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Defining and Measuring Access to Knowledge: Towards an A2K Index

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Defining and Measuring Access to Knowledge: Towards an A2K Index

Abstract

Comparative indices are widely used in international development circles to benchmark and monitor public policy objectives. To date, however, no one has examined how an index of Access to Knowledge might be constructed. This article examines the methodological issues involved in such a project and provides a blueprint for the development of a robust and reliable A2K Index. For those new to the Access to Knowledge framework, this article also serves as a concrete and concise orientation to the ideological perspective rapidly reshaping the fields of international development, communications, technology, education, and intellectual property policy.

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Defining and Measuring Access to Knowledge: Towards an A2K Index

> "*I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, you knowledge is of a meagre and unsatisfactory kind . . . .*"
>
> *"If you cannot measure it, you cannot improve it."*
>
> *- Lord Kelvin*[1]

Introduction

The importance of access to knowledge for human development is increasingly recognized by international development agencies, national policy-makers, academic researchers, and non-governmental organizations. Within the past decade, both the World Bank and the UNDP have issued major global reports focused on the themes of knowledge and technology for development.[2] UNESCO also took up the theme of the knowledge society as the focus of its first – and to date, only – world report.[3] Meanwhile a global civil society movement has emerged around a Draft Treaty on Access to Knowledge, in tandem with Southern governments' push for a new "development agenda" within the World Intellectual Property Organization.[4]

* The author wishes to acknowledge the Information Society Project at Yale Law School and the MacArthur Foundation for their support of this research.

[1] William Thomson, First Baron Kelvin (1824-1907), originator of the Kelvin absolute temperature scale.

[2] UNITED NATIONS DEVELOPMENT PROGRAMME, HUMAN DEVELOPMENT REPORT 2001: MAKING NEW TECHNOLOGIES WORK FOR HUMAN DEVELOPMENT (2001), *available at* http://hdr.undp.org/reports/global/2001/en/; THE WORLD BANK, WORLD DEVELOPMENT REPORT 1998/99: KNOWLEDGE FOR DEVELOPMENT (1999), *available at* http://www.worldbank.org/wdr/wdr98/.

[3] UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION, UNESCO WORLD REPORT: TOWARDS KNOWLEDGE SOCIETIES (2005), *available at* http://www.unesco.org/en/worldreport.

[4] Draft Treaty on Access to Knowledge, 9 May 2005, *available at* http://www.cptech.org/a2k/a2k_treaty_may9.pdf;

Yet, even as more and more civil society organizations and policy-makers sign onto the Access to Knowledge (A2K) agenda, many remain unsure about exactly how this concept translates into practice. To date there has been little theoretical literature defining precisely what is meant by "access to knowledge" and how to improve it. Existing published work has been largely qualitative in nature, with an emphasis on explication through descriptive case studies.[5] Quantitative measures to guide policy-making, such as have been developed for other areas of public policy, are lacking in the field of A2K.[6] As a result, citizens and policy-makers have no way of knowing how well their nations "stack up" to their peers in promoting and facilitating access to knowledge, and social scientists wishing to test hypotheses about the determinants and benefits of improved access to knowledge have no data set to draw upon.

To bridge this gap, this article offers a model framework for an A2K index: a quantitative tool drawing on a variety of data points to assess how well countries are doing in promoting

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Proposal by Argentina and Brazil for the Establishment of a Development Agenda for WIPO, WO/GA/31/11, August 27, 2004, endorsed by WIPO General Assembly October 4, 2004, *available at* http://www.wsis-pct.org/WIPO/devel-agenda-27aug05.html.

[5] The 2005 UNESCO World Report, for instance, offers a comprehensive overview of access to knowledge themes including internet communications technologies, education, scientific research, indigenous knowledge, linguistic diversity, and gender gaps in knowledge access and participation. However, the report is overwhelmingly qualitative in method, with only a handful of quantitative tables and graphs between nearly 200 pages of descriptive accounts and policy recommendations. UNESCO, TOWARDS KNOWLEDGE SOCIETIES, *supra* note 3.

[6] Two of the most widely used examples are the Human Development Index, which the United Nations Development Programme introduced in 1990 and has updated in each annual Human Development Report; and the Environmental Sustainability Index, developed at the Yale Center for Environmental Law and Policy. *See* UNDP, HUMAN DEVELOPMENT REPORT 1990: CONCEPT AND MEASUREMENT OF HUMAN DEVELOPMENT (1990), *available at* http://hdr.undp.org/reports/global/1990/en/; World Economic Forum, Pilot Environmental Sustainability Index (2000), available at http://sedac.ciesin.org/es/esi/ESI_00.pdf. Other tools include the Corruption Perceptions Index, maintained by Transparency International and Freedom in the World Index maintained by Freedom House. In the area of knowledge policy, the World Bank has introduced the Knowledge Index (KI) and Knowledge Economy Index (KEI). While the Bank's indices focus on the role of knowledge in development, they are not grounded in an access to knowledge perspective. A number of factors considered important to A2K are not represented in the Knowledge Index, including: a nation's respect for freedom of expression, a balanced intellectual property regime, and issues of equity in access to information and communications technology. Moreover, some features of the Bank's indices are highly problematic from the A2K perspective, in particular the use of patent application rates as an indicator of innovation. At bottom, these critiques stem from a fundamental difference between the World Bank's interest in the "knowledge economy" and the A2K project. The knowledge economy approach is fundamentally concerned with harnessing the potential of knowledge to drive national competitiveness and GDP growth. In contrast, the A2K perspective believes that the innovation and diffusion of knowledge contributes to human development in a number of ways, not necessarily mediated by increases in the gross domestic product. For more detail on the World Bank's knowledge indices, visit their online presentation of the Knowledge Assessment Methodology at http://web.worldbank.org/WBSITE/EXTERNAL/WBI/WBIPROGRAMS/KFDLP/EXTUNIKAM/0,,contentMDK:20584250~pagePK:64168427~piPK:64168435~theSitePK:1414721,00.html?.

access to knowledge, relative to their peers. The index focuses on five key components of access to knowledge: education for information literacy, access to the global knowledge commons, access to knowledge goods, an enabling legal framework, and effective innovation systems. Within each component, I explain the factors that impact access to knowledge and identify appropriate indicators for inclusion in the A2K Index.

The resulting index is useful to a variety of audiences. For development and human rights practitioners not already familiar with access to knowledge, this concrete framework provides an accessible point of entry to the A2K concept. For academics and activists within the access to knowledge community, this proposal also serves as a challenge to critique and improve upon the conceptual framework of A2K as I have defined it. Finally, because some elements of the proposed index will require extensive research to fully develop, this article should also be understood as the outline of an A2K research agenda for scholars and foundations.

The Access to Knowledge Framework

Access to knowledge remains a contested concept, and there is currently no one authoritative explanation of what the term encompasses. Despite a certain degree of theoretical ambiguity, three basic points about the access to knowledge framework can be made. These three principles serve as starting points for the elaboration of the A2K index.

First, the A2K framework rests on the premise that knowledge is a resource of particular importance to human well-being. Princeton historian Joel Mokyr best illustrated the strong causal relationship between the spread of useful knowledge and improvements in mankind's material welfare in his work GIFTS OF ATHENA.[7] Mokyr's central premise is that the rationalization and diffusion of knowledge that accompanied the Enlightenment directly enabled the Industrial Revolution. During this era, widespread improvements in both the stock of knowledge about the world and the ease of accessing that knowledge enabled rapid technological innovation and diffusion. The spread of knowledge in the areas of agriculture, industry, and medicine led to higher productivity and rising living standards. To accelerate development then,

policy-makers should pay attention to the driving role of knowledge.

Second, as the phrase "access to knowledge" suggests, the A2K perspective is particularly concerned with the accessibility of knowledge. According to Mokyr's theory, the ease or difficulty of gaining access to existing knowledge is an important determinant of how quickly improvements in the knowledge stock will translate into the adoption of superior techniques. Moreover because existing knowledge is also an input to the production of new knowledge, access costs also impact the rate of further innovation.[8] Beyond concern for the overall efficiency of knowledge production and diffusion, however, A2K's concern with "access" is also motivated by a concern for equity; an ethical commitment to the proposition that the world's poor and vulnerable populations should not be excluded from sharing in the benefits of advances in human knowledge. This commitment requires that an A2K index pay careful attention to issues of distribution and access among disadvantaged groups.

