Wireless communication and development in the Asia-Pacific: Institutions matter

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Abstract:
Wireless technologies play an enormously important role in extending access to voice and data communications by hitherto excluded groups in society, especially in the world's most populated region and now the largest mobile market, the Asia-Pacific. The present rates of growth and levels of connectivity could not have been achieved without wireless in the access networks, for mobile as well as for fixed, and in the backbone networks. But the solution is not simply wireless, it is wireless combined with new investment; it is wireless combined with other inputs and systems. Ability to participate in the supply of services to meet pent up demand in the form of removing barriers to entering hitherto monopolized markets is an essential condition for applying wireless technologies to extend connectivity. Although more than half the Asian countries now allow some form of market entry in basic services (higher in mobile, etc.), even where entry is allowed the conditions are not optimal for investment. For innovations using wireless, the creation of a better telecom regulatory environment constituted by better policies, regulation and implementation with regard to market entry, management of scarce resources, interconnection and access, and the enforcement of regulatory and competition rules is essential. In sum, wireless matters, but only when the institutional arrangements allow it to matter.

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Introduction

Development is one of the most overused of terms of our times. After much debate, it has been recognized that economic growth is a necessary and important condition of reducing human misery (or achieving human development). The relation between the ability to communicate over distance using technological means and economic growth has been much discussed.[1] Correlation is beyond dispute, but the case for causation is not fully proven. While establishing causation is essential when public funds are being expended for telecom access, the burden of proof is less when private capital is the main source of funding for expanding telecom access, as is the case today. The always-beyond-expectations demand that has been exhibited by financially constrained people in the developing world when they were given the opportunity to use telecom is reason enough for governments to facilitate the provision of telecom services by private suppliers.[2]

Therefore, this paper takes as a starting point the necessity of greater access to telecom by the hitherto unserved or underserved people of the developing world. For the most part, the access networks which connect these people are wireless, whether the services are fixed, mobile, voice or data. By contrast, fiber still plays an important role in backbone networks, even though satellite, digital microwave, and even some forms of unlicensed IEEE 802.11 type technologies play marginal roles there as well.[3]

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1 See: Cronin, F. J., Colleran, E. K., Parker, E. B. and Gold, M. A. (1991)'Telecommunications Infrastructure and Economic Growth: An Analysis of Causality', *Telecommunications Policy*, 15(6): 529-535. Cronin, F. J., Colleran, E. K., Herbert, P. L. and Lewitzky, S. (1993a) 'Telecommunications and Growth: the Contribution of Telecommunications Infrastructure Investment to Aggregate and Sectoral Productivity', *Telecommunications Policy*, 17(9): 677-690. Cronin, F. J., Colleran, E. K., Parker, E. B. and Gold, M. A. (1993b) 'Telecommunications Infrastructure Investment and Economic Development', *Telecommunications Policy*, 17(6): 415-430. Hardy, A. P. (1980) 'The Role of the Telephone in Economic Development', *Telecommunications Policy*, 4(4): 278-286.

2 Bhutan, Morocco, and Sri Lanka provide examples.

3 Goswami, Divakar & Onno Purbo (2005). "Innovations in the access network: The case of WiFi in Indonesia." LIRNE*asia* Research report, available at www.lirneasia.net

However important wireless is to modern telecom in the developing world as well as in the developed world, wireless is not something that can be simply dropped in. Its effective use requires the satisfaction of a whole series of institutional conditions. If anything, the government has more of a role to play in enabling effective use of wireless than in conventional fixed-wire telephony.

The Asia-Pacific includes South Korea, the country with the world's highest broadband penetration, and Bhutan, which joined the Internet only in 1999 and does not even report broadband penetration (not surprisingly, because its monopoly provider, according to the ITU, charges USD 1,680 a month for a broadband connection). Taiwan and Hong Kong boast of having more mobile connections than people; two other Asian countries, Afghanistan and Bangladesh bring up the rear with just over 1 mobile connection per 100 people.[4] Many countries in Asia, including India (though not yet reflected in the ITU data), now have more mobile connections than fixed connections, underlining the importance of wireless. The very first country where mobile overtook fixed in the world was the Asian country of Cambodia, as far back as in 1993. In the context of Cambodia's overall low connectivity, this was more an artifact of the ineptitude of the fixed incumbent than of the efficiency of the mobile operators or of some unusual preference for mobile among Cambodians.

