DOI Applied to Indonesia: Assessing ICT Policy & Regulatory Environment*

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Introduction

The ITU's *World Information Society Report 2006* is an important step in developing a common methodology to assess ICT infrastructure, access and use globally. The Digital Opportunity Index unveiled in the report can become an important tool for policymakers to evaluate ICT sector performance not only in their country over time but also in comparison with their peers in the region and globally. For a long time, fixed teledensity was used as a catch-all indicator of telecommunication development. In light of the explosive growth of mobile telephony and new low-cost wireless technologies that offer last-mile access network solutions to developing countries with limited network infrastructure, it has become evident that fixed teledensity, by itself, is no longer a good indicator of communication access.

In the face of the changed telecom landscape, countries have started collecting data on new measures to capture ICT development. However, in the absence of a common methodology and a composite index it is impossible to make any kind of meaningful cross-country comparisons. Over time, a number of composite ICT indices have been developed, roughly based on UNDP's Human Development Index methodology that measure different facets of ICT development as the *World Information Society Report 2006* discusses in greater detail. With the development of the Digital Opportunity Index, however, we have a composite index that has the widest coverage of any of the other indices (180 countries); a modular design that allows specific aspects of ICT development to be measured; and most importantly, it has a relatively small number of indicators that makes collection of data more feasible. Furthermore, the DOI basket of ICT indicators provides not only traditional measures of infrastructure but also offers insights on ICT affordability and utilization, which are crucial components for measuring progress in bridging the digital divide.

This paper will apply the DOI to Indonesia and will outline some of the methodological challenges in collecting data for the indicators. The paper will also consider the implications of the DOI results for Indonesian policymakers and regulators.

DOI Applied to Indonesia

The DOI indicator data that has been provided for Indonesia is neither complete nor is it current. If one goes through the Excel datasheet for Indonesia, it will become evident that complete data for the DOI composite index is only available for 2003. Hence, it was necessary to collect indicator data for 2005 to update Indonesia's DOI score. In doing so however, a number of methodological issues were encountered. There was significant variance in the data that was collected for this report versus the data that has been reported by ITU for Indonesia. By presenting the assumptions behind the data and the methodology used to calculate the different indices, it is hoped that the variance can be explained.

Reference Data

Reference data are used for calculating actual scores for most of the indices. Therefore, if the reference data are inaccurate, errors will proliferate throughout the Index.

Population

Population figures for Indonesia vary dramatically if one relies on CIA Factbook estimation or the data provided by BPS (Badan Pusat Statistik), the Indonesian national statistical organization (NSO). This is due to different estimates of population growth rate used by the above organizations. For 2005, for example, the CIA Factbook estimates Indonesia's population to be 246 million whereas BPS puts it at 219 million. This would result in fixed teledensity for Indonesia varying from 5.33 (CIA) to 5.99 (BPS). The World Bank seems to adopt BPS population estimates for Indonesia although ITU's population figures are somewhere between CIA and BPS estimates. It would make sense to rely on a country's national statistical organization for demographic data since this is the only organization that conducts a nationwide census which is the basis for most of the estimates.

For this study, BPS population figures were used:

Year	Population
2000	206 million
2001	208 million
2002	212 million
2003	215 million
2004	218 million
2005	219 million
2005	222 million

Households

The number of households in a country is usually derived from census data and is obtained from the NSO. In Indonesia's case, BPS was not able to provide this data. When asked for this data they suggested that we divide the total population by four to obtain household estimates. This is not a reliable manner for obtaining precise household numbers. In looking through various reports, it was found that household figures cited by the Anti-Competition Monitoring Commission of Indonesia were 55 million. However, this number is suspiciously a result of dividing Indonesia's 2005 population by four! This case highlights the need for regulatory agencies and other data gathering organizations to work more closely with the NSOs to obtain reliable and relevant statistics. This study uses household figure of 55 million cited by the government Commission above.

Gross National Income (GNI)

The GNI per capita figure for this study was obtained from the World Bank's *World Development Indicators 2006* report. Indonesia's GNI per capita is $1,140. The average monthly GNI per capita works out to $95.

Exchange Rate

Indonesian Ruppiah (IDR) and USD exchange rate from Xe.com were used for this study for the relevant dates.

Calculating the DOI

The DOI is structured around three categories that include *Opportunity* (measures accessibility and affordability of ICTs); *Infrastructure* (measures the extent of ICT infrastructure that is deployed); *Usage* (the degree of ICT use in a country).

Opportunity

This category is composed of three indicators that measure coverage and affordability of mobile and Internet service.

1. Percentage of population covered by mobile cellular technology

Data on total mobile cellular coverage of the Indonesian population is reported by the largest cellular operator, PT Telekomsel, as 85%. However, how this estimate was arrived at is not explained. No common methodology exists that the researcher is aware of that mobile operators employ to estimate population coverage of its service. Since any figure that a mobile operator provides is nearly impossible to verify, this indicator, as currently defined, is not reliable. Either methodology should be proposed for collecting data on this indicator and operators should be required to report this data to National Regulatory Agencies (NRAs) or a different indicator should be proposed that captures the same concept. Operators have incentive to overstate coverage; a fact that should be taken into account in data collection and use.

