. Descriptions below are summarized from the ITU's information site:

- Total Internet users (ITU) for 2000, 2001, 2002 and earlier. URLs for three years of data are provided below for time-series analysis. ITU calculates the estimated number of Internet users based on reported estimates, derivations based on reported Internet subscriber counts, or by multiplying the number of Internet hosts by a certain multiplier.

- Internet users per 10,000 inhabitants (ITU) for 2000, 2001, 2002. URLs for three years of data are provided below for time-series analysis. This contains the estimated number of Internet users divided by population of the country then multiplied by 10,000; this calculation normalizes the data value among larger and smaller populations for better comparisons.

- Total estimated PCs (k) (ITU) for 2000, 2001, 2002. URLs for three years of data are provided below for time-series analysis. This contains the estimated number (in thousands) of personal computers (PCs) from sales and import data. It does not account for PCs obtained by smuggling, gray market, or local assembly. It does not include game machines, electronic calculators or personal digital assistants.

- Estimated PCs per 10,000 inhabitants (ITU) for 2000, 2001, 2002. URLs for three years of data are provided below for time-series analysis. This contains the estimated number of Internet users divided by population of the country then multiplied by 10,000; this division normalizes the data value among larger and smaller populations for better comparisons.

- Telephone subscribers per 100 inhabitants (ITU) for 2000, 2001, 2002. URLs for three years of data are provided below for time-series analysis. This contains the estimated number of telephone subscribers (customers who are billed individually) divided by population of the country then multiplied by 100; this division nor-

malizes the data value among larger and smaller populations for better comparisons.

All of the above indicators for the years 2002, 2001, and 2000 can be found at the following sites:

- 2002 http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet02.pdf
- 2001 http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet01.pdf
- 2000 http://www.itu.int/ITU-D/ict/statistics/at_glance/Internet00.pdf

- Cellular mobile subscribers per 100 inhabitants (ITU) for 2000, 2001, 2002. URLs for three years of data are provided below for time-series analysis. This contains the estimated number of cellular subscribers (customers who are billed individually) divided by population of the country then multiplied by 100; this division normalizes the data value among larger and smaller populations for better comparisons. Cellular technology includes analog, digital, and personal communications services (PCS), but does not include public mobile data services, private trunked mobile radio, telepoint, noncellular mobile, fixed cellular, and radiopaging services:

  - 2002 http://www.itu.int/ITU-D/ict/statistics/at_glance/cellular02.pdf
  - 2001 http://www.itu.int/ITU-D/ict/statistics/at_glance/cellular01.pdf
  - 2000 http://www.itu.int/ITU-D/ict/statistics/at_glance/cellular00.pdf

## *Indices, Scores and Weighted Averages*

Just as the Dow Jones or Standard and Poor indices are able to suggest a central tendency of equities markets there are several indices that purport to be indicators of a nation's success in categories like ICT, electronic government, and many others.

- The ITU's digital access index (DAI) measures an individual user's ability to access and use ICT and combines a weighted mix of scores on infrastructure, affordability of access, educational level, quality of ICT services and Internet usage. DAI was formally introduced in November 2003 and currently providing 2002 data only.

  - http://www.itu.int/newsarchive/press_releases/2003/30.html

- E-government Index 2001 (UPAN) is derived from a country's official on-line presence, telecommunications infrastructure, and human development capacity. The index weighs conditions that enable a country to sustain an e-government environment. Countries identified have a high e-gov capacity score between 2.00–3.25, medium e-gov capacity score between 1.60–1.99, minimal e-gov capacity score between 1.00–1.59, and deficient e-gov capacity score below 1.00.

  - http://www.unpan.org/egovernment2.asp#survey

- Freedom House assigns each country and territory the status of "free," "partly free," or "not free" by averaging the political rights freedom index and the civil liberties index ratings. Based on this average, countries and territories averaging between: 1–2.5 are free; 2–5.5 are partly free; and 5.5–7 are not free.