In almost all the Asian countries where connectivity is growing rapidly, wireless is playing a major role. India's recent growth spurt was driven, not only by mobiles but also by CDMA 800 technology that began life in that country in the guise of limited mobility services. In Cambodia and Laos, the fixed network is being expanded, primarily for data, using CDMA 450.[5] Sri Lanka's expansion of fixed connections in 2005 was enabled by the refarming of frequencies for CDMA 800. In this case, the customer equipment looks like a conventional fixed telephone and unlike a mobile handset, but can be used anywhere within the range of the assigned base station using a rechargeable battery.

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4 ITU (2004) *Asia-Pacific Telecom Indicators*, International Telecommunication Union, September 2004

5 Tanner, John C., CDMA 450 to save fixed line in Laos and Cambodia, *telecomasia.net*, August 7th, 2004. At: http://www.telecomasia.net/telecomasia/article/articleDetail.jsp?id=120365

Given this heterogeneity, it is, obviously, more than a little difficult to weave a coherent narrative about Asia's experience with wireless and development. What will be attempted is to document the growing importance of wireless in Asia and to identify the institutional conditions necessary for greater use of the potential of wireless.

Wireless in the Asia-Pacific

Mobile telephony is the most visible manifestation of the use of wireless technologies. In 2003, the Asia-Pacific became the world's largest mobile market with 560 million connections, overtaking North America. The Asia-Pacific market grew at 31 percent, compared to 13 percent for North America. Despite this, the number of mobile connections per 100 people is the Asia-Pacific was only 16, compared to 52 in Europe and 35 in the Americas.[6] This suggests that the Asia-Pacific growth rates will accelerate even more, as the other two regions slow down, making wireless even more important than it is today.

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[6] ITU (2004) Asia-Pacific Telecom Indicators, International Telecommunication Union, September 2004, p. 9.

Figure 1: Mobile penetration & growth in high-mobile Asia-Pacific

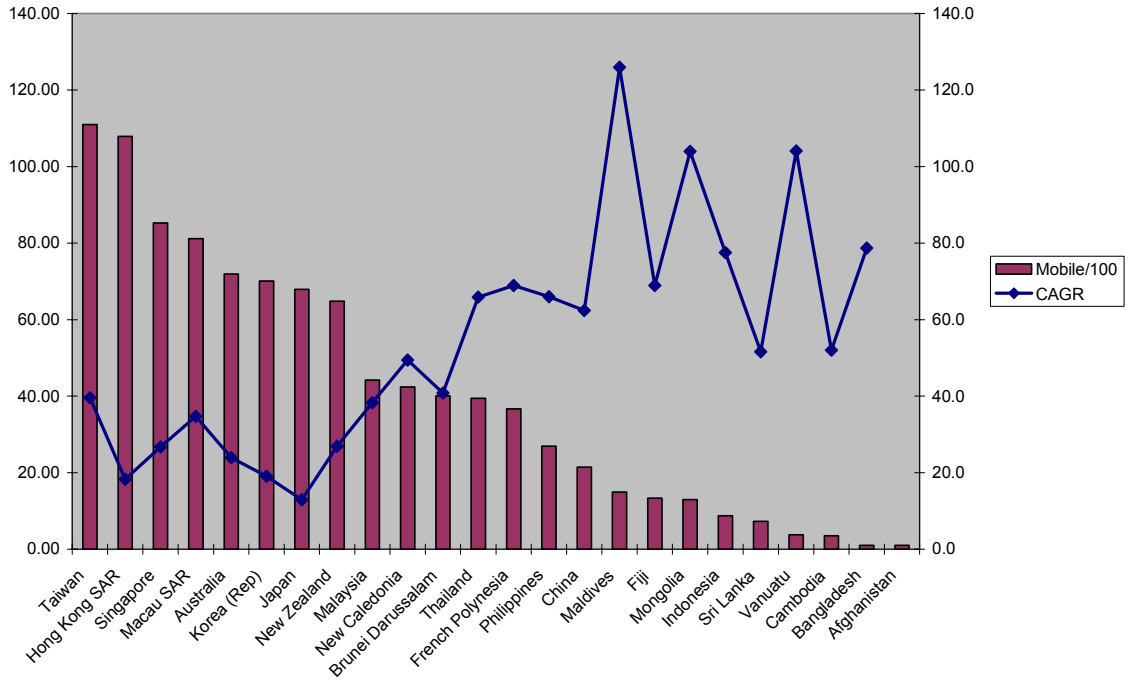

Figure 1, based on the most recent (2003) ITU data,[7] show the mobiles per one hundred people and the 1998-2003 CAGRs for the subset of Asia-Pacific countries where mobiles constitute more than 50% of the overall connections (i.e., where mobile connections exceed fixed connections). The figure clearly shows that the growth rates in the low mobile-penetration countries are very high, indicating that the overall numbers can only go up further.