Finally, the proposal of an A2K index also rests on the assumption that the promotion of access to knowledge is a task that governments must actively pursue. In some instances this means refraining from imposing regulatory burdens; in others it means actively investing resources to create facilitating structures and provide resources. A fundamental premise of the A2K movement is that the challenge of facilitating widespread access to useful knowledge is hampered by systematic market and political failures, which require political solutions.[9] In other words, we cannot simply sit back and wait for advances in science and technology to rescue us from the world's problems. Thus, the A2K index should focus its attention on those aspects of knowledge production and diffusion which may be affected by public policy choices.

With these three theoretical underpinnings in mind, the remainder of this article sets forth a proposed framework for an A2K index. The index I propose is separated into five categories representing key components of access to knowledge: education for information literacy, access

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[7] JOEL MOKYR, GIFTS OF ATHENA: HISTORICAL ORIGINS OF THE KNOWLEDGE ECONOMY, 28-29 (2004).
[8] *See generally*, YOCHAI BENKLER, THE WEALTH OF NATIONS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM, Chapter 2: Some Basic Economics of Information Production and Innovation (2006).
[9] One of these is the failure of market-driven knowledge production to respond to the needs of groups with less pull in the market, such as third world residents suffering from diseases not common in affluent countries. A second is the inability of market mechanisms to capture incentives to invest in knowledge production which does not yield discrete saleable goods, such as basic research in biology. A third failure is the problem of regulatory capture by particular rent-seeking interests.

to the global knowledge commons, access to knowledge goods, legal and policy framework, and effective innovation systems. Within each category, I identify several potential indicators that the index could draw upon, with a discussion of their relative strengths and weaknesses. For ten of the proposed indicators, data is already readily available, and could be used to compile a preliminary version of the A2K index in relatively short time frame. Where data is not yet readily available, the gap is highlighted as presenting an opportunity for future research.

I. Education for Informational Literacy

The first aspect of access to knowledge to be measured is education for informational literacy. Informational literacy represents the ease with which an individual is able to locate, understand, apply, and communicate stored information; in short, the ability to be a sophisticated consumer and producer of knowledge. As the name suggests, the ability to read and write is an important component of informational literacy. Informational literacy, however, is much more than the sum of these two very basic skills. An individual's ability to be a proficient and sophisticated consumer and producer of knowledge depends on broader educational factors such as the degree of technical training they have attained, their skills in critical thinking, and the languages they are fluent in, among others.[10]

To illustrate this principle, imagine a person who cannot read, nor operate simple communications technology such as a radio or telephone, and who lacks the critical thinking skills to separate reliable sources from dubious ones. Like a young child, this person depends on person-to-person verbal communication to meet all their knowledge needs, and relies on simple luck to access a knowledgeable and honest informer. At the other end of the scale, imagine a technologically-savvy, university-educated individual who is fluent in both English and Chinese. This person is able to access a large amount of sophisticated information on the internet, digest it with ease, and produce a bilingual report to be redistributed over the internet.

[10] There are, of course, exceptions to the general rule that an individual must be information literate to access knowledge. Many knowledge-embedded goods transfer the benefits of knowledge, without any intellectual effort on the part of the consumer. For instance, an infant enjoys access to the fruits of scientific knowledge when he or she receives a vaccine, without needing to understand the principles of medicine. Access to knowledge-embedded goods as one component of A2K is addressed later in this article.

The two individuals in the example above enjoy vastly different levels of access to knowledge production and consumption as a result of their differing set of information skills. The benefits of informational literacy, however, accrue not only to the particular individual possessing the skills, but also to other members of his or her society. A very young girl may not be able to directly consume available information about nutrition, agriculture, or education, but she can benefit greatly if her parents, teachers, and community members are empowered to locate, understand, and apply that knowledge. Informational literacy represents the human capital necessary for a society's members to benefit from existing knowledge and contribute to its increase.

Informational literacy assessment tools

It is simple enough to define informational literacy as the ability to effectively locate, understand, apply, and communicate stored information. But how do we measure it for the purposes of an A2K index? Several institutions have worked to develop standards for assessing informational literacy.[11] So far, however, no organization has translated these guidelines into a standardized assessment tool for measuring informational literacy. A new testing approach developed by the Educational Testing Service however, offers a model for how such an assessment might be designed.

[11] As early as 1998, the American Association of School Libraries (AASL) and the Association for Educational Communication and Technology (AECT) adopted informational literacy standards appropriate to the primary and secondary grades. AASL & AECT, INFORMATION LITERACY STANDARDS FOR STUDENT LEARNING (1998), *excerpt available at* http://www.ala.org/ala/aasl/aaslproftools/informationpower/InformationLiteracyStandards_final.pdf. The Association of College and Research Libraries (ACRL) has adopted a related set of standards geared to students in higher education. ACRL, Information Literacy Competency Standards for Higher Education, January 18, 2000, *available at* http://www.ala.org/ala/acrl/acrlstandards/standards.pdf. *See also* TERESA Y. NEELY, INFORMATION LITERACY ASSESSMENT: STANDARDS-BASED TOOLS AND ASSIGNMENTS (2006), *available at* Google Books. several U.S. states have developed more specific outcome-based standards for assessing informational literacy among schoolchildren. Among these, Alaska's Library/Information Literacy Standards offers a robust and concise framework of the specific skills that should be measured as part of any information literacy assessment. For much greater detail, compare Ohio's K-12 Academic Content Standards in Technology at 111-129. More examples can be found at Florida International University Libraries' list of Information Competencies, Standards and Outcomes.

The ETS recently introduced a computer-based testing method to evaluate ICT literacy, called iSkills.[12] The iSkills exam challenges test-takers to perform specified tasks involving information retrieval, analysis, and communication using basic office software such as email and slideshow applications. For example, one iSkills scenario challenges test-takers to translate an email discussion of persuasive arguments into an overhead slide. The testing software assigns a numeric score based on the test-taker's proficiency in completing the tasks.

Although the iSkills exam is designed to measure ICT literacy, its task-based assessment approach offers an interesting model on which to design an informational literacy exam. Relevant skills which might be tested by such an exam could include locating relevant materials through an internet search engine, evaluating the reliability of different information sources, summarizing content in one's own words, and answering comprehension questions, among others. Because this methodology relies on direct testing, however, the research costs incurred in administering the exam to a representative sample in each country at regular intervals would be quite significant, perhaps prohibitive.

An alternative approach would be to use an oral interview testing relevant knowledge as a proxy for the ability to actually perform the tasks. Recent research on digital literacy suggests that asking people to rate their own skills is quite inaccurate; the responses more closely measure a person's digital confidence than their digital aptitude. The same research suggests, however, that quizzing people on their familiarity with specific terms – such as Advanced Search, mp3, Preference Settings, and Newsgroups – yields a much better proxy for actual digital literacy.[13] Following this insight, once an acceptable performance-based assessment of informational literacy is developed, additional research can identify robust proxy indicators, which would be more suitable to broader data collection.

[12] For more detail on the iSkills assessment of information and communications technology literacy, view the online demonstration or the slideshow presentation prepared for the 2005 national conference of the American Library Association.

[13] Eszter Hargittai, *Survey Measures of Web-Oriented Digital Literacy*, SOCIAL SCIENCE COMPUTER REVIEW, Vol. 23, No. 3, Fall 2005, 371-379, full text *available at* http://www.eszter.com/research/pubs/hargittai-SSCORE05.pdf.

Education as a proxy for informational literacy

As the discussion above makes clear, development of an appropriate informational literacy assessment will require a great deal of further research. Until direct measures are developed, the A2K index will need to rely on educational attainment as a proxy for informational literacy. This approach assumes that a person's level of educational attainment is strongly correlated with their ability to locate, understand, apply, and communicate stored knowledge. This assumption seems reasonable enough in the abstract, but has some important limitations in practice. Completion statistics alone cannot reveal how effective a society's education system is at preparing people to participate as active knowledge consumers and producers. Two students completing ten years' education in Austria and Afghanistan will probably not end up with comparable information skills. Educational attainment should thus be viewed as only a very rough proxy for informational literacy, until better measures are developed.