  - http://www.freedomhouse.org/research/freeworld/FHSCORES.xls

- The human development index (HDI) value (UNDP) is a composite index measuring average achievement in three basic dimensions of human development—a long and healthy life, knowledge, and a decent standard of living. HDI is based on the following measurable indicators: longevity, as measured by life expectancy at birth; educational attainment, as measured by a combination of adult literacy (two-thirds weight) and the combined primary, secondary, and tertiary enrollment ratio (one-third weight); and standard of living, as measured by real GDP per capita (PPP$). The calculation methodology for HDI is available at the following site:

  - http://hdr.undp.org/reports/global/2002/en/indicator/excel/hdr_2002_table_1_15.zip

## *E-Readiness Indices and Inventories*

Because of the growing importance of e-commerce, m-commerce, l-commerce, and other business and governmental uses of on-line applications, many systems have been developed to measure deployment results. A recent Massachusetts Institute of Technology study classified e-readiness assessment categories, models, and indices and found a large number of sources. A summary is provided in *Table 1.*

Two popular e-readiness comparisons are becoming more widely used and reported: the *Economist*'s rankings and a Harvard Center for International Development E-Readiness Index. Both include data from a variety of components that contribute to e-readiness. Unfortunately, many developing nations are omitted. The Harvard report covers 75 nations and the *Economist*'s covers only 60.

***E-Readiness Score (EIU Ebusiness Forum)***
The Economist Intelligence Unit (EUI)/Pyramid Research provides e-readiness ranking for 60 countries. EUI tallies scores across six categories: connectivity (30 percent), business environment (20 percent), e-commerce consumer and business adoption (20 percent), legal and regulatory environment (15 percent), supporting e-services (10 percent), social and cultural infrastructure (5 percent). Then they calculate a score based on weighted factors. The weighted factors allow researchers to take into account not only technology, but also social and cultural factors.
http://www.ebusinessforum.com/index.asp?layout=rich_story&doc_id=367

***Network Readiness Index (CID, Harvard)***
This index is developed by Geoffrey S. Kirkman, Carlos A. Osorio, and Jeffrey D. Sachs of the Center for International Development (CID) at Harvard University. Networked readiness index is defined as "the degree to which a com-

**TABLE 1**

**Reports, Models, and Indices Concerning E-Readiness**

| Study | Focus |
|---|---|
| 1. APEC (Asia Pacific Economic Cooperation) | E-Commerce Readiness |
| 2. CIDIF (Centre International pour le Dvelopment de l'Inforoute en Francais) | Internet Service Market |
| 3. CSPP (Computer Systems Policy Project) | Existing Infrastructure |
| 4. EIU (Economist Intelligence Unit) | E-Business Readiness |
| 5. IDC | Infrastructure |
| 6. KAM (World Bank. Knowledge Assessment Matrix) | K-Economy |
| 7. MI (McConnell International) | Infrastructure. Digital Economy. Education and Government |
| 8. MN (Metric Net) | E-Economy |
| 9. MQ (Mosaic Group) | Internet |
| 10. NRI (CID. Harvard) | Infrastructure. E-Society. Policies. Digital Economy. Education and Government |
| 11. CID (Center for International Development) | Society |
| 12. CIDCM (University of Maryland) | Qualitative Assessment based on past performance and current internet pervasiveness |
| 13. ITU (International Telecommunication Union) | Telecom |
| 14. Mosaic | Economy Focus |
| 15. SIDA (Swedish International Development Cooperation Agency) | Mainly SWOT analysis of a Nation |
| 16. USAID (US Agency for International Development) | Access. Government. People |

*(Source: Budhiraja R, & Sachdeva S (2003). "E-Readiness Assessment,." p 6 Retrieved February 20, 2004 from www.mit.gov.in/eg/ereadiness.doc)*

munity is prepared to participate in the networked world." The Networked readiness index (NRI) is used to assess countries' capacity to exploit the opportunities offered by information and communication technology.

- http://www.cid.harvard.edu/cr/pdf/gitrr2002_ch02.pdf

## *Using the Indicators to Discern ICT "Haves" and "Have Nots": The MENA Case*

As an example of using some of the statistics just described we present a specific case. The region selected is the Middle East and Northern Africa (MENA) group, which has a full range of government forms, from dictatorship to democracy; of population, from a few hundred thousand inhabitants to more than sixty million; and of economic health, from desperately poor to extremely wealthy. We examine some of the ICT and other characteristics of the MENA nations in order to suggest a template, or model, for similar reviews in other countries. MENA nations are relatively homogeneous in the context of their location, history, climate, religion, and cultural traditions. Israel is an exception to this homogeneity, but is an important component, because it leads the others in many telecommunications categories.