In the absence of a methodology or reliable data for this indicator for Indonesia, the researcher has used the number of Base Transceiver Station (BTS) deployed by the various cellular operators to estimate population coverage. The proposed indicator does not precisely answer the original question on the percentage of the total population covered by mobile service. However, this indicator gives a sense of the extent of mobile infrastructure that is deployed and how many users it can potentially support.

The average loading per BTS varies based on the operators' configuration. Based on PT Telkom's (that has 56% of total GSM market share) total network capacity expressed as 26.2 million subscribers[1], the researcher has estimated average loading at 2648 users per BTS.

[1] PT Telkom's Annual Report 2005.

Operator	Number of BTS deployed[2]
PT Telkom	9895
PT Excelcomindo	4235
PT Indosat	7000
Total	21,130

The estimated total network capacity of all cellular operators combined can support approximately 56 million users. Since mobile networks are designed with the expectation that not all customers are connected at the same time, the above number is a conservative estimate. Based on Indonesia's population for 2005, 56 million users represent 25.6% of the population. So the index score is 0.256.

2. Mobile cellular tariffs as a percentage of per capita income

The OECD low user mobile basket for Indonesia for 2004 was $4.6 or 4.8% of average monthly GNI as per World Bank data[3]. The index score is 0.95. But OECD low-user basket has little or no relevance to real users in these countries.

3. Internet access tariffs as percentage of per capita income

The methodology calls for using the cheapest package for 20 hours of Internet service. In Indonesia, the cheapest Internet service package offered in Jakarta may not be available in other parts of Java leave alone the other islands where the ISP may not have a presence. For calculating this indicator, PT Telkom's Internet service package *Telkomnet Instan,* which is most widely available, was used. By calling a special access number, any fixed phone line can connect to the Internet.

Telkom Instan provides a 56 Kbps connection at the rate of 165 Ruppiah per minute. This works out to $22 for 20 hours of Internet service or 23.2% of average monthly GNI. The index score is 0.77.

Infrastructure

This category is composed of five indicators that measure extent of infrastructure deployment for various ICTs.

1. Proportion of households with a fixed line telephone

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[2] BTS numbers obtained from companies' annual report except for PT Indosat's figures that are based on a news story that appeared where? on March 2005: www.pikiran-rakyat.com/cetak/2005/0305/21/0604.htm

[3] *Ibid* 1.

In 2005, PT Telkom had a total of 12.3 million subscriber lines consisting of fixed wireline and wireless (CDMA). The two other CDMA operators Esia and StarOne (PT Indosat) had a total of 0.35 million subscribers in 2005.

The total fixed lines of all operators combined are 12.65 million. Hence, 22.5% of total number of Indonesian households own telephones. The index score is 0.23.

In many developing countries with low teledensity, a substantial number of fixed phones are located in offices. Hence, any assumptions on household ownership based on the above number are problematic. In order to accurately assign the share of fixed phones to households and businesses or government offices, it is necessary that data is collected separately for each of the categories. Currently, operators in Indonesia, or for that matter in a large number of developing countries, do not collect disaggregated data as above and nor are they required to do so by the regulator. Unless that changes, it will not be possible to accurately represent the number of fixed phones in households.

2. Mobile cellular subscribers per 100 inhabitants

The total number of cellular subscribers for 2005 reported by the three operators is 47.4 million. Based on the researcher's interviews with cellular operators and the regulator in Indonesia, it became evident that a common methodology for counting mobile subscribers has not yet been established. For example, PT Excelcomindo (XL) purges a prepaid number from their database after 60 days of inactivity. However, this is not a practice followed by all the operators. According to a Director at XL, the total number of mobile subscribers reported by all operators includes a significant number of people who have thrown away their simcards. In his view, an estimation based on Visiting Location Register (VLS) database that keeps track of all visiting mobile phones being used in a network should be used for reporting number of active subscribers.

Based on the total number of cellular subscribers reported by the operators, 21.6% of Indonesian have a mobile connection. The index score is 0.22.

3. Proportion of households with Internet access at home

According to APJII, the Indonesian Internet Service Provider's Association, the total number of Internet subscribers reported by its members is 1.5 million for 2005. All fixed wireline subscribers of PT Telkom, that number 8.7 million for 2005, are potentially able to connect to the Internet if they own a PC with a modem and wish to do so (they don't need to subscribe for Internet service with *Telekom Instan*). The current definition is not clear on whether fixed line subscribers who can connect to the Internet if they owned a PC and modem should be added to the total.

For the current study, the number provided by APJII is used. Based on that number, 2.7% of all households in Indonesia have an Internet connection. The index score is 0.03.