7 Which is of course obsolete, but are the most recent comparative data that are available

Figure 2: Mobile/100 and mobile as a % of total in high-mobile Asia Pacific

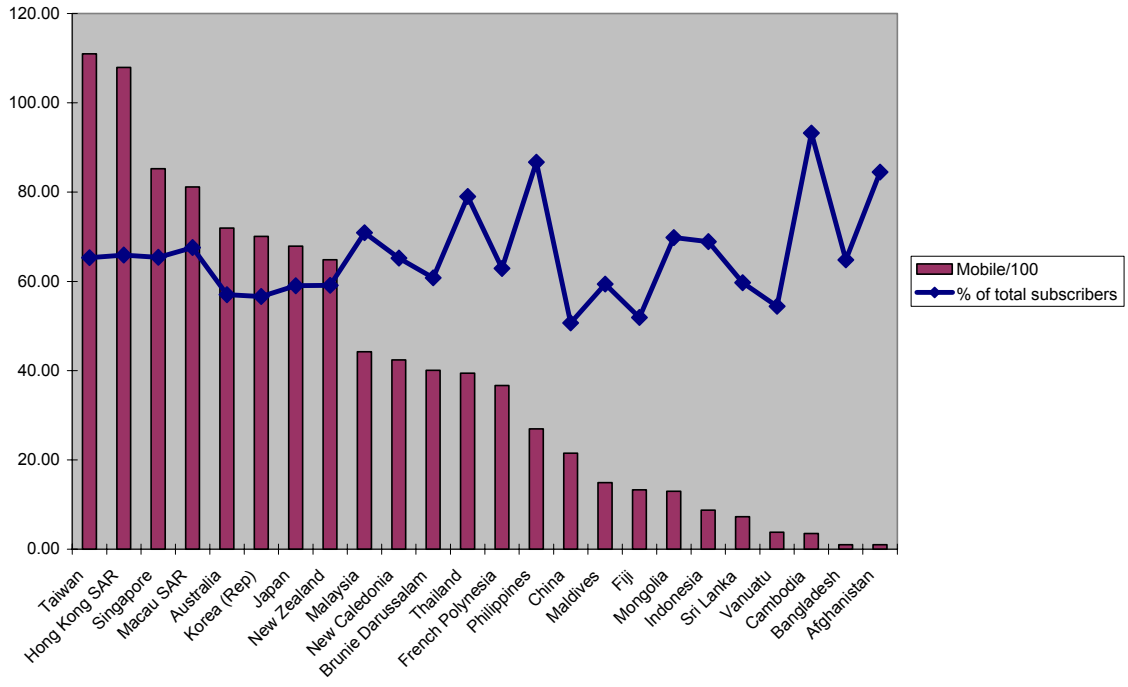

Figure 2, again based on 2004 ITU data, compares the number of mobiles per 100 with the percentage of mobiles among the total number of telephone connections (fixed plus mobile) for the same subset as above. It shows that high-mobile countries can be found right across the spectrum, from Taiwan which has one of the world's highest mobile penetrations to Afghanistan which has one of the lowest penetrations.

As stated above, wireless is found in all parts of the network and in all sorts of services, not just the most obvious – that is, mobile services. In many cases, rapid growth in fixed also occurs because of heavy use of wireless in the access network. The Indian "fixed" growth of the past few years was driven by the use of limited-mobility (at the outset) CDMA services by fixed operators including the incumbent.

The Asia-Pacific is also a major player in mobile data. One consultancy firm calculated that 77 per cent of the world's estimated 100 million mobile data subscribers in 2003 came from the Asia-Pacific, principally Japan and South Korea.[8] The region was making significant

[8] ITU (2004) Asia-Pacific Telecom Indicators, International Telecommunication Union, September 2004, p. 10.

progress on 3G mobile services as well, with over 10 million subscribers in 2004.[9] The consultant estimate for WiFi deployments of 21,000+ hot spots in the Asia Pacific in 2003, reported by the ITU, has surely been exceeded in the past year.