MENA nations are listed in *Table 2* along with applicable statistics from various world databases delineated above. MENA countries include kingdoms, emirates, republics, and one democracy Israel. We also include United States and France as well as China and Turkey in the list because they offer contrasts and comparisons that are helpful. China has the world's second largest number of Internet subscribers (because of Hong Kong's high ICT capability) and Turkey is the only large democracy contiguous to the MENA region.

The largest of the MENA nations in terms of population Egypt has more than 60 million inhabitants while the smaller countries like Bahrain, Qatar, and Oman have a few million or fewer. Egypt's ICT numbers are surprisingly low, considering the variety of initiatives that have been attempted there (Burkhart and Older, 17). In eco-

**TABLE 2**

**MENA Data (with the United States, France, Turkey, and China Added)**

| List of Countries | Number of Inhabitants 2002 (million) | GDP per capita (PPP US$) 2002 est. | Internet Users per 10,000 Inhabitants 2002 | Telephone Subscribers per 100 Inhabitants 2002 | Cellular Mobile Subscribers per 100 Inhabitants 2002 | Digital Access Index 2002 (Rank) | Freedom Index 2003 (PR,CL,Status) |
|---|---|---|---|---|---|---|---|
| Algeria | 31.29 | 5,400 | 159.78 | 6.42 | 0.96 | .37 (110) | 6,5,NF |
| Bahrain | 0.67 | 15,100 | 2,474.66 | 84.64 | 58.33 | .58 (38) | 5,5,PF |
| Egypt | 65.64 | 4,000 | 92.95 | 14.69 | 6.72 | .40 (98) | 6,6,NF |
| Iran | 65.55 | 6,800 | 155.57 | 20.10 | 3.23 | .43 (87) | 6,6,NF |
| Iraq | --- | 2,400 | --- | --- | --- | --- | 7,5,NF |
| Israel | 6.64 | 19,500 | 3,014.05 | 142.17 | 95.45 | .70 (25) | 1,3,F |
| Jordan | 5.33 | 4,300 | 451.56 | 29.60 | 16.71 | .45 (80) | 5,5,PF |
| Kuwait | 2.36 | 17,500 | 879.13 | 59.36 | 38.59 | .51 (60) | 4,5,PF |
| Lebanon | 3.42 | 4,800 | 1,171.30 | 42.58 | 22.70 | .48 (67) | 6,5,NF |
| Libya | 5.55 | 6,200 | 35.84 | 11.83 | 0.90 | .42 (93) | 7,7,NF |
| Morocco | 29.64 | 3,900 | 168.67 | 24.71 | 20.91 | .33 (118) | 5,5,PF |
| Oman | 2.71 | 8,300 | 457.49 | 21.34 | 12.37 | .43 (91) | 6,5,NF |
| Palestine | 3.46 | --- | 231.55 | 17.90 | 9.26 | .38 (105) | --- |
| Qatar | 0.61 | 20,100 | 827.87 | 72.66 | 43.72 | .55 (48) | 6,6,NF |
| Saudi Arabia | 23.06 | 11,400 | 693.84 | 25.81 | 11.33 | .44 (82) | 7,7,NF |
| Syria | 17.04 | 3,700 | 36.12 | 11.50 | 1.20 | .28 (126) | 7,7,NF |
| Tunisia | 9.81 | 6,800 | 516.81 | 14.90 | 4.01 | .41 (95) | 6,5,NF |
| UAE | 3.2 | 22,100 | 3,673.80 | 110.05 | 75.88 | .64 (34) | 6,6,NF |
| Yemen | 19.39 | 800 | 9.01 | 3.05 | 0.81 | .18 (139) | 5,5,PF |
| United States | 288.37 | 36,300 | 5,513.77 | 114.70 | 48.81 | .78 (11) | 1,1,F |
| China | 1,284.53 | 4,700 | 460.09 | 32.78 | 16.09 | .43 (84) | 7,6,NF |
| France | 59.64 | 26,000 | 3,138.32 | 121.59 | 64.70 | .72 (23) | 1,1,F |
| Turkey | 67.27 | 7,300 | 728.39 | 62.86 | 10.92 | .48 (70) | 3,4,PF |