Assuming that educational attainment belongs in the A2K index, which education indicators should be used? International statistics on education commonly emphasize two indicators: primary enrollment rates, and basic literacy.[14] The choice of these two indicators focuses attention on expanding basic educational opportunities to the least advantaged members of society. This emphasis, however is probably not appropriate for the A2K index, because the extremely basic level of skills captured by these indicators is of almost no use in securing access to knowledge. A barely literate individual with only a primary education cannot be expected to use print media or the internet to meet their knowledge needs. To effectively participate in the knowledge commons, individuals need much more than a primary education and basic literacy.

Secondary and Tertiary enrollment levels are more relevant proxies for the level of informational literacy which substantially expands an individual's effective access to knowledge.

[14] Net primary enrollment is calculated by dividing the number of elementary school students by the total population of the children in that age bracket. UNITED NATIONS STATISTICS DIVISION, SOCIAL INDICATORS: INDICATORS ON ILLITERACY, *at* http://millenniumindicators.un.org/unsd/mi/mi_series_xrxx.asp?row_id=589 (last visited May 2006). Literacy is measured as the percentage of the population that ages 15 and over who can, with understanding, both read and write a short, simple statement on his or her everyday life. UNITED NATIONS STATISTICS DIVISION, SOCIAL INDICATORS: INDICATORS ON ILLITERACY, *at* http://unstats.un.org/unsd/demographic/products/socind/illiteracy.htm (last visited May 2006). The United Nations' Human Development Index measures educational achievement by a two-thirds weight on the level of adult literacy, and a one-thirds weight on combined enrollment rates.

Secondary education is where most individuals acquire the print literacy and complex thinking skills needed to utilize knowledge resources such as books, print media, and most materials on the internet. Tertiary education, in turn, is the stage where most individuals move from being primarily knowledge consumers, to acquiring the specialized skills needed to refine, produce, and share new knowledge. Enrollment at this level, therefore, is a useful proxy for the percentage of the population with the level of informational literacy needed to contribute to knowledge production and diffusion.[15]

II. Access to the Global Knowledge Commons

Much of human knowledge is still proprietary, stored in private databases or encapsulated in knowledge-embedded goods, which can only be accessed by paying a fee. In contrast, commons-based knowledge is in theory freely available, without the need to pay or negotiate for access. Just because knowledge or information exists the public domain, however, does not mean that everyone has access to it. Individuals still need to have a means of accessing the knowledge commons. This can occur either directly, as when an individual uses a library or the internet to access knowledge, or indirectly through the assistance of a community educator, health professional, or other expert. Though many factors play a role in shaping individual access to the global knowledge commons, the A2K index should focus on the two most important: internet access and linguistic fluency.

Internet Access

The decision to treat internet access as one of the most important A2K indicators requires some justification. In many parts of the world, internet access still comprises a relatively insignificant mode of accessing information. The number of internet users worldwide doubled between 2002 and 2007, but remains at only 17.2% of the global population, with regional

[15] This second data point is also suggestive of the amount of locally-relevant knowledge being produced in a society, since tertiary institutions are where most research is produced that specifically addresses national or regional economic, social, health, agricultural and environmental priorities. The size of the university student body thus has implications for rest of the population's access to locally-relevant knowledge.

figures ranging from 69.7% in North America to 3.6% in Africa.[16] In the face of these statistics, emphasizing internet access arguably reflects a developed-world bias out of touch with the realities of the majority world, where access to knowledge still predominantly occurs through newspapers, broadcast media, and word of mouth. Despite these concerns, I argue that internet access is worth privileging in the A2K index, because it is qualitatively and quantitatively distinct from other ways of accessing information.

First, internet access enhances the reach and efficiency of traditional forms of knowledge transmission. While a doctor can reach only a limited number of patients through personal consultation, she can educate thousands via the internet, and with a much smaller investment of her time. Mass media such as radio, newspapers, and magazines, can also be distributed beyond the boundaries of their traditional broadcast range or physical distribution chains. Whereas access to the Great Library of Alexandria was physically out of reach for most world denizens, the digital collections of the Bibliotecha Alexandrina can be accessed almost instantly from anywhere in the world.

Second, unlike traditional forms of knowledge transmission, knowledge on the internet is available on demand. Broadcast media and periodicals offer only a limited selection of information to choose from at any one time, but the interactive nature of the internet allows individuals to access the information they want, when they want it. The internet can thus offer access to a much broader range of knowledge and information than any conventional library, personal knowledge network, or print publication. Sophisticated digital archiving, searching, and translation tools further enhance this advantage of new media, enabling individuals to quickly sort through vast amounts of information.

Third, the internet uniquely offers the possibility for large numbers of people not only to access knowledge for consumption, but also to contribute to its production. Few people will ever have the opportunity to publish a book; the labor and production costs are simply too high. A much larger number of people, however, can contribute to the global knowledge commons through posting to the internet. This might take the form of editing an Wikipedia entry, adding information to the Traditional Knowledge Database, describing one's personal experiences on a

[16] Internet World Stats, Internet Growth Statistics and Internet Usage Statistics. Internet World Stats' data is drawn

community discussion board, or answering a question at knowledge-exchange site such as Naver.com.[17] Again, the ability of internet-based media to archive these contributions, with searchability and anytime access, means the accumulated knowledge contributions can in turn be distributed to a larger number of people.

Even individuals who do not themselves have the skills or technology to access the internet benefit from the greater diffusion of internet access in their communities. Local knowledge elites—such as the village school teacher, health professionals, high school students, and NGO leaders—can use the internet to access locally relevant knowledge and information and then share it with other community members. The dynamic can also go the other way, as when a community's political manifesto is posted online by an internet-savvy member or sympathizer. Internet access multiplies and extends the reach of more traditional forms of knowledge transfer based on face-to-face interaction, even within largely non-connected communities.

Assuming that internet access deserves a special place in the A2K index, what is the best way to measure it? Working from data collected by the International Telecommunications Union (ITU), a number of organizations have developed composite indices measuring different aspects of information technology access.[18] In November 2003, in advance of the first World Summit on the Information Society (WSIS), the ITU published the first Digital Access Index (DAI).[19] In the same year, the United Nations Conference on Trade and Development proposed

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from Nielsen//Net Ratings, the International Telecommunications Union, and local NICs.

[17] *See generally* Choe Sang-Hun, *To outdo Google, Naver taps into Korea's collective wisdom*, INTERNATIONAL HERALD TRIBUNE, 4 July 2007, *at* http://www.iht.com/articles/2007/07/04/technology/naver.php.

[18] The International Telecommunications Union (ITU) collects a variety of cross-national data related to internet access, ranging from the number of personal computers, the monthly cost of dial-up and broadband internet subscriptions, and total international internet bandwidth, to the number of public internet access centers and the percentage of internet users that are female. For a full list of available indicators, with definitions, *see* ITU, Telecommunications Indicators Handbook, at http://www.itu.int/ITU-D/ict/publications/world/material/handbook.html.