4. Mobile Internet subscribers per 100 inhabitants
The definition of who qualifies as a mobile Internet subscriber is very broad and includes all post-paid customers who may have a GPRS enabled handset. Since some CDMA subscribers in Indonesia can also connect to the Internet on the move, they have also been added to the total. The potential mobile Internet subscribers for 2005 for Indonesia are:

Operator	Number of subscribers
Easia postpaid (CDMA)	20,303
Indosat postpaid (CDMA)	19,708
Indosat postpaid GSM	676,407
Excel postpaid (GSM)	176,000
Telkom postpaid (CDMA)-	727,000
Telkom postpaid (GSM)	1,470,755
Total	3,090,173

The index score is 0.01.

5. Proportion of households with a computer
Ideally, PC ownership by household figure should be obtained from the NSO, BPS. But since this figure is not available from BPS, this study will rely on World Bank's numbers instead. For 2004, the World Bank reported 19 computers per 1000 people for Indonesia, which totals 4.1 million PCs for the total population. Accordingly, 7.5% of households in Indonesia had PCs for 2004. The index score is 0.08.

In many developing countries with low PC ownership, a substantial number of PCs are located in offices. Hence, any assumptions on household ownership based on the total number of PCs in Indonesia are problematic. In order to accurately assign the share of PCs to households and businesses or government offices, it is necessary to conduct a national representative survey of all households to estimate PC ownership. Currently, the NSO in Indonesia, or for that matter in a large number of developing countries, do not collect disaggregated data as above. Unless that changes, it will not be possible to accurately represent the number of PCs in households.

<u>Utilization</u>
This category consists of three indicators that measure the extent of ICT usage.

1. Internet users per 100 inhabitants.
Ideally this data is collected by the NSO, BPS, by conducting a national survey. However, since BPS does not collect this data at this time, the researcher has relied on estimates used by APJII. When the researcher interviewed officials from APJII in August of 2004,

he was informed that Internet subscriber numbers were multiplied by 10 to arrive at Internet user numbers. This is obviously not a reliable statistic but in the absence of a national survey, this number will be used.

APJII estimates Internet users in Indonesia to be 16 million for 2005. This represents 7.3% of the total population. The index score is 0.07.

2. Ratio of Fixed Broadband Internet subscribers to total Internet subscribers.
The total number of ADSL *Speedy* subscribers of PT Telkom is 31,000 for end of 2005. Broadband subscribers in Indonesia consist 2.1% of all Internet subscribers. The index score is 0.02.

3. Ratio of Mobile Broadband Internet subscribers to mobile Internet subscribers
Although 3G licenses have been issued in Indonesia, operators are planning to launch their service later this year. The index score is 0.00

Explaining Variance in Digital Opportunity Index Scores

As can be seen on Table 1, the composite score on the Digital Opportunity Index for Indonesia is 0.27 based on the data that has been presented above from 2004-2005. This score is significantly lower than ITU's data from 2003, which is 0.31.
Table 1

	ITU 2003-2004 data	Goswami 2004-2005 data
Digital Opportunity Index	**0.31**	**0.27**
Opportunity	**0.84**	**0.66**
Percentage of population covered by mobile cellular telephony	0.85	0.26
Internet access tariffs as a percentage of per capita income	0.72	0.77
Mobile cellular tariffs as a percentage of per capita income	0.96	0.95
Infrastructure	**0.05**	**0.11**
Proportion of households with a fixed line telephone	0.12	0.23
Proportion of households with a computer	0.03	0.08
Proportion of households with Internet access at home	0.01	0.03
Mobile cellular subscribers per 100 inhabitants	0.09	0.22
Mobile Internet subscribers per 100 inhabitants	0.00	0.01
Utilization	**0.03**	**0.03**
Internet users per 100 inhabitants	0.04	0.07
Ratio of fixed broadband Internet subscribers to total Internet subscribers	0.06	0.02
Ratio of mobile broadband Internet subscribers to mobile Internet subscribers	-	0.00

Based on the DOI for the current study, Indonesia would have dropped about 20 places in the ranking. The variance in the scores can be explained by the scores for Indonesia on two categories, Opportunity and Infrastructure, where the differences between ITU's score and the researcher's scores are significant. Under Opportunity, the percentage of population covered by mobile network is where the main difference lies. As explained above, this indicator does not have a clear methodology behind it and hence the results obtained will be unreliable. The methodology that has been used in the current study using number of BTS to estimate mobile network deployment is more transparent and rigorous. Under Infrastructure, the indicator that has the greatest variance in score is the proportion of households with a fixed line. It is quite likely that ITU score does not include fixed wireless (CDMA) subscribers to the total fixed subscriber number. In Indonesia, fixed wireless operator is regulated as a fixed provider and hence its subscribers need to be considered as fixed subscribers.

What the DOI scores of Indonesia say about its policy and regulatory environment will be dealt in greater detail in the next section.