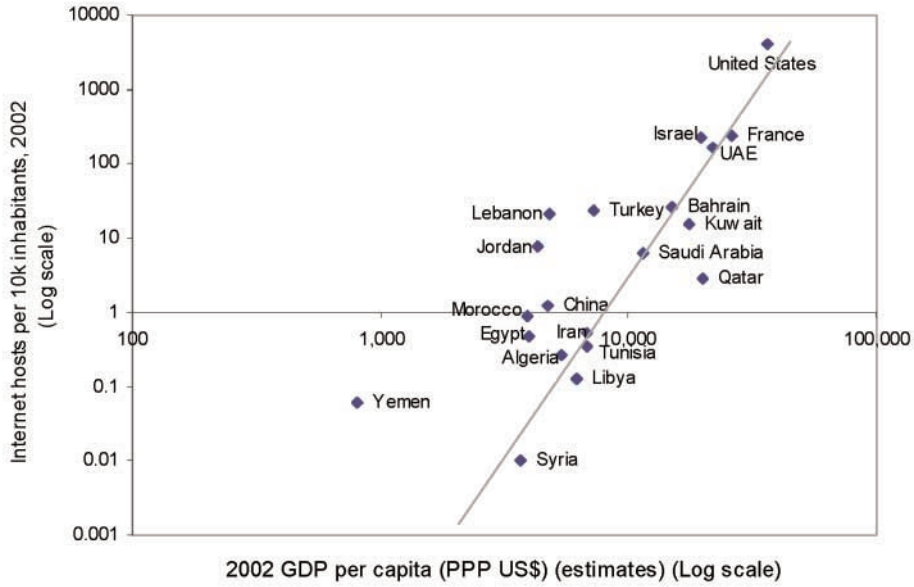
**Notes:**

1. The data in columns 2, 4, 5 and 6 are from International Telecommunication Union (2003). Basic indicators. Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/statistics/at_glance/basic02.pdf
2. The data in column 3 are from CIA (2003). The World Factbook 2003, Retrieved February 15, 2004 from http://www.cia.gov/cia/publications/factbook/rankorder/2004rank.html
3. The data in column 6 are from International Telecommunication Union (2003). Mobile cellular subscribers per 100 people. Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/statistics/at_glance/cellular02.pdf
4. The data in column 7 are from International Telecommunication Union (2003). Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/publications/wtdr_03/material/DAI.pdf
5. The data in column 8 are from Freedom House (2004). Freedom in the World 2003. Retrieved February 28, 2004 from http://www.freedomhouse.org/ratings/allscore04.xls Designations: NF, Not free; PF, Partly Free; F, Free.

nomic terms MENA nations are mostly poor by OECD standards, but the United Arab Emirates (UAE), Qatar, and Israel show economic and technical statistics on a par with developed nations, and several other smaller MENA countries are also close to this level. Cell phone–utilization percentages in Israel, Bahrain, UAE, Kuwait, and Qatar in aggregate exceed those of the United States and France. Israel's cell phone–penetration rate is nine times that of Saudi Arabia, the world's leader in oil production. Egypt's Internet penetration is third from last, ahead of only Syria and Yemen. In aggregate terms, Greg Lamotte has noted that the Arab world has approximately one person per hundred connected to the Internet (Lamotte). The MENA statistics clearly show a digital divide between large nations that are ICT have-nots and about a half dozen small nations that are in the main stream of technology utilization.

**FIGURE 3**

**Scatter Plot of Digital Access Index, 2002, Against Internet Hosts per 10,000 Inhabitants, 2002 (Log Scale)**




*(Source: 1. GDP per Capita Data Are from CIA (2003);The World Factbook 2003, Retrieved February 15, 2004 from http://www.cia.gov/cia/publications/factbook/rankorder/2004rank.html*
*2. Internet Hosts Data Are from International Telecommunication Union (2003); Basic Indicators; Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/statistics/at_glance/basic02.pdf)*

## *ITU's Digital Access Index as a Capacity Indicator*

The ITU's newly formulated DAI is a very helpful starting point. DAI measures an individual user's ability to access and use ICT and combines a weighted mix of scores on infrastructure, affordability of access, educational level, quality of ICT services and Internet usage (ITU, 2003). The DAI separates scores into three rankings. In the first level, only one MENA country Israel qualifies. All but two of the MENA nations are in ITU's middle interval, which covers DAI scores between .30 and .69. The lowest tier, which includes scores below .30, includes Syria and Yemen. DAI scores between .55 and .85 place a country in the top 50 rank, which includes North America, Western Europe, the so-called Asian Tigers (South Korea, Singapore, Taiwan, and Hong Kong), Japan, and Australia.