Table 1: Estimates of mobile data customers in Asia-Pacific excluding Japan

3G Subscribers in APeJ		
	2004	2009
Hong Kong	259,000	3,336,598
South Korea	9,541,407	25,230,800
Australia	410,000	6,465,470
Singapore	0	744,800
Malaysia	0	1,612,500
Taiwan	0	3,960,391
PRC	0	97,973,215
Philippines	0	1,020,000
Thailand	0	1,660,876
India	0	632,258
Total	10,210,407	142,636,909
Source: IDC, February 2005		

In some cases, wireless substitutes for components that are unavailable from the incumbent. For example, in the early days of Internet in Indonesia, the incumbent could not or would not issue leased lines to Internet Service Providers, who were also prohibited from building their own networks. An ingenious solution based on WiFi, used also for relatively long distances, was used to as a stopgap measure.[10]

Institutional conditions

Wireless technologies require the use of frequencies. Frequencies are scarce resources that have to be well managed for optimal use. Improper use of frequencies (e.g., use of high-powered or badly tuned transmitters) can degrade the quality of service or require large guard bands for example. At present, frequencies are managed under a quasi-property rights regime with government-specified applications in assigned frequency bands. What this means is that while it is difficult to impossible to dislodge an unwilling users from a

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9 "IDC: 3G to Pick Up Pace in Asia/Pacific as Subscriber Numbers is Expected to Grow," *Computerworld*, 11(11), 25 March-7 April 2005. http://computerworld.com.sg/ShowPage.aspx?pagetype=2&articleid=584&pubid=3&issueid=33

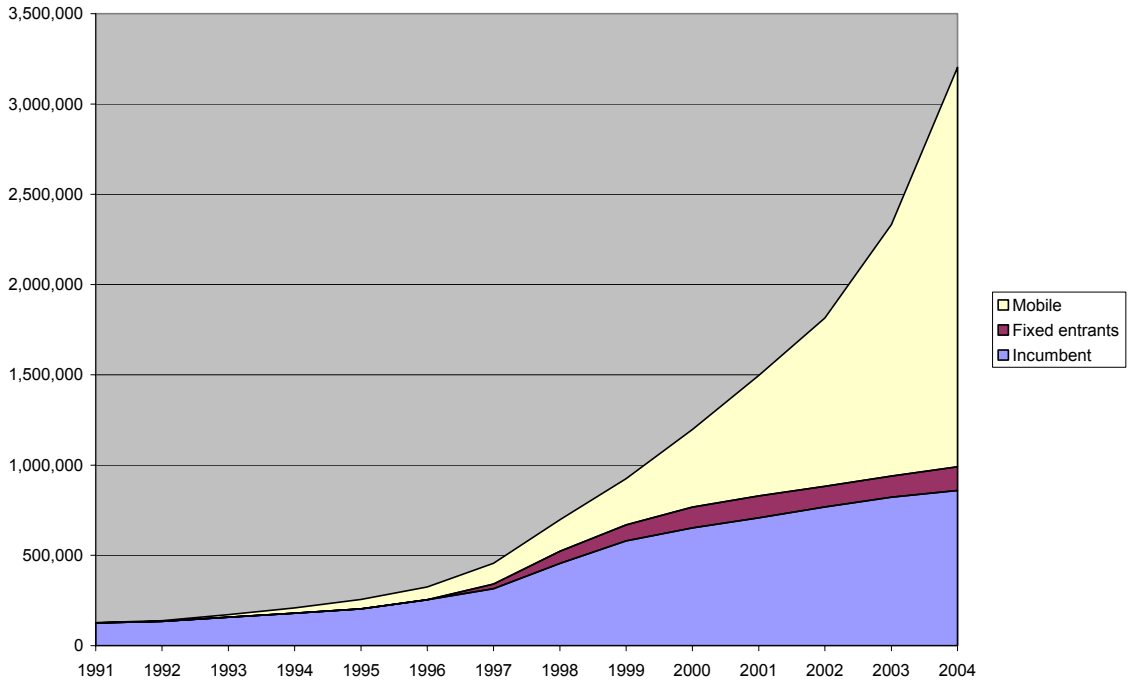
10 Goswami, Divakar & Onno Purbo (2005). Innovations in the access network: The case of WiFi in Indonesia. LIRNE*asia* Research report, available at www.lirneasia.net

frequency, the user does not have the right to alienate the frequency (except by selling the company that has been assigned the frequency) and in most cases is subject to various government-imposed limitations regarding power, polarity, etc. As a result spectrum users are heavily dependent on the propriety and efficiency of relevant government/regulatory agencies.