Overview of Indonesia

Indonesia is the world's largest archipelagic state with more than 17,000 islands that stretch from the Indian Ocean to the Pacific Ocean[4] spanning 5,150 kilometres. Among the major inhabited islands are Java, where 60% of Indonesians live, Sumatra, Kalimantan, Sulawesi and Papua. Out of a total area of 9.8 million square kilometres, 81 per cent is sea. This physical characteristic poses a challenge in rolling out communication infrastructure to thousands of islands spread over a large area, as can be seen in Figure 1. Along with the challenges of extending physical infrastructure is providing communication services to 222 million inhabitants of Indonesia, the fourth most populous country in the world.

Figure 1: Map of Indonesia

Overview of Indonesia's ICT Sector

The economic crisis of 1997 had a profound impact on the telecom sector. Although foreign and domestic investments dried up in the aftermath of the political turmoil unleashed by the financial crisis and forced the Indonesian government to bring the ambitious Nusantara 21 Project to connect Indonesia's major islands by submarine and terrestrial cable to a halt[5], the long term gains from the restructuring of the sector due to this external shock are being reaped today. The financial crisis opened the way for greater private investment and participation in the telecom sector. As can be seen from Figure 3, the telecom sector as a whole is more dynamic than ever.

The crisis forced the Indonesian government to follow a reform trajectory that it probably would not have taken if left to itself. Forced to borrow from the IMF to tide over the crisis, the Indonesian government had to undertake a number of reforms, a

[4] CIA Factbook: http://www.cia.gov/cia/publications/factbook/geos/id.html

[5] ".id: Indonesia country profile," M. Chowdhury and H. Murniadi, available at: http://www.cid.harvard.edu/cr/profiles/Indonesia.pdf

number of them in the telecom sector. IMF's letter of Intent issued in January of 2000[6], stipulates that the Indonesian government make the telecom sector fully competitive by first privatizing both state-owned telecom companies (PT Telkom & PT Indosat) and restructuring the sector; finalising and implementing regulations for the 1999 Telecommunications Law that explicitly separates policy and regulatory functions; rationalizing the extensive cross-ownership of PT Telkom and PT Indosat in the sector, among other measures.

Indonesia's telecom reform process can be broadly divided into two stages, the first one spanning the early 1990s with the partial privatization of the state-owned telecom incumbents and the second one post the 1997 financial crisis with the setting up of a regulatory agency and ending of the exclusivity rights of the incumbents in fixed telephony[7]. As can be seen from Figure 2, the reform process in Indonesia has been slow and halting with the result that even after 15 years since the process was initiated, the Indonesian telecom sector is still dominated by two government-controlled incumbents and a regulatory agency that is still not independent from the policy makers and possibly not of the incumbents also.

The first generation of reform consisted of liberalization of the sector that allowed private investment in the sector in 1980, the granting of competitive licenses for the provision of GSM service, Internet services and the partial privatization of the two government-owned operators[8].

Currently the market structure, as seen in Table 2, shows why the barriers to market participation remain high. Exclusive licenses make PT Telkom the monopoly provider of fixed line services. Even though the government has recently allowed PT Indosat to provide fixed line services, in the absence of an interconnection regime, it is not surprising that PT Indosat has not deployed much access networks. Currently, PT Indosat does not have adequate infrastructure on the ground to compete with PT Telkom and provide fixed services like leased lines. In fact, PT Indosat relies on PT Telkom for leased lines and domestic backbone links.

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[6] http://www.imf.org/external/NP/LOI/2000/idn/02/index.htm

[7] Indonesia: Telecommunications on a road to reforms, K. Sugondo and R. Bhinekawati, in *Telecommunications Reform in the Asia-Pacific Region* (Eds.) Brown et al., Edward Elgar, Northhampton, MA, USA, 2004.

[8] "Telecommunications in Indonesia and its WTO commitments," DG Telecom & UNESCAP, 2003.