Looking at the only MENA nations that fall in the top-50 category —Israel, UAE, Bahrain, Qatar, and Kuwait—there are several common characteristics. These countries lead the MENA nations in GDP per capita, telephones and cell phones per capita and Internet users. They also have relatively small populations, compared to many of the other MENA countries. Among the five DAI leaders, only Israel does not have major oil revenues. It is interesting that Saudi Arabia, the world's leader in oil production, is not near the top in DAI rankings or any of the other variables shown in *Table 2*.

## *Another Comparison of MENA Countries: Internet Users and DAI vs. Wealth*

National wealth has been found to be a good predictor for ICT diffusion and it would be expected that this relationship would hold for MENA nations (Norris, 77). *Figure 3* describes the comparisons based on per capita GDP and Internet host sites statistics. Internet host sites is a statistic frequently used in comparisons of this type, ahead of others which may seem more appropriate, like total Internet users. The Human Development Index, described earlier, uses host sites as its primary input to describe technology (*Human Development Report 2003*). *Figure 4* shows the DAI rankings, a possible proxy for ICT wealth, regressed with Internet usage, with relatively similar results.

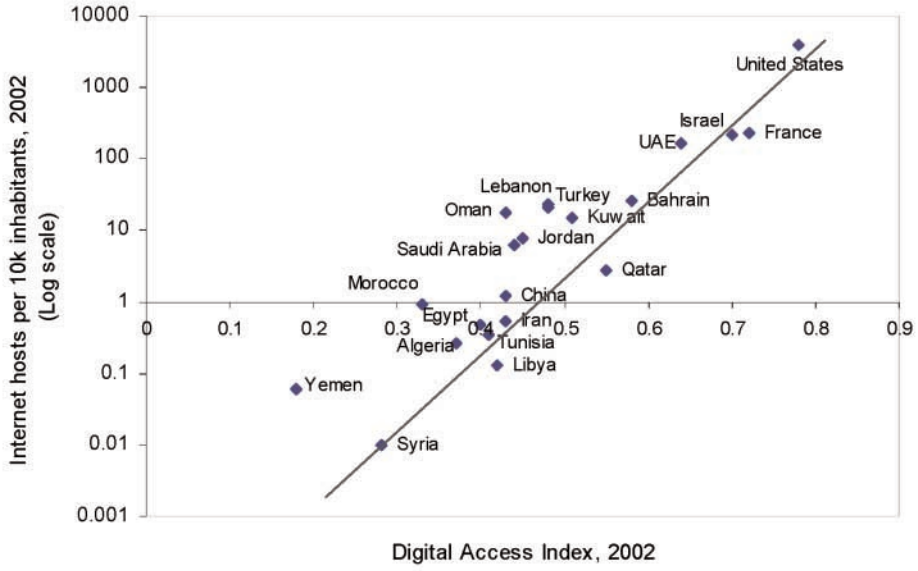
The DAI and GDP comparisons with Internet host sites appear unremarkable. It would be expected that a wealthy nation would have more ICT capacity per capita. It will be interesting to follow the rankings and observe shifts in leaders as criteria are varied. If the results change little across many variables, the status and position of countries with respect to longer term ICT development becomes clearer.

Do Individual Freedom and Freedom of the Press Relate to ICT Diffusion?