Providing communication services that use wireless technology requires paying attention to all aspects of the overall regulatory environment, not simply the spectrum management part. This is because the running of a viable communication business is bigger than using wireless. In a great majority of countries, government-owned, vertically integrated, monopoly telecom suppliers failed to provide services in rural areas and to non-elite groups. The normal incentives of monopolies to supply less quantity and charge higher prices than optimal, exacerbated by the perverse effects of government ownership, led to this almost universal outcome. Wherever these groups were served, it was because the barriers to investment in the sector as a whole, or in particular geographical areas were lowered. Because incumbents will not invest in serving underserved groups (except in exceptional circumstances), removing barriers to entry is key. This creates competition, which causes even the incumbent to serve groups it previously did not deem worthy of serving. In many cases, policy and regulation are major barriers. Their reform leads to the increase in supply of services.

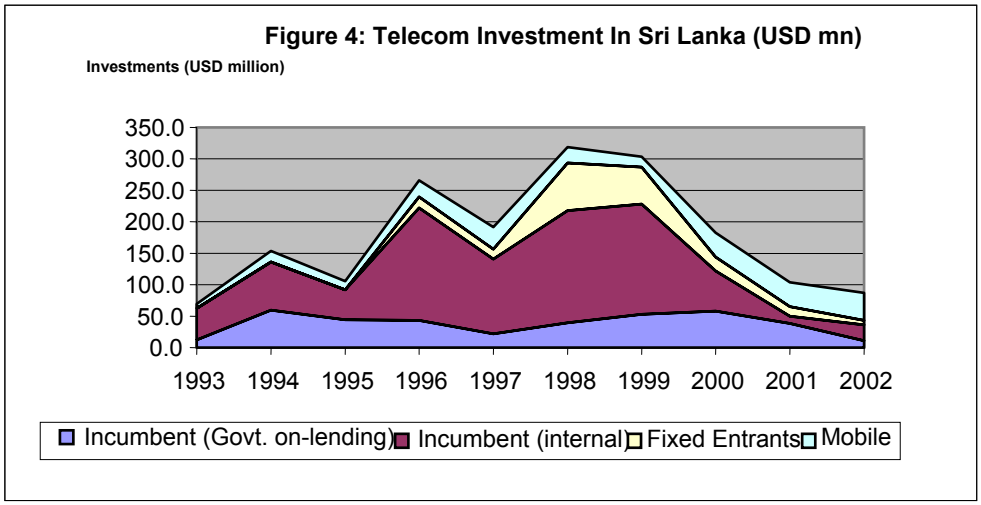
Sri Lanka is illustrative. Market entry by mobile operators under unfavorable conditions was allowed, starting in 1989. The fourth mobile operator as well as the two fixed competitors (limited by license conditions to using wireless) entered the market in 1995-96. It is at this point that investment and connections took off. The removal of the egregiously unfavorable conditions of interconnection in 1999 and authorization to originate and terminate international calls without being compelled to go through the incumbent in 2003 may have also contributed to the growth.