[19] The DAI ranked countries based on performance across the five categories of ICT infrastructure, affordability, quality, and usage, as well as education. The eight indicators included in this index were: 1. Fixed telephone subscribers per 100 inhabitants; 2. Mobile cellular subscribers per 100 inhabitants; 3. Internet access price as percentage of Gross National Income per capita; 4. Adult Literacy; 5. Combined primary, secondary and tertiary school enrolment level; 6. International Internet bandwidth (bits) per capita; 7. Broadband subscribers per 100 inhabitants; 8. Internet users per 100 inhabitants. International Telecommunication Union Press Release: "ITU Digital Access Index: World's First Global ICT Ranking," 19 November 2003. The DAI made its print debut in the 2003 ITU WORLD TELECOMMUNICATIONS DEVELOPMENT REPORT: ACCESS INDICATORS FOR THE INFORMATION SOCIETY, also available online in pdf format.

its own ICT Diffusion Index.[20] The following year, the ITU, UNCTAD, and other international organizations later launched the Partnership on Measuring ICT for Development.[21] The Partnership's work led to the Digital Opportunity Index (DOI) methodology, presented to the second World Summit on the Information Society in June 2005.[22] Full cross-national rankings according to the DOI were released in the 2006 and 2007 WSIS reports.[23]

Other measurement tools have also been developed. By far the most comprehensive internet access indexing effort was initiated in the Global Information Technology Report 2001-2002, a collaborative project of Harvard's Center for International Development and the World Economic Forum. The CID/WEF Networked Readiness Index (NRI) offers the most sophisticated analysis of the numerous factors driving internet accessibility in various countries, from regulatory profile to affordability of bandwidth to educational quality.[24] In contrast, the

[20] UNCTAD, Information and Communication Technology Indices (2003). UNCTAD's Index of ICT Diffusion incorporated eight indicators: 1. Internet hosts per capita, 2. Number of PCs per capita, 3. Telephone mainlines per capita, 4. Cellular subscribers per capita, 5. Internet users per capita, 6. Literacy, 7. GDP per capita, and 8. Cost of a local call. The Index of ICT Diffusion was updated in 2004 and 2005. UNCTAD, The Digital Divide: ICT Development Indices 2004; UNCTAD, The Digital Divide Report: ICT Diffusion Index, 2005.

[21] The international agencies involved included the Organization for Economic Co-operation and Development (OECD), the UN Conference on Trade and Development (UNCTAD), the UNESCO Institute for Statistics, the UN Economic Commission for Africa (UNECA), the UN Economic Commission for Latin America and the Caribbean (UNECLAC), the UN Economic and Social Commission for Asia and the Pacific (UNESCAP), the UN Economic and Social Commission for Western Asia (UNESCWA), the UN ICT Task Force, and the World Bank.

[22] The DOI is based on a list of eleven indicators agreed to by the Partnership members: 1. Percentage of population covered by mobile telephony, 2. Internet access tariffs as a percentage of per capita income, 3. Mobile cellular tariffs as a percentage of per capita income, 4. Proportion of households with a fixed-line telephone, 5. Proportion of households with a computer, 6. Proportion of households with internet access at home, 7. Mobile cellular subscribers per 100 inhabitants, 8. Mobile internet subscribers per 100 inhabitants, 9. Proportion of individuals that have used the internet, 10. Ratio of fixed broadband subscribers to total internet subscribers, and 11. Ratio of mobile broadband subscribers to total mobile subscribers.

[23] ITU & UNCTAD, WORLD INFORMATION SOCIETY REPORT 2007: BEYOND WSIS. The top-ranking countries according to the DOI methodology were: Korea (.80), Japan (.77), Denmark (.76), Iceland (.74), and Singapore (.72). The average score globally was .40. In addition to the Digital Opportunity Index, the ITU also continued work on an index of telecommunications access more closely resembling the original Digital Access Index. This methodology retains seven of the eight factors included in the DAI, while dropping the measure of internet access cost and adding three new indicators: computers per 100 inhabitants, percentage of households with a TV, and international outgoing internet traffic. The revised methodology was renamed the ICT Opportunity Index. Ultimately the DOI and the ICT-OI measure very similar items, the major difference being that only the ICT-OI incorporates measures of educational achievement. The 2007 World Information Society Report noted that the two methodologies have a correlation coefficient of 0.94, with only minor variations in rankings. WORLD INFORMATION SOCIETY REPORT 2007 at 17.

[24] THE GLOBAL INFORMATION TECHNOLOGY REPORT 2001-2002: READINESS FOR THE NETWORKED WORLD, some sections available online. THE GLOBAL INFORMATION TECHNOLOGY REPORT 2003-2004: TOWARDS AN EQUITABLE INFORMATION SOCIETY, executive summary *available at* http://www.weforum.org/pdf/Global_Competitiveness_Reports/Reports/gitr_2006/summary.pdf; and THE GLOBAL

World Bank's Knowledge Index (KI) has the advantage of simplicity. Its measure of Information and Communication Technology tracks just three data points: 1. telephones per 1,000 people, 2. computers per 1,000 people, and 3. internet users per 10,000 people.

Given the wide variety of approaches described above, what is the best way to measure internet access for the purposes of the A2K index? Rather than counting physical infrastructure or tracking prices, I argue for a focus on actual internet usage as the ultimate measure of access. The inclusion in other indices of extensive data on infrastructure availability, cost, and literacy offers important perspective on why internet usage rates are high or low in particular countries. For our purposes, however, these data points cloud the central issue of whether people have access to global knowledge commons via the internet or not. This question is more precisely captured by measures of who is online and who is not.

For this, the best data currently available is the ITU's estimated number of internet users relative to population. Although this indicator has the advantage of already being collected and available in internationally comparable form, it also has some drawbacks. The estimated number of internet users does not shed light on how frequently the counted users access the internet, nor the quality of their internet access (high-speed connection, privacy of venue, etc.). Moreover, as the term "estimated number of internet users" suggests, the ITU's data is based on imperfect estimation techniques. Worse yet, the method of estimation is currently not consistent across countries. Because of these problems, sole reliance on this indicator risks biasing the A2K index with inaccurate data.

This is, however, a problem that can be overcome. The most accurate way to assess internet usage rates is through a statistically representative survey. Such surveys are already regularly conducted in several countries by Nielsen//NetRatings. A2K researchers should push to extend the reach of such survey efforts to other countries as well, either in partnership with other research institutions that currently use such data, or as part of a broader A2K survey instrument. This will yield accurate, cross-nationally comparable data on internet usage. Conducting such a survey would also provide an opportunity to capture other internet usage data relevant to Access to Knowledge.

Because the A2K perspective is particularly interested in the potential for access to knowledge to alleviate social vulnerability and inequity, data on digital divides should also be part of our assessment of internet access. In the U.S. context, digital divides exist in rates of internet access along the lines of age, income, race, and geography, in the case of the rural/urban gap. Internationally, these gaps also exist, often alongside significant gaps in internet access by gender. Unfortunately, few countries currently collect data on internet usage by sex.[25] Even fewer track internet usage along other socio-economic categories. Both of these data gaps could be addressed by an A2K survey of internet usage. Until that time, the A2K index will only be able to track overall internet usage, using the ITU's estimates. `

Linguistic fluency

The mere ability to digitally access information stored in the global knowledge commons does not guarantee that an individual will be able to understand it. Virtually all stored knowledge is linguistically encoded, usually in text form. Even the more modern audio and video media rely on communication through spoken language.[26] Individuals only have effective access to knowledge that is encoded in languages they can understand. And unfortunately, not all languages are equal when it comes to providing access to knowledge. Some languages, such as English and Chinese, offer access to immense bodies of printed literature and online content. Others, such as Estonian and Quechua, offer access to distinctly smaller bodies of stored knowledge.

At the individual level, language skills powerfully shape a person's ability to access the global knowledge commons. Additionally, as with informational literacy, the distribution of linguistic skills within a society can also have an indirect impact. If the most educated fifth of the Estonian population is also literate in English and French, that segment will be able access

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available at http://www.weforum.org/pdf/gitr/summary2007.pdf.

[25] Michael Minges, Gender and ICT Statistics, 26 November 2002, presented to the 3rd World Telecommunication/ICT Indicators Meeting, Geneva, 15-17 January 2003. Data on internet usage by sex is available, however, for those countries where Nielsen//NetRatings performs surveys.

[26] Some knowledge can be transmitted through non-linguistic representations, including pictoral representation. For example, an online video could demonstrate how to use a certain technology. Understanding the verbal explanations accompanying the video would be greatly helpful, but might not strictly be necessary. It should be safe to say, however, that very little of the world's stored knowledge exists in such formats. Non-textual formats also require much greater bandwidth for transmission, greatly limiting their relevance in most parts of the world.

the most current ideas in science, medicine, industry, agriculture, and politics from abroad, adapting and translating them in ways that become accessible even to their monolingual countrymen. An example of such a society is Sweden, where Swedish – a language spoken by less than ten million people worldwide – remains the dominant language of daily life, government, and the media. But because so many Swedes are also literate in English as well as French or German, even monolingual Swedes enjoy the benefits of strong national ties to the global knowledge commons, such as cutting-edge medical, agricultural, and industrial science.