Earlier we described the Freedom House indices, a respected scoring system that attempts to rank nations according to the

**FIGURE 4**

**Scatter Plot of 2002 Gross Domestic Product per Capita (Estimates) Against Internet Hosts per 10,000 Inhabitants, 2002 (Log Scale)**




*(Source: 1. Internet Hosts Data Are from International Telecommunication Union (2003); Basic Indicators; Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/statistics/at_glance/basic02.pdf*
*2. Digital Access Index Data Are from International Telecommunication Union (2003); Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/publications/wtdr_03/material/DAI.pdf)*

relative openness and freedom of their governments. Because of the importance of open telecom policy in the diffusion of ICT improvements in developed nations, it would seem reasonable that the Freedom Index would predict telecom and ICT diffusion. *Table 2* showed that only one MENA nation is categorized free (Israel), two as partly free (Jordan and Morocco), and the remaining 17 countries not free. Will these differences in governmental control affect ICT development? *Figure 5* regresses press freedom scores with Internet host sites. The result shows a moderately discernable relationship between the two variables, but with significant outliers like UAE, Morocco, and Syria. Israel, the only MENA nation listed as free, is in a category with France and the US, considerably ahead of the other MENA nations in this analysis.

## *The Human Development Index (HDI) as a Predictor for ICT Diffusion*

Any search for variables that explain Internet diffusion in MENA nations should include the United Nations Development Programme's (UNDP) HDI. This indicator is often used in multisector studies as an indicator of well-being and includes proxies for education, health, technology, and wealth. Unlike some of the widely used technology indicators available from the ITU and other sources, the HDI data have been stable and comparable for many years. Does HDI predict ICT success? It would seem that because the highest-scoring nations on HDI are generally the wealthiest, ICT indicators in MENA nations would be related to HDI in a way similar to DAI or GDP per capita. *Figure 6* shows a tightly packed, apparently significant, relationship between HDI and Internet users. As in many of the previous comparisons, Israel, UAE, Bahrain, Qatar, and Kuwait are the leaders

## *Knowledge Diffusion*

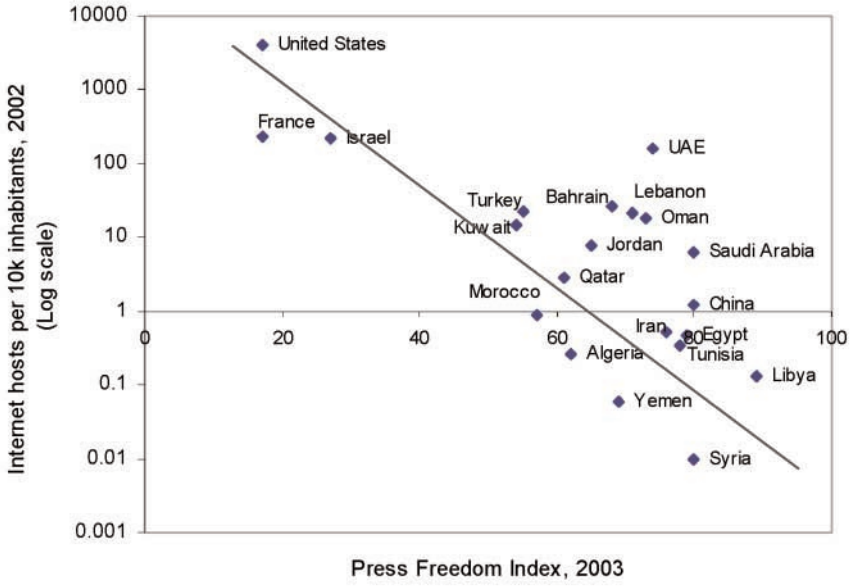
An emerging method for assessing businesses and nations is the application of knowledge management (KM) approaches. KM is concerned with the process of diffusion of knowledge, so the various KM indicators attempt to present organizations in the context of willingness to seek new approaches, to share existing information, to search beyond traditional information boundaries, etc. A recent global KM assessment is shown in *Figure 7.* The majority of MENA countries are in the lower levels of the classification, with the exception of Israel and Kuwait.

## *Other Sources and Predictors*

*Table 3* is a list of other possible predictor variables that are available from open sources. Each of the variables could be employed as part of the assessment strategy, depending on the needs of the organization. An NGO would perhaps be interested in various health and education indicators; a business considering telecom regulatory history; a multilateral in a cluster of the variables. There are also numerous fee-based services that can offer ICT–specific analysis. For aggregate data Telegeography.com offers a wide range of tailored data summaries from individual national information to global projections of fiber deployment. In the