Figure 3: Sri Lanka telecom growth 1991-2004



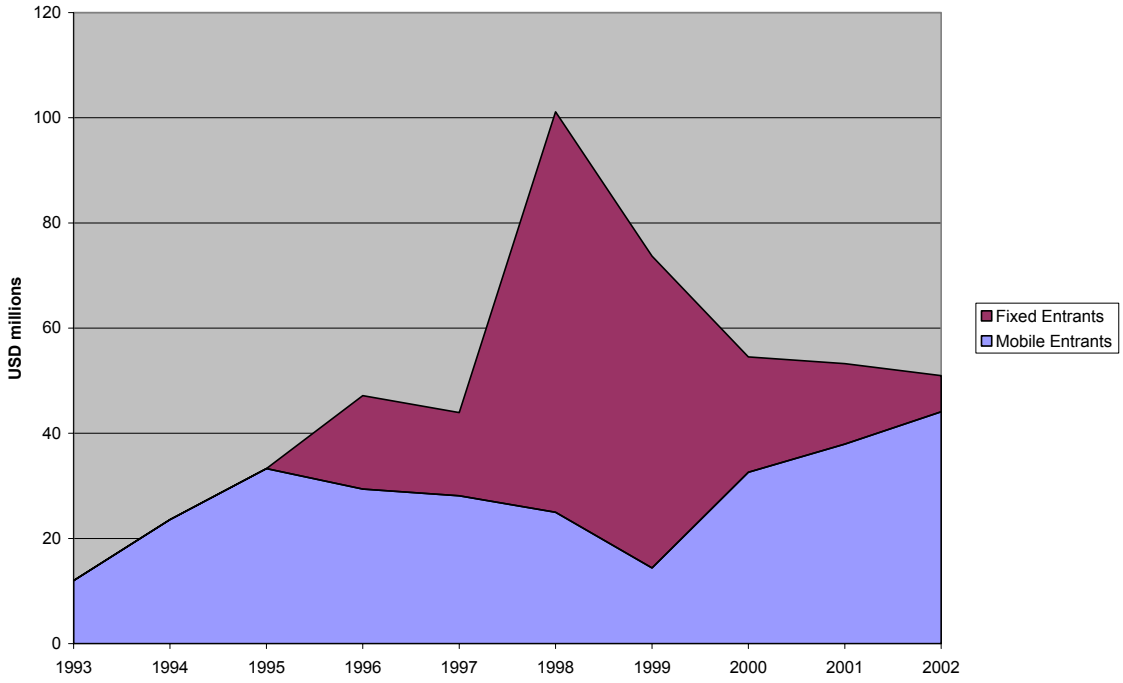
Source: Telecommunications Regulatory Commission of Sri Lanka.

This growth was led by an increase in investment from fixed entrants and mobile operators as well as from the incumbent. Using privileged access to capital through government and the monopoly rents from its nominal exclusivity over international telecommunications services, the incumbent did make significant investments in the period up to 1999, which was the period of highest growth in connectivity. However, as those advantages dissipated, the investments went down sharply, with investments by entrants overtaking those of the incumbent in 2001, as shown in Figure 4. Though the data for the period after 2002 is not shown in Figure 4, in actual fact the investment, particularly by the mobile operators, increased significantly from 2003 when the international exclusivity was ended. It is noteworthy that in Sri Lanka, both the mobiles and the fixed entrants, whose investments are shown in the two strips above the strip representing the investments of the incumbent, are entirely dependent on wireless for their access networks, and for the most part for their backbone networks as well. The increase in wireless-based investment is shown in Figure 5.



Source: Samarajiva, R., et al. (2005), Regulation and investment: Sri Lanka case study, in Melody, W.H. and Mahan, A. (eds.). *Stimulating investment in network development: Roles for regulators* (Lyngby, Denmark: World Dialogue on Regulation) http://www.regulateonline.org/content/view/435/31

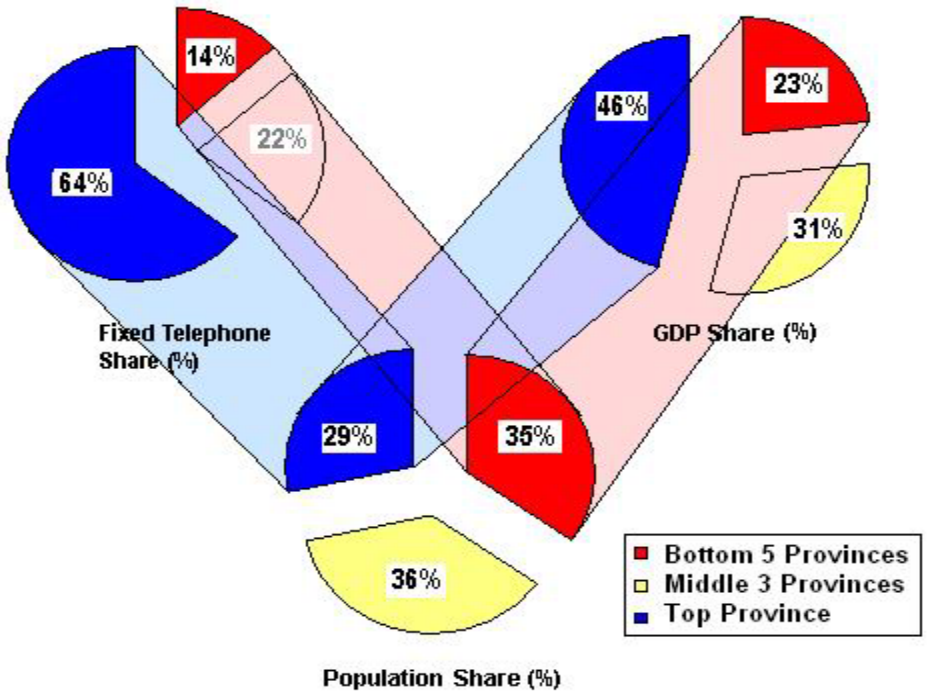
Figure 5: Wireless-based investment in Sri Lanka, 1993-2002