Because of the important role that linguistic fluency plays in mediating access to knowledge, and the susceptibility of this factor to government intervention, it is an important factor for the A2K index to track. But how? Which languages "count" for the purposes of access to knowledge? The United Nations recognizes seven languages as having international status: Arabic, Chinese, English, French, Portuguese, Russian, and Spanish. The political importance of a language, however, may not necessarily correlate with the amount of information and knowledge accessible through it. Ideally, the A2K index would assign varying weights to languages based on efforts to estimate the size of the knowledge commons encoded in that language, using counts of print literature, current periodicals, and web content. As an intermediate step, the index could weigh languages according to the number of speakers, or set a benchmark, above which a language qualifies as a "global gateway" language. Using the figure of 100 million speakers, for instance, the list would include the world's ten most-spoken languages: Chinese, Spanish, English, Arabic, Hindi, Portuguese, Bengali, Russian, Japanese, and German.[27]

The A2K index should take into account both what percentage of the population is fluent in at least one global gateway language, and what percentage of the population is fluent in more than one. Fluency should be defined as the ability to read a book or article in the language. This standard might be more than necessary to utilize a webpage, but is probably less than necessary to give an oral presentation or prepare a document. Ideally, a statistically representative survey would ask respondents to report the languages in which they are able to read a book or article,

[27] The ten languages are presented in descending order by number of first-language speakers. Drawn from chart summary of the top 20 languages according to the 2005 Ethnologue available at Wikipedia. The original data

yielding the most accurate and up-to-date information. In the short term, this data could be compiled from national statistics on what percentage of the population speaks different languages; with the assumption made that they have the requisite level of fluency.

III. Access to Knowledge Goods

The previous section focused on access to knowledge in its abstract form, as linguistically encoded information to be intellectually processed. But knowledge is not always accessed through books and broadcasts. Individuals can also benefit from access to knowledge in concrete form, as when they are able to use genetically-improved seed, modern pharmaceuticals, or a cell phone. Following the conceptual framework proposed by Yochai Benkler, these can be classified as information-embedded goods and information-embedded tools.[28] Information-embedded goods are those goods which are "better, more plentiful or cheaper because of some technological advance embedded in them or associated with their production," such as medicines, movies, and improved crop seed. Information-embedded tools, in turn, are those technologies necessary for research, innovation, and communication of knowledge. Examples here include: books, computers, and scientific research equipment. Of course, many items may be both an information-embedded good and an information tool. A cell phone is an information tool because you can use it to find out the price of cotton, obtain medical advice, or give directions. It is also an information-embedded good because its functioning depends on discoveries in microchip technology, electronics manufacturing, and software.

Unlike linguistically-encoded knowledge, which can be reproduced and shared at little to no cost in a global commons, commodified knowledge requires a significant input of resources to produce and distribute each chip, pill, or unit. Access to these forms of knowledge is determined by the individual good's market price, and the individual consumer's ability to pay that price. Access to both types of goods plays an important role in mediating access to

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appears in: Gordon, Raymond G., Jr. (ed.), 2005. Ethnologue: Languages of the World, Fifteenth edition. Dallas, Tex.: SIL International. Online version**:** http://www.ethnologue.com/.

[28] These concepts are drawn from Benkler's four-part conceptual categorization, including: knowledge, information, information-embedded tools, and information-embedded goods. *See* YOCHAI BENKLER, THE WEALTH OF

knowledge, but for different reasons. The affordability of information tools constitutes an important input to innovation and accessibility of knowledge; if these are difficult to obtain in the market, the rate of knowledge diffusion and development will slow. The affordability of information-embedded goods, in contrast, represents an output measure of knowledge innovation and diffusion, reflecting the extent to which the entire human population is able to benefit from developments and improvements in human knowledge. In practice, however, it is difficult to measure these two aspects of access separately, because most information tools are also information-embedded goods. For this reason, both categories will be considered jointly as "knowledge goods."

Affordability of Knowledge Goods

To capture how well a country is doing in making knowledge goods accessible to its population, the A2K index should track the cost of a "basket" of these goods. This methodology is widely used to generate consumer price indices. Researchers first design a hypothetical shopping cart or "basket" of representative goods to be measured. The costs are summed and the result is tracked over time to assess shifts in the cost of living. The same approach could be applied to a basket of knowledge goods. The cost of the basket from country to country will reflect some variables over which countries have no control, such as higher transportation costs due to geographic isolation. However, the basket price will also be influenced by important government policies, such as taxes and tariffs, intellectual property and licensing regimes, the general state of economic competition, and subsidies for innovation. Reductions in the cost of the basket can be achieved through elimination of sales or value-added taxes and import tariffs, widening competition in production and distribution, and the effective diffusion of new innovations.

Further research should be done to determine which knowledge goods are most important for access to knowledge, and most relevant to global knowledge consumers. As a starting point, however, a few considerations may be offered. First, it is important to include information tools

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NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM (2006), *available at* http://www.benkler.org/wealth_of_networks/index.php?title=Chapter_9%2C_section_3.

whose prices vary from country to country due to local conditions. Second, the information tools chosen should be ones of broad use. An IBM super-computer, for example, would be a poor measure; it is manufactured in only a few locations, is sold for the same price in every country, and is used by very few consumers. In contrast, a good candidate for initial inclusion in the information tool basket might be blank CDs, or a dictionary translating between locally-spoken languages and ones widely spoken internationally. The cell phone is an information tool in particularly wide use globally; its technological complexity means that is price also reflects the cost of a wide variety of underlying high-tech components. Another possible candidate is the cost of an internet connection of a certain duration and quality, a data point already tracked by the ITU. The basket of goods ultimately selected must be broad enough to capture the diversity of knowledge goods, and not be susceptible to disproportionate bias due to shifts in any one item.

Of course, the market price of knowledge goods is not the only component of affordability. The distribution of resources necessary to purchase access to these goods is equally important. Austria and Armenia might both succeed in bringing the knowledge goods basket down to the same price, but their citizens will have very different levels of access to these goods as long as per capita GDP is $32,700 in Austria and $3,900 in Armenia.[29] The cost of the knowledge goods basket in each country must be weighted by some measure of available income, such as per capita GDP; adjusting this figure for purchasing power parity (PPP) will yield the most accurate basis of comparing buying power cross-nationally.

Until an appropriate knowledge goods basket can be designed, tested, and implemented, there is another set of data already in existence which may serve as a useful proxy. The Millennium Development Goals project has developed an indicator measuring access to modern medicines.[30] Under this system, medical experts in each country report approximately what percentage of the population has effective access to the medicines on the WHO's List of Essential Drugs. This is an imperfect proxy because access may depend significantly upon public investments in health care provision, not only the market prices of these goods. The dynamics of access to medicine within a society may not reflect the dynamics of access to other information-

[29] From IMF data for per-capita GDP, based on purchasing power parity (PPP) in current international dollars for Austria and Armenia. Figures are from 2004, the most recent year for which Armenian data is available, and are rounded to two significant digits. Visit links for most up-to-date information.

embedded goods. Additionally, the data provided by the measure is not very precise, with data points falling into only four categories: less than 50%; between 50-80%; 80-95%; or above 95%.[31]

The methodology of the Access to Essential Drugs indicator also suggests a simplified alternative to assessing the affordability of knowledge goods. Rather than pricing a basket of knowledge goods, in-country experts could roughly estimate the proportion of the population which has access to the listed items. The information yielded by this approach would be less detailed, but would also have a much lower cost to implement. Until further research can be developed along these lines, a preliminary version of the A2K index could employ data already available on access to three knowledge goods: the Millennium Indicator of Access to Essential Drugs in combination, the ITU indicators of internet access affordability, and MDG data on cell phone subscriptions. Per capita GDP, adjusted for purchasing power parity, should also be included as a major determinant of access to knowledge goods.