Figure 2: Timeline of Indonesia's Halting Reform Process

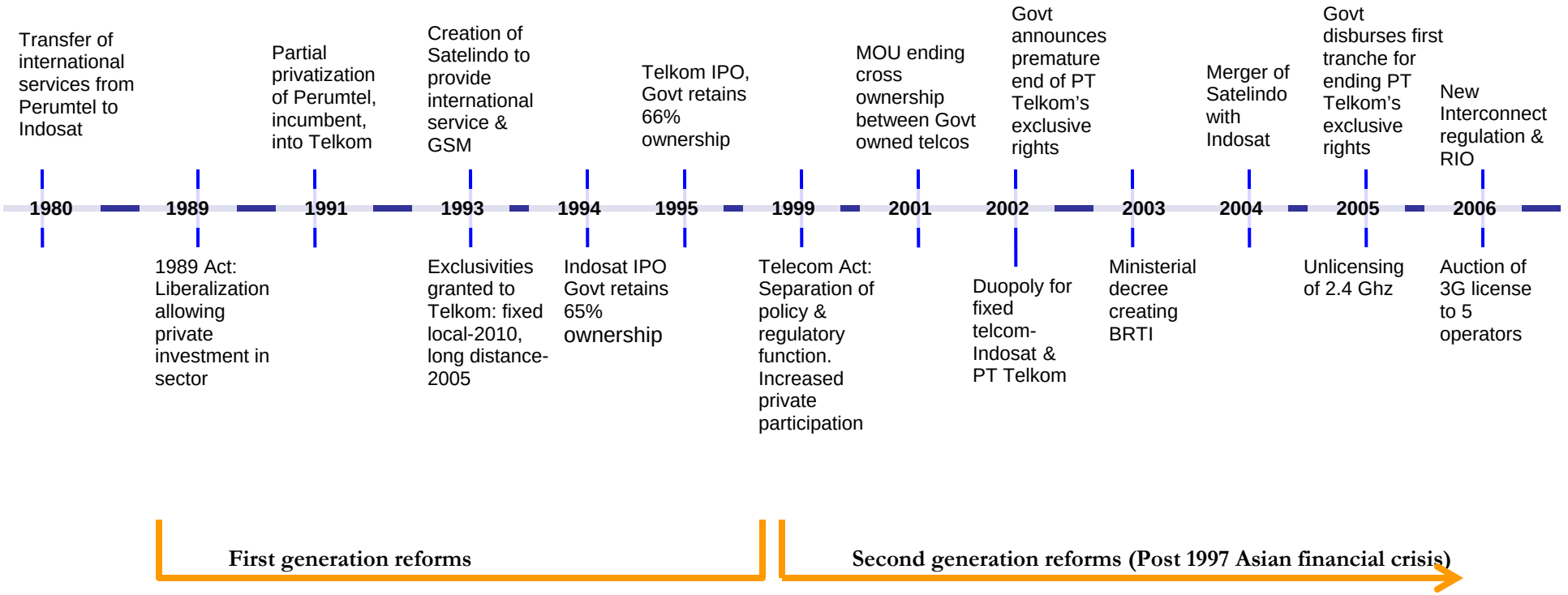


Table 2: Barriers to Market Participation

Telecom services	Telecom operators
Fixed wireline local	Exclusive right 1996-2010 PT Telkom (Prematurely ended in 2002, but only in theory)
Fixed domestic LD	Exclusive right 1996-2005 PT Telkom (Prematurely ended in 2003, but only in theory)
Fixed wireless local	Limited competition (PT Telkom, PT Indosat and Bakrie Telecom)
Fixed international	Monopoly from 1995-2004 (PT Indosat) Currently, duopoly (PT Telkom) and third license under consideration.
Mobile GSM	Competitive (Telkmosel, Excelkomindo, Indosat)
Internet Service Provision	(Quasi?) Competitive Currently 124 ISPs official, 54 unlicensed

Sector Performance

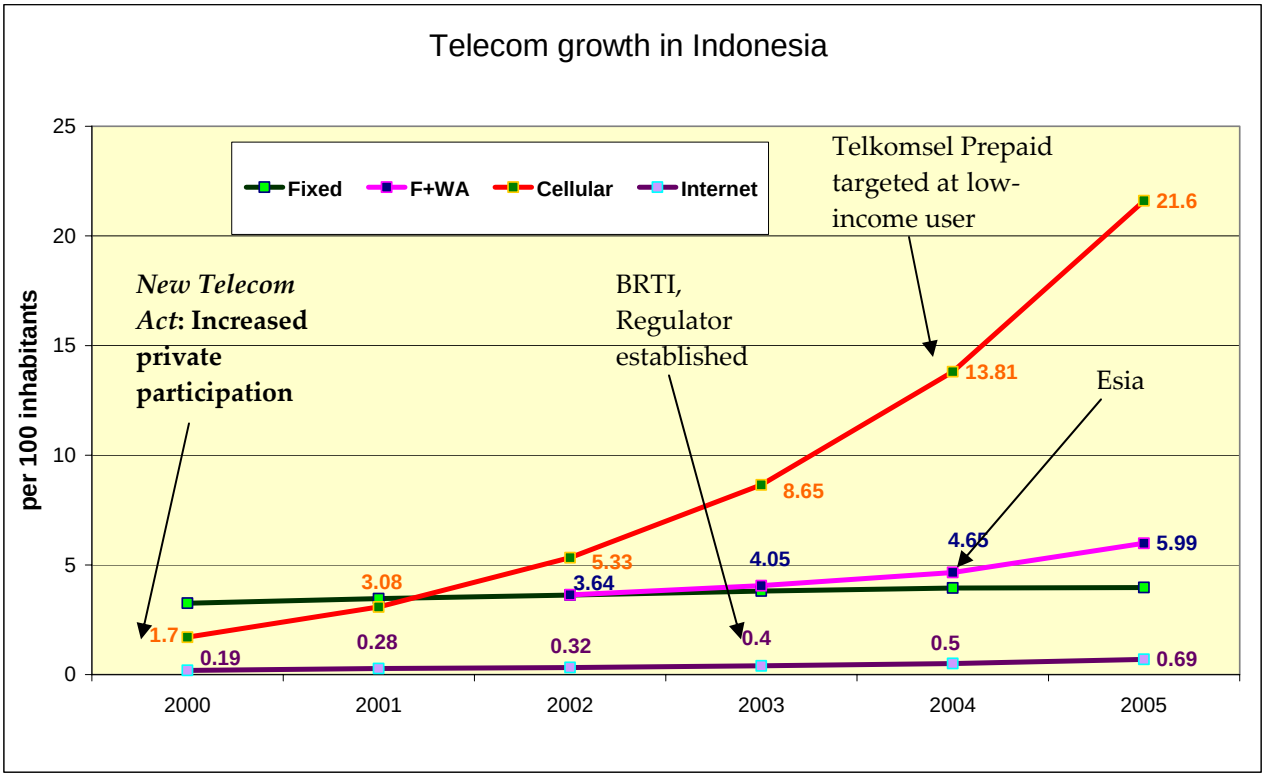
The performance of the Indonesian telecom sector has been uneven. Wherever competition has been introduced performance has been stellar, except for Internet service that rely on fixed infrastructure which has not seen much competition. In the end of 2005, Indonesia had a combined mobile and fixed line teledensity of 27.4 per 100 inhabitants [5.8 fixed, 21.6 mobile]. Majority of the ICT infrastructure is concentrated in the island of Java and there exists an acute digital divide within Indonesia itself. In the Eastern Indonesia provinces, only 0.02 percent of the population has fixed-line phones. More than half Indonesia's 70,000 villages (or about 43,000 villages) do not have access to any public telephones.[9] Universal service levies are being assessed on all operators' revenues but disbursement mechanisms are still not in place. Least cost subsidies will be used to roll out telecom infrastructure to high cost areas later in 2006. Whether mobile