Source: Derived from Samarajiva, R., et al. (2005), Regulation and investment: Sri Lanka case study, in Melody, W.H. and Mahan, A. (eds.). *Stimulating investment in network development: Roles for regulators* (Lyngby, Denmark: World Dialogue on Regulation) http://www.regulateonline.org/content/view/435/31

Despite increased investments and growth, rural growth does not necessarily follow. Even after years of investment and rapid growth, the distribution of fixed connections in Sri Lanka was skewed toward the highly urbanized Western Province where the capital and much of the industrial base is located. The fixed entrants stayed close to the major urban centers despite the oft-repeated claims of the superiority of wireless in serving rural areas. The high per-line costs of the adopted technologies (DECT and Nortel's Proximity) and the unsatisfactory interconnection arrangements were seen as the main causes. It is not possible to identify mobile connections with particular locations in Sri Lanka. However, mobile coverage also extended out from the main urban centers along the highways to popular destinations in the first decade, with service being offered to rural subscribers as such only from around 1999.

Figure 6: Distribution of population, GDP and fixed telephones in Sri Lanka



Source: Central Bank of Sri Lanka and Telecommunications Regulatory Commission of Sri Lanka

Per-line costs of connections are a significant factor in operators choosing to go to rural areas or not. However, policy, regulatory and implementation shortcomings that create a poor environment for investment by non-incumbent operators also contribute to the under supply of connectivity to rural areas. Costs of supplying service in the rural areas are increased by poor policy and regulatory environments. Governments of developing Asia cannot determine the per-line costs of networks. What is within their purview is the reduction of the costs caused by poor policy and regulation

Policy and regulatory reforms

The inter-related nature of regulatory problems requires multi-pronged solutions. The optimal environment for rural supply by wireless or otherwise is constituted by

- Existence and enforcement of transparent market entry policies;
- Efficient management of scarce resources, primarily frequencies, numbers and rights of way;
- Effective, cost-oriented and non-discriminatory interconnection and access to backbone capacity; and
- Effective enforcement of regulatory and competition rules.

Market entry policy

The above discussion demonstrated the importance of minimizing barriers to entry. Even after the monopoly of the government-owned incumbent is broken, governments tend to maintain control over market entry, using various rationales, ranging from national security to spectrum scarcity. The potential to collect rents either in the form of high auction proceeds to the government or in the form of bribes to key decision makers is a major factor in restrictive market-entry policies.

The market-entry principle that is now accepted as best practice is "licenses where scarce resources are involved; authorizations otherwise." The latter refers to standard procedures where the discretion has been stripped out or minimized, whereby entities that meet specified, public criteria will be authorized to provide services without numerical limit. Until

the advent of unlicensed wireless services based on IEEE 802.11 standards, there was almost universal agreement that radio frequencies were scarce resources. Indeed, under most current technological standards, most wireless-based services require exclusive or heavily regulated shared use of frequencies, justifying the classification of frequencies as scarce resources.

Market entry with regard to wireless-based services is therefore inextricably connected to the assignment of appropriate frequencies. Bangladesh issued "authorization" type licenses for fixed services (without numerical limit), but found all the licensees then asking for frequencies, for which the necessary planning had not been done. Even in India, the policy of unifying the mobile and fixed licenses first focused on license fees and termination charges. It was only later that attention was paid to the necessity of issuing the appropriate frequencies