IV. An Enabling Legal Framework

Access to knowledge does not take place in a political vacuum; it is greatly shaped by what types of knowledge sharing a nation's legal framework does or does not permit. The precise contours of what constitutes ideal information policy are a matter of great debate, and to assure scientific credibility and wide acceptance, the index must avoid penalizing countries for political and legal measures whose contribution to the creation and diffusion of access to knowledge is controversial or not well-documented. It is possible, however, to identify two issues for which there exists substantial political and scientific consensus: respect for freedom of expression and a balanced intellectual property regime. The A2K index should monitor both these issues, paying attention not just to what the law says on paper, but to how it works in practice.

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[30] Essential Drugs are defined as those necessary to satisfy the health care needs of the majority of the population.
[31] UNITED NATIONS STATISTICS DIVISION, MILLENNIUM INDICATORS DATABASE, *at* http://millenniumindicators.un.org/unsd/mi/mi_dict_xrxx.asp?def_code=457 (last visited May 2006).

Protection for freedom of expression

The first element of a nation's legal framework which is widely identified as important in promoting access to knowledge is the protection for freedom of expression.[32] According to Article 19 of the Universal Declaration of Human Rights, the right to freedom of expression includes "freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers." The importance of freedom of expression to A2K is self-evident: freedom of expression protects the ability to communicate existing knowledge to new parties, and promotes uninhibited collaboration for the development of new knowledge.

Because freedom of expression has long been accepted as important to human welfare within the human rights paradigm, there are already several useful sources of cross-nationally comparable data upon which the A2K index can draw. The three sources of data most frequently cited in social scientific literature on human rights are the annual global human rights reports produced by the U.S. Department of State, Amnesty International, and Human Rights Watch. Although all three of these institutions publish their reports in narrative form only, scholars have developed various techniques to translate this information into numerical data.[33] Unfortunately, the resulting indices typically lump together various types of human rights violations, and/or focus only on extreme violations such as disappearances and torture.

The Freedom House Comparative Survey of Freedom offers an indexing measure more specifically focused on freedom of expression. This annual assessment of "civil liberties" in 192 countries, including "freedom of expression, assembly, association, education, and religion," comes closer to A2K's target set of concerns.[34] Importantly, the Freedom House survey looks

[32] *See, e.g.,* UNESCO World Report 2005: Towards Knowledge Societies (identifying freedom of expression as the touchstone of the knowledge society).

[33] These efforts include the Humana Human Rights Guide, the Guardian human rights index and, most notably, the Maplecroft Human Rights Index, which provides normalized scores for 194 countries.

[34] See the Freedom House website for an explanation of the index's methodology. For the category of civil liberties, countries are awarded up to 60 points based on expert answers to 15 questions in the categories Freedom of Expression and Belief, Associational and Organizational Rights, Rule of Law, and Personal Autonomy and Individual Rights. Points are not awarded on the basis of what rights a country's legal system promises on paper, but on the extent to which the freedoms are actually enjoyed in practice. The 0-60 score is then reduced to a scale of

not to formal characteristics such as whether a nation's constitution guarantees freedom of expression, or whether the nation has signed international agreements to protect freedom of expression, but to the actual conditions prevailing in a country. This is probably the best data set for early versions of the A2K index to rely upon.[35]

A2K advocates should not stop with existing indicators, however. None of the existing tools capture certain elements of the right to freedom of expression which are particularly important from the perspective of access to knowledge. For example, freedom of expression in the context of A2K requires particular emphasis on the subsidiary principle of "freedom of information . . . the right to access data held by public authorities and to receive regular information on the initiatives taken by public authorities."[36] Another aspect of freedom of expression which may be important from the A2K perspective is the role of foreign visitor policies in promoting the international exchange of ideas and learning. These examples suggest that while A2K advocates might rely on existing measures of freedom of expression in the first generation of an A2K index, it is worth investing energy in developing an additional measure which is more sensitive to particular A2K issues.

1-7 for publication; to achieve greater sensitivity of measurement, the A2K index should use the underlying subscores. It may also be desirable to use only the most relevant categories of Freedom of Expression and Belief and Associational and Organizational rights, while excluding the less-relevant Rule of Law and Personal Autonomy subscores.

[35] The Freedom House methodology has, however, been subject to a number of criticisms for its subjectivity and an alleged political bias toward American allies. *See e.g.*, Kenneth A. Bollen, *Political Rights and Political Liberties in Nations: An Evaluation of Human Rights Measures, 1950 to 1984*, *in* HUMAN RIGHTS AND STATISTICS: GETTING THE RECORD STRAIGHT, 188 (Thomas B. Jardine & Pierre P. Claude, eds., 1992); Christopher Mitchell et al., *State Terrorism: Issues of Concept and Measurement*, *in* GOVERNMENT VIOLENCE AND REPRESSION: AN AGENDA FOR RESEARCH 1, 20 (Michael Stohl & George A. Lopez eds., 1986). The charge of subjectivity has merit, as the country scores are based upon expert assessments rather than hard data. This is, however, inevitable in any attempt to judge a legal system, as civil liberty is not something that can be objectively counted like educational achievement or internet access. Use of expert assessments to capture hard-to-count phenomena of governance is a widely accepted methodology. *See e.g.*, Daniel Kaufmann, et al, Measuring Governance Using Cross-Country Perceptions Data, The World Bank, August 2005 (examining the reliability of perception-based data versus objective data sources as a basis for World Bank governance indicators). The charge of political bias in the rankings is more concerning; however, the evidence for such allegations seems to be anecdotal only. Additionally, excluding sub-scores in the category of Personal Autonomy and Individual Rights, see *supra* note 34, would yield a modified freedom of expression score not influenced by a country's capitalist/socialist orientation to economic rights. This should reduce or eliminate the perceived bias in favor of U.S. allies.

[36] UNESCO, Towards Knowledge Societies, *supra* note 3 at 39. *See generally* TOBY MENDEL, FREEDOM OF INFORMATION: A COMPARATIVE LEGAL SURVEY (2003), *at* http://www.article19.org/pdfs/publications/foi-as-an-international-right.pdf; Toby Mendel, *Freedom of Information as an Internationally Protected Human Right*, http://www.article19.org/pdfs/publications/foi-as-an-international-right.pdf.

A Balanced Intellectual Property Regime

In addition to the central role of freedom of expression, Knowledge policy experts also agree on the need for a "balanced" intellectual property regime.[37] Defining precisely what constitutes a balanced intellectual property regime, however, is a matter on which substantially less consensus exists. At a minimum, it is possible to say that a "balanced" intellectual property regime is one that takes into consideration both the need to recognize and protect intellectual property in order to promote innovation, as well as the need for some limits on intellectual property to promote other public interests. To date there is no international data set that attempts to assess whether nations' intellectual property regimes are balanced.[38]

Indeed, there has been little academic research – much less an international consensus – on what the criteria for such an assessment would be. The World Intellectual Property Organization has issued guidelines in the form of model national IP laws.[39] To date, however these recommendations have only addressed minimum floors for IPR protections. The tendency to focus only on IP expansion, rather than balance, is unfortunately a feature of current international law. Conventions on intellectual property have to date focused primarily on setting policy "floors" in the form of minimum terms for intellectual property protection.[40] No particular exceptions or limitations on copyright and patent privileges are mandated by these international conventions; such attempts at balance are up to each nation's discretion. This

[37] *See, e.g.* World Development Report 1998/1999: Knowledge for Development, at p. 146: "Well designed intellectual property regimes try to balance the private incentives for creation of knowledge against the social benefits from its dissemination. …[Developing countries] should negotiate internationally for intellectual property rights regimes that give adequate consideration to their urgent need to narrow the knowledge gap—while maintaining incentives for knowledge producers everywhere to continue their creative activity." Despite this theoretical recognition, the concept of a balanced intellectual property regime does not find representation in the World Bank's Knowledge Assessment Methodology indices.

[38] The World Intellectual Property Organization maintains an Intellectual Property Digital Library, including some statistics on patent applications by country. However, WIPO maintains no indicators addressing the quality of countries' intellectual property regimes. *See* WIPO, Intellectual Property Digital Library Data Collections, *at* http://www.wipo.int/ipdl/en/resources/content.jsp (last visited May 2006); WIPO, Industrial Property Statistics Online Directory, *at* http://www.wipo.int/ipstats/en/links/ (last visited May 2006).