**FIGURE 5**

**Scatter Plot of Press Freedom Index, 2003, Against Internet Hosts per 10,000 Inhabitants, 2002 (Log Scale)**

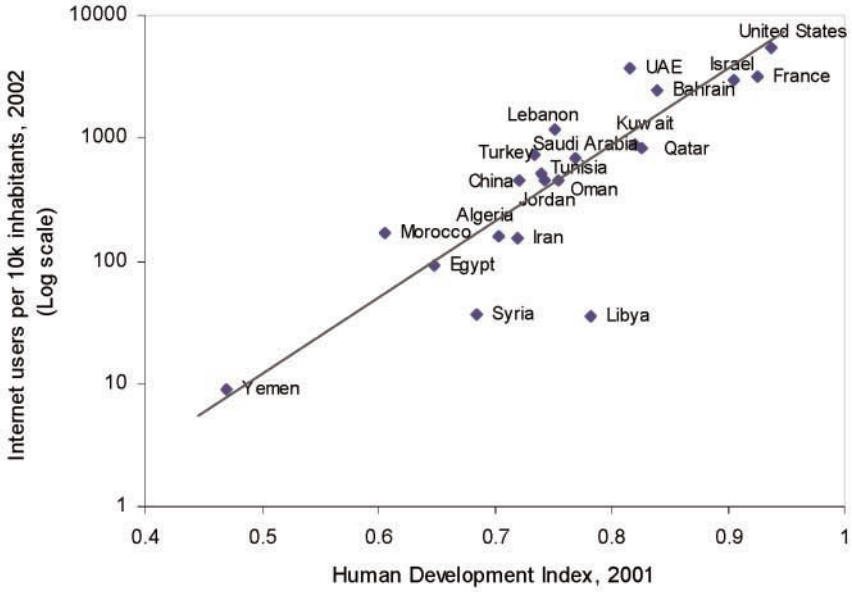



*Source: 1. Internet Hosts Data Are from International Telecommunication Union (2003); Basic Indicators; Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/statistics/at_glance/basic02.pdf*

*2. Press Freedom Index Data Are from Freedom House (2004); Freedom in the World 2003; Retrieved February 15, 2004 from http://www.freedomhouse.org/pfs2003/pfs2003.pdf)*