[9] "Indonesia requires digital connectivity," by Craig Warren Smith and Idris F Sulaiman, 30 September 2004, *The Jakarta Post*.

operators, who have the highest contribution to total teledensity will be included in the auctions along with the fixed line providers remains to be seen.

As can been seen on Table 3, mobile growth has been explosive and has surpassed total number of fixed lines in 2001. The growth has been largely fuelled by competition among the two former incumbents, PT Telkom (majority ownership by Indonesian government) and PT Indosat (golden share controlled by Indonesian government, majority stakeholder is STT) and PT Excelcomindo whose major shareholder is Telekom Malaysia. In 2004, Bakrie Telecom (Esia) launched its CDMA based fixed wireless service in three regions and has stimulated growth not only in the fixed sector but also in the mobile sector. Its aggressive pricing schemes have spurred cellular providers to offer lower prices and to target more actively the bottom end of the market. As can be seen on Table 3, the entry of Esia has seen a rise in the growth trends for both fixed and wireless sector.

Figure 3



The low Internet penetration in Indonesia of 0.69% can be explained by high Internet connectivity prices due to the lack of competition in the fixed domestic and international sectors. Furthermore, Indonesia's licensing framework disallowed anyone other than the incumbent from building communication infrastructure. In the absence of build options, ISPs and other end-users like cyber cafes and corporate customers were confronted with

having to lease domestic and international bandwidth at some of the world's highest prices[10]. The regulator is currently considering issuing a new license for international service and for significantly lowering domestic leased line prices of the incumbent. Both these actions should help lower Indonesia's high Internet service prices.

Benchmarking Indonesia's ICT Sector Performance

Indonesia's ICT sector performance can be better understood in relation to its peer countries. Indonesia is a member of the ASEAN that consist of countries in South East Asia that include Brunei, Cambodia, Indonesia, Laos, Malaysia, Philippines, Singapore, Thailand and Vietnam. This group of countries is an interesting mix because they have representatives from low income, low middle income, upper middle income and high-income country categories that are used by the ITU.

Low income countries include: Cambodia, Indonesia, Laos and Vietnam.
Lower middle income countries include: Philippines and Thailand.
Upper middle income countries include: Malaysia.
High income countries include: Brunei and Singapore.

As can be seen from Figure 4, Indonesia's ICT infrastructural development is the best among low-income ASEAN countries and this is also borne out by its higher DOI score. However, Vietnam's fixed infrastructure is more developed than Indonesia's and this can be seen for both fixed lines and Internet penetration. When compared to other members (outside the low-income group) of the ASEAN countries, Indonesia lags behind[11] on all ICT infrastructure. Although the operators and the regulator in Indonesia point to the cellular sector's success story, it is evident that even for this sector its performance fades in the context of Philippines or Thailand or any of the other countries above it. What do policymakers in Indonesia need to do to score higher on DOI Infrastructure and move Indonesia into the next category of Lower-middle-income group? The paper attempts to answer this question in the concluding section.