[39] See, e.g. WIPO Model Provisions on National Laws for Measures

[40] The1971 Berne Convention established a minimum 50-year term of copyright; the 1995 TRIPS Agreement similarly established international floors of protection for trademarks, patents, trade secrets, and other forms of

approach is also reflected in the USTR's intellectual property "watch list."[41] Countries are only penalized by the USTR watch list for offering too little protection to intellectual property, never for offering too much.

An alternative to the USTR watch list is needed; one that defines the characteristics of a balanced intellectual property regime and fairly assesses all countries accordingly. The highly-charged international politics around this issue, however, make it difficult for international organizations to undertake this task.[42] This is a task, however, that academic and civil society A2K advocates are well-suited to do, giving consideration both to the need for intellectual property privileges to stimulate innovation and for limits on those privileges to promote access. Once the terms of the framework are established, researchers can use existing data on national intellectual property regimes available at the WIPO website to compile the index.[43]

Until this work is completed, a provisional form of the A2K index will need to rely on proxies for assessing intellectual property regime balance. This could be accomplished by examining whether the particular state has—in a number of areas—gone beyond the (already imbalanced) international standards to accord still greater intellectual property privileges. These include: permitting patents on business methods, establishing patent terms of longer than 20 years or copyright terms of longer than 50 years, enacting data exclusivity provisions, or failing to provide for copyright exceptions.[44] These elements are not meant as the definitive standards

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intellectual property. For a summary of TRIPS provisions, see http://www.wto.org/english/tratop_e/trips_e/intel2_e.htm.

[41] The Office of the United States Trade Representative maintains an annual review of the "adequacy and effectiveness of intellectual property rights protection" in 87 countries, referred to as the Special 301 Report. *See, e.g.*, U.S.T.R., 2006 SPECIAL 301 REPORT, *at* http://www.ustr.gov/Document_Library/Reports_Publications/2006/2006_Special_301_Review/Section_Index.html. The Report is a diplomatic tool designed to target attention and pressure on countries the U.S. Trade Representative believes have intellectual property practices that disadvantage American companies.

[42] Although WIPO collects information about national IP practices on its website, it has made no attempt to translate these descriptions into value judgments. WIPO, WIPO Index of Patent Systems, http://www.wipo.int/ipstats/en/resources/patent_systems.html (last visited May 2006). Despite the name "Index of Patent Systems," WIPO's information provides information in narrative form only, based on surveys completed by member countries. It does not constitute a quantitative index or scoring scheme.

[43] *Ibid*.

[44] Although intellectual property rights themselves are internationally standardized and required by international law, exceptions are permitted to these standards as an optional matter of national public policy. This makes copyright exceptions a good target for cross-national comparisons. What exceptions does a country permit for research and educational purposes, for library lending, for orphan works, for digitization and indexing, for

of a balanced intellectual property regime. Rather, the existence of such provisions suggests that a nation's IP regime has an overall bias toward over-protecting property privileges and under-protecting the public interest.

V. Effective Innovation Systems

Although innovation and access are often analyzed as separate—and even conflicting—concerns, they are in fact intricately related. Until innovation occurs to produce new knowledge, no one can have access to it. No country can afford to neglect innovation, free-riding on the importation of existing knowledge innovated in other nations. Every country has unique challenges imposed by its geography, distribution of resources, history and cultural factors. Local innovation, therefore, is crucial to developing geographically appropriate agricultural techniques, finding appropriate prevention and treatment measures for endemic health problems, utilizing locally-available resources to meet the country's energy needs, publishing materials for citizens to learn from their own history, and solving the challenges of democratic governance.

Support for innovation can take a variety of forms. One aspect is promotion of the conditions necessary for market-based innovation. In this model, innovation is motivated by the prospect of recovering rents on a patent, or by the desire to gain a short-term competitive advantage through discovery and implementation of a non-patented innovation. Governments may also promote innovation by offering subsidies for scientific research, or supporting institutions of higher education and centers of public research and development that nurture and facilitate innovation. Rather than trying to presume which types of innovation systems are most effective, the A2K index should focus on judging a nation's innovation systems by its achievements: the amount of innovation produced.

Existing measures of innovation have focused on the indicators for which the most complete data currently exists: number of patents registered, and returns on patent licensing.[45] Patent-

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translation into less-used languages and disability-accessible formats? And are those exceptions that exist clearly defined and easy to invoke in practice?

[45] See, e.g., World Bank, Knowledge Assessment Methodology and UNDP, HUMAN DEVELOPMENT REPORT 2006, Table 13, Technology: diffusion and creation, at 327-30. Both institutions use patent data as one measure of innovation, in addition to research & development (R&D) expenditures as a proportion of GDP, and the proportion

based measures, however, are highly problematic indicators of innovation, because most innovations do not get patented. Research indicates that the rate at which innovations are patented varies dramatically by industrial sector, from 8.1% in textiles to 79.2% in pharmaceuticals.[46] This immense variability means that cross-country comparisons of patent applications are more likely to reflect the relative distribution of high-patenting and low-patenting industries in the national economy, rather than differing rates of innovation.[47] Even controlling for the type of industry, the rates at which firms patent their innovations vary dramatically by country, making patenting a poor indicator for a cross-national index.[48] Moreover, patent-based indicators by definition cannot capture types of innovation for which patents are not awarded, such as basic science and (in most jurisdictions) business methods.

Tracking royalties on patent licenses may still have some value for an index like the World Bank's KEI, where the underlying purpose is to measure innovation's contribution to GDP (although the research suggests that unpatented innovations are most important to corporate profits).[49] From the A2K perspective, however, relying on patents – which represent the right to exclude others from access to the innovation - is particularly problematic. Patents likely represent the segment of innovation of least value for expanding access to knowledge: improvements in the knowledge stock whose application is limited by exclusive property rights. Contributions to basic science, new business methods, and anything made available for free in

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of the population employed in R&D. The World Bank also tracks the number of publications in scientific and technical journals, using data provided by the National Science Foundation.

[46] Anthony Arundel & Isabelle Kabla, *What percentage of innovations are patented? Empirical estimations for European firms*, 27 RESEARCH POLICY 2, 127-41, June 1998, *available at* http://dx.doi.org/10.1016/S0048-7333(98)00033-X (empirical study of innovation in European firms, finding that approximately one-third of all reported corporate innovations led to a patent application; product innovation patent propensity rates were over 50% only in five sectors – pharmaceuticals (79.2%), chemicals (57.3%), machinery (52.4%), office and computing equipment (56.8%) and precision instruments (56.4%)). *See also*, Paul H. Jensen & Elizabeth Webster, *Examining Biases in Measures of Firm Innovation*, Paper presented in Copenhagen, Denmark on June 27-29, 2005, *at* http://www.druid.dk/uploads/tx_picturedb/ds2005-1506.pdf (empirical research concluding that the correlation between IP proxies and underlying corporate innovation is less than 20%).

[47] *See* Anthony Arundel, Patents – the Viagra of innovation policy? Internal report to the Expert Group, prepared as part of the project "Innovation Policy in a Knowledge-Based Economy" commissioned by the European Commission, at 5 (describing research indicating that product innovations result in a patent application at a rate of 52% within U.S. firms but only 44% for European firms; the patent application rates for process innovations are 44% in the U.S., but only 26% in Europe).

[48] Arundel, Patents – the Viagra of innovation policy? supra note 46 at 5-6 (concluding that European companies patent a lower percentage of both product and process innovations).

the global knowledge commons, in contrast, will not find representation in patent counts. Moreover, counting patents obscures the important fact that not all innovation is equal. A meaningful innovation indicator would capture the difference in social impact between the development of a video game and an AIDS vaccine. Other commonly tracked innovation metrics have similar flaws.[50]

This author is not the first to call for new and improved innovation metrics.[51] Developing new indicators for innovation, however, is a particularly urgent task for A2K researchers. Despite ample research indicating that patent application rates are a poor measure of innovation, international institutions continue to rely on this data, reinforcing the misconception that patenting is the primary incentive to innovation. Many A2K researchers and advocates believe that "strong" intellectual property rights actually inhibit innovation; but until better indicators are developed, there will be no way to prove this theory. Although we are still quite far from a solution to this problem, I will offer a few suggestions on how A2K researchers might approach the question.