**FIGURE 6**

**Scatter Plot of Human Development Index, 2001, Against Internet Users per 10,000 Inhabitants, 2002 (Log Scale)**

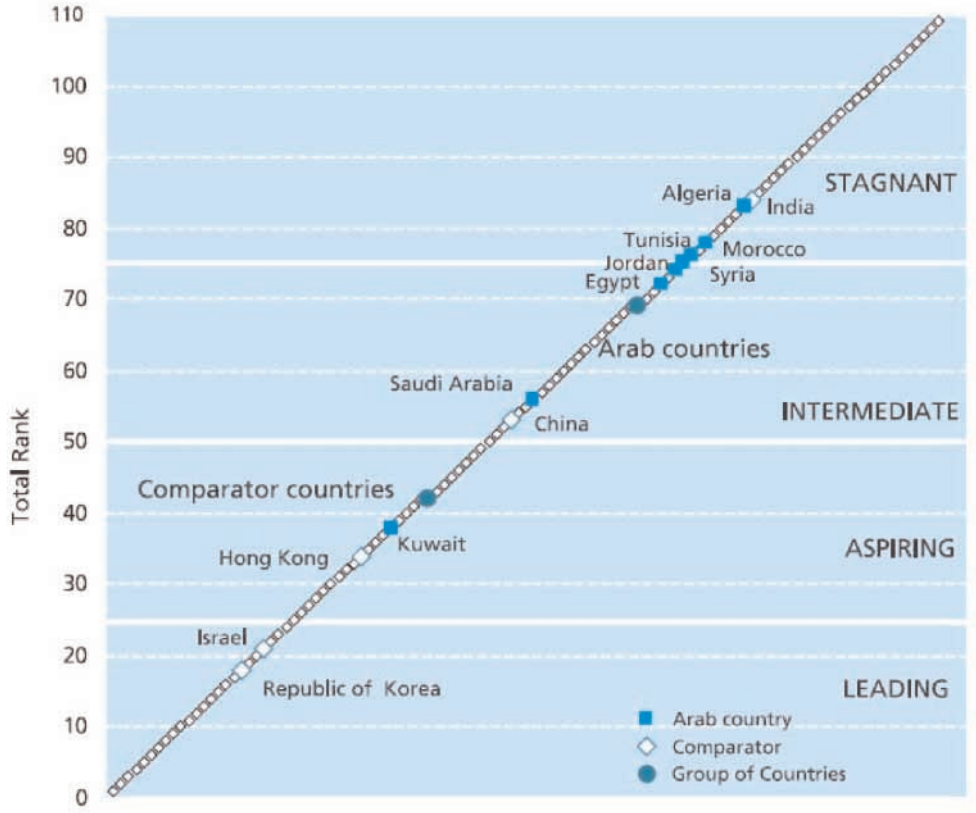



*(Source: 1. Internet Users Data Are from International Telecommunication Union (2003); Basic Indicators; Retrieved February 15, 2004 from http://www.itu.int/ITU-D/ict/statistics/at_glance/basic02.pdf*

*2. Human Development Index Data Are from United Nations Development Programme (2003); Human Development Report 2003; Retrieved February 15, 2004 from http://hdr.undp.org/reports/global/2003/pdf/hdr03_HDI.pdf)*

**FIGURE 7**

**Ranking of Arab Countries Compared to Other Countries and Regions on the Composite Indicator of Knowledge Capital, 2000**




*(Source: United Nations Development Programme (2003); Arab Human Development Report, 2003, p 93)*

**TABLE 3**

**Examples of Additional Data Types and Sources**

| Examples of Additional Data Types and Sources |
|---|
| Total Domains (TeleGeography, Inc) |
| Total Internet Bandwidth (Mbps) (TeleGeography, Inc) |
| Bit-Minute Index (TeleGeography, Inc). |
| Average Monthly Cost for 20 Hours of Internet Access (CID, Harvard). |
| R&D Expenditure as % of GNP (UNDP) |
| Telecommunication Investment with Private Participation ($ M-World Bank) |
| Adult Literacy Rate (UNDP) |
| Education Index (UNDP) |
| Mean Years of Schooling (age 15 and above-UNDP) |
| Piracy Rate (CID, Harvard) |
| Gender-related Development Index (GDI) Value (UNDP) |
| Seats in parliament held by women (as % of total-IPU) |

MENA region The Arab Advisor's Group (Arab Advisors Group) produces country-by-country telecommunications summaries and offers reports that focus directly on regulation, Internet service providers (ISPs), user statistics, and the like.

## *Assessing the MENA Results: Do Oil Revenues Predict ICT Development?*

The analysis process described above can be applied to many combinations of nations and regions. The size of the MENA cluster is probably too large to be valuable, yet some of the insights from this broad-brush analysis can be helpful. For MENA there are five outcomes of interest. First, the larger nations show up consistently as being in the middle or lower rankings, possibly an indication that rapid increases in rates of ICT diffusion in these countries is unlikely in the near term. Egypt, despite significant efforts to increase citizen participation in the Internet, still has use rates below one per hundred and Yemen and Syria are well below that of Egypt. Iran, with a population nearly as large as Egypt, shows better ICT diffusion, but still well below the leaders. Second, several nations in the region, especially Israel and the UAE, have ICT results on a par with fully developed nations like the United States and France. Bahrain, Kuwait, and Qatar are also quite advanced. All five of these nations are small compared with Egypt, and four of them are major oil producers. Third, oil wealth apparently does not lead directly to ICT diffusion. Saudi Arabia is the world's largest oil producer and exporter and Oman is a major producer but neither country has high levels of technology diffusion, according to the statistics available. Fourth, several nonfinancial variables, like knowledge diffusion and possibly press freedom, seem to be related to ICT deployment, although the strength of the relationships is unclear. Fifth, the most stable indicator of ICT success in MENA seems to be the ITU's new DAI, a weighted average of significant, practical ICT diffusion predictors. The DAI could be a very helpful indicator for businesses or donors considering new projects in the MENA region.

## *Summary*

The gap between developing and developed nations is an important issue for businesses or multilateral organizations to consider in planning for investments in the various sectors: education, health care, ICT, agriculture, etc. We have described a relatively simple approach to assessing the ICT trajectory of developing nations through the use of a variety of accessible, unobtrusive measures. A thorough analysis of each nation's ICT potential would require extensive use of more detailed reports and summaries, but the methodology we outline for MENA countries is capable of giving a first cut that may provide significant insights.

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