In terms of affordability, Indonesia outperforms the countries in the low-income group as can be seen from Figure 5. The red line indicates the costs to a low mobile user (OECD basket) relative to the user's average monthly income. What is interesting is that if straight price comparisons are made between the low income group and the rest, three of the low income countries have significantly lower price than the countries in the other income groups. But seen in terms of affordability, it becomes evident that mobile prices are more affordable in the higher income groups than the low income groups.

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[10] Goswami, D. and O. Purbo, 2006, *Wi-Fi Innovation in Indonesia: Working Around Hostile Market and Regulatory Conditions*. WDR Discussion paper 0611, available online: http://www.lirneasia.net/projects/completed-projects/indonesia-wifi/

[11] "Still long way to go to bridge digital divide," 17 May 2002, *Jakarta Post.*

Methodologically, it is important to note that the DOI scores are strongly correlated to the indicator scores on both figure 4 and 5.

Figure 4

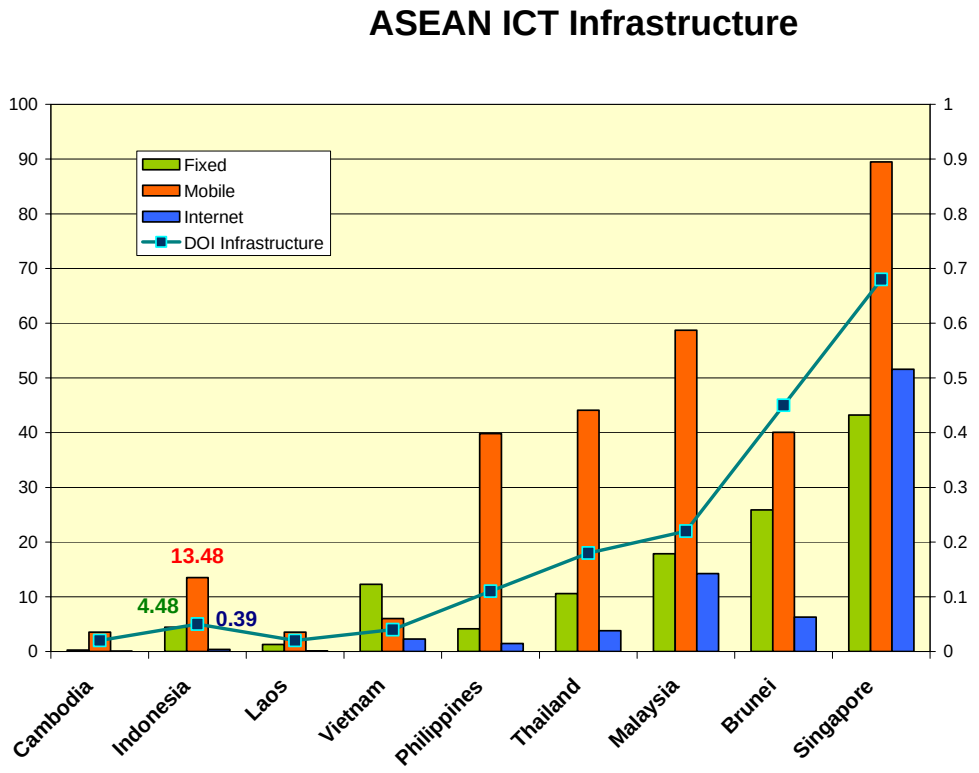
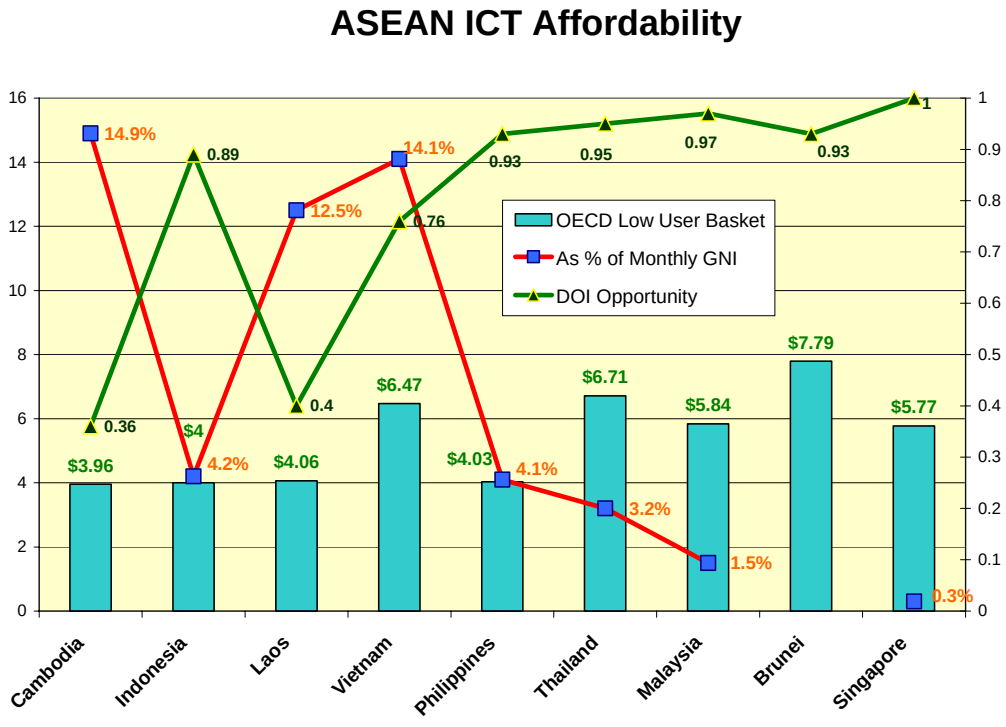


Figure 5



How can Indonesia Get a Higher DOI Score?

Ultimately, the utility of a benchmarking index like DOI depends on what it can say to policymakers about the ICT sector and in stimulating thinking on how performance can be improved for the various categories.

In the case of Indonesia, there are a number of barriers that are preventing more ICT infrastructure roll-out and cheaper services for the masses. These should be the key components of any strategy to bridge the yawning digital divide that exists within the country and between itself and other ASEAN countries.

<u>Opportunity</u>

1. Mobile coverage can be improved by giving operators an incentive to provide services in high-cost areas outside of Java and especially in the east of the country. By allowing mobile operators and fixed wireless operators the opportunity to participate in the least cost subsidy auctions for universal service funds to be held later this year, will be a first step. PT Telkom has had decades to provide communication services and infrastructure to the whole of Indonesia, but it has not effectively used that mandate to connect the country. There is no guarantee that connectivity will be improved if funds collected from all the operators as their universal fund contributions are pumped into PT Telkom.
2. Mobile cellular tariffs in Indonesia are lower in absolute terms than many ASEAN countries. However, as a proportion of household income, it is still very high. ARPUs for mobile operators, although falling, are still quite high compared to South Asian countries for example. There is opportunity for greater competition and CDMA operators like Esia can play a significant role in driving prices down lower. BRTI, the Indonesian regulator, is moving towards a unified licensing regime which will hopefully be designed in a manner that allows greater competition in both fixed and mobile sectors in Indonesia and leads to lower prices.
3. Internet prices can be lowered significantly if ISPs are allowed to build their own infrastructure and a transition is made towards class-licensing. The current licensing structure inhibits infrastructure competition. BRTI is in the process of revising the current licensing framework and it is hoped that suitable changes will be made. Introducing more competition in the international gateway sector, as the Ministry is planning, may also result in lower costs for ISPs and to consumers. Leased lines are a significant input for Internet service. High leased line prices in Indonesia have translated into high retail prices. Lowering leased line prices of the dominant operator, as the regulator is considering, should also help bring down retail Internet prices and improve opportunity for consumers.

Infrastructure

1. Fixed-line penetration and growth has been poor in Indonesia because of lack of competition in this sector. Growth has been further hampered historically by a lack of an interconnection regime which the regulator has recently remedied. Since license exclusivities for the fixed sector have ended, it depends entirely on the political will of the Indonesian government to introduce new entrants into this sector.
2. Faster mobile sector growth will take place when a transition is made to a unified licensing regime, as has been the case in India, with wireless operators using their low-per-line cost technology to gain new subscribers.

Utilization

1. Utilization can be increased by lowering prices, whether it is dialup Internet or broadband. The Indonesian regulator can lower prices by regulating tariffs, which it is loathe to do, or by introducing more competition. Currently, ADSL service is only provided by PT Telkom and its prices are about 4-5 times the comparable price in India or EU countries[12]. If the regulator can mandate the unbundling of the local loop of the incumbent, ADSL services will probably grow faster and at a lower price. This is also financially lucrative for the incumbent as it gains a new revenue stream from access fees.
2. Mobile broadband Internet will grow, albeit slowly, when 3G services are introduced later in 2006-2007. The high price of 3G handsets along with comparably higher tariffs than GSM, will probably not result in addition of new subscribers as much as an opportunity to existing GSM subscribers to upgrade. However, there is great potential in WIMAX to bring affordable broadband Internet to parts of Indonesia that are currently unconnected. The Ministry is currently planning to license WIMAX service along with auctioning the necessary frequencies. Auctioning of the frequencies for commercial use of WIMAX may be necessary but licensing the whole class of WIMAX services may actually restrict the deployment of this technology to remote areas that are perceived to be commercially unviable by existing operators. If the Ministry can license exempt the band range from 5.725-5.85, as it has been done in many countries, and allow ISPs, cooperatives, entrepreneurs to use WIMAX as a viable solution for leapfrogging some parts of the traditional wired network to connect far-flung villages to each other and to the wider world via the Internet, great progress can be made in bridging the digital divide in Indonesia.

[12] *Ibid* 11.