First, rather than attempting to measure the overall level of innovation in a society, it may be worthwhile to focus measurement efforts specifically on high-value innovation, including commons-based innovation. Conducting empirical studies in specific areas such as basic science, agriculture, or education should be methodologically simpler than attempting to capture innovation throughout a society or economy, and may more effectively capture the aspects of

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[49] Arundel, Patents – the Viagra of innovation policy? supra note 46 at 6-9 (finding that most firms rate secrecy and lead-time as more important than patents to realizing competitive advantage from innovation).

[50] Additional commonly-tracked innovation indicators relate to R&D expenditure, employment in R&D, and higher education enrollment in the area of science and engineering. The first problem with these measures is that they are all measures of inputs, not of results; while a correlation with innovation outcomes appeals to common sense, it has not been empirically demonstrated. Available research suggests that R&D measures have no greater correlation with actual innovation than do patent-based measures. *See generally* Jensen & Webster, *supra* note 46. A more recent line of research suggests looking at international trade flows in research and development services as a market signal of nations' relative strength in innovation; unfortunately this research is still at a very early stage. National Science Foundation, Division of Science Resources Statistics, Trade in R&D-Related Services: A New Indicator of Industrial Knowledge Flows (NSF 06-326) August 2006, *at* http://www.nsf.gov/statistics/infbrief/nsf06326/.

[51] The United States Department of Commerce has recently launched a special advisory committee to help it develop metrics for measuring the innovativeness of a country's economy, *see* http://www.innovationmetrics.gov; Brian Wingfield, Measuring Innovation, Forbes.com, 23 February 2007 (article describing first meeting of the committee). *See also* National Science Foundation, Division of Science Resources Statistics, Advancing Measures of Innovation: Knowledge flows, Business Metrics, and Measurement Strategies, 6-7 June 2006, *at*

innovation most important to human development.

Second, A2K researchers should also focus efforts on the five economic sectors in which patenting strategies are most prominent, with particular attention to the extreme outlier: pharmaceuticals.[52] The argument for IP exclusivity as an incentive to innovation is stronger in these sectors than in those where patents are rarely sought. Improving the understanding of innovation dynamics in these sectors is thus particularly important for A2K advocates. This may also be a more fruitful line of research since current literature suggests that existing innovation measures are more appropriate points of comparison within industrial sectors than between national economies. In other words, patent citations or R&D employment figures mean more when comparing two pharmaceutical firms than when comparing two countries.

Finally, there may be value in acknowledging that "innovation" is a soft concept. Much more like freedom of expression or quality of governance than internet access or educational achievement, innovation is difficult to capture by counting objective phenomena. Perception surveys may therefore be a better method of measurement than attempting to count objective data with only a tenuous correlation to actual innovation.[53] A survey approach could provide cross-nationally comparable indicators of innovativeness in both publicly-funded research centers and in private firms. Until such indicators are developed and validated, it is better for early versions of the A2K index not to incorporate any innovation indicators, rather than rely on deeply flawed ones. Innovation is unquestionably an important part of access to knowledge policy, but one unfortunately not yet subject to easy measurement.

Conclusion

In the preceding discussion, I identified a set of 10-25 data points that could compose an

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http://www.nsf.gov/statistics/nsf07306/start.cfm (concluding that much further research will be necessary to develop reliable innovation metrics).

[52] *See* supra note 46.

[53] *See e.g.*, Jensen & Webster, supra note 46 at 21-24 (describing construction of survey administered to corporate managers to assess their firms' innovativeness, with scores based on averaging responses to a number of questions designed to get at the same underlying issue; the methodology is quite similar to that employed by the Freedom House assessment of civil liberties discussed *supra*).

index assessing the state of Access to Knowledge in the various nations of the world. The proposed indicators reflect the five key components of access to knowledge: education for information literacy, access to the global knowledge commons, access to knowledge goods, an enabling legal framework, and effective innovation systems. To review this discussion, the five components of the Access to Knowledge Index may be summarized as follows:

Education for informational literacy. Informational literacy – defined as the ability to locate, understand, apply, and communicate information – is an important determinant of access to knowledge at both the individual and societal levels. The A2K index can use existing data on secondary and tertiary enrollment as proxies for informational literacy. Future versions of the A2K index would ideally assess a nation's level of informational literacy through survey tools measuring individuals' actual ability to perform information tasks, or through proxy measures empirically demonstrated to correlate strongly to the ability to perform these tasks.

Access to the Global Knowledge Commons. Vast stores of knowledge are available in the public domain, yet not everyone has access to them. The two most important determinants of access to the global knowledge commons are internet access, and fluency in a global gateway language. International data on internet usage is already available; linguistic fluency can also be estimated through available data sources. A statistically representative survey would increase the accuracy of both figures. More research is also needed to better understand the role of language differences in access to knowledge.

Access to Knowledge Goods. In addition to knowledge stored in libraries and databases, knowledge is also exchanged in commodified form. Access to knowledge goods is influenced by economic competition, transportation structures, the distribution of wealth, as well as taxes and tariffs. The A2K index can draw on existing data on the affordability of medicines, cell phones, and internet service, and per-capita GDP, adjusted for purchasing power parity. A more sophisticated mechanism for tracking prices through a "knowledge goods basket" would improve future versions of the A2K index..

An Enabling Legal Framework. Knowledge experts agree that two areas of law are particularly important to access to knowledge: respect for freedom of expression, and a balanced intellectual property regime. Legal frameworks are difficult to subject to objective data collection, but ratings based on expert assessments offer usable data for cross-national comparisons. The A2K index can draw upon existing ratings of freedom of expression, while working to develop an improved, A2K-specific metric. In the area of intellectual property, a pilot A2K index can track a small set of issues suggestive of IPR imbalance. Further work is required to develop a more complete set of standards for a balanced intellectual property regime.

Effective Innovation Systems. Promoting access to knowledge also requires attention to innovation – how well a country is doing at promoting the development of new knowledge. Of all the components of the A2K index, this is the area in which available data is least satisfactory. Existing data on patent applications and revenues is of very little use in capturing underlying innovation, creates large data biases distorting comparisons between countries, and reinforces the false impression that patenting opportunities are the primary incentive to innovation. Further research is needed to develop metrics that can better capture the dynamics of knowledge innovation.

Although it will be years before a truly comprehensive A2K Index can be implemented, a pilot version – tracking 10 essential indicators – could be constructed in a relatively short timeframe. Implementation of an index along these lines would be an important step forward in improving the monitoring and management of access to knowledge efforts.

Summary of A2K Indicators*

Category	Area	Indicator
Education for Informational Literacy	Educational Achievement	**Secondary education completion**
		Tertiary enrollment rates
	Informational Literacy	*Direct assessments of IL*
		Survey using proxies for IL
Access to the Global Knowledge Commons	Linguistic fluency	**% speaking a global gateway language**
		Weighting languages by knowledge base
		Survey of linguistic fluency
	Internet Access	**ITU estimated internet users**
		Survey of actual internet users
		Digital divide indicators
Access to Knowledge Goods	Affordability of Knowledge Goods	**Access to essential medicines**
		Cost of internet connection
		Number of cell phone subscribers
		Cost of basket of knowledge goods
		Survey of access to knowledge goods
	Purchasing Power	**GDP per capita, adjusted for PPP**
Legal & Policy Framework	Freedom of Expression	**Freedom House civil liberties score**
		A2K freedom of expression score
	Balanced IP Regime	**IP protections exceed international norms**
		Scope and effectiveness of exceptions
		Conformance to model IP policies for A2K
Effective Innovation Systems	New Contributions to Knowledge	*Survey of innovation in public centers*
		Survey of innovation in private firms
		Metrics specific to high-value innovation

* Indicators in bold type are currently available in cross-national form or could be collected at low cost. Indicators in italicized type will require greater research and development to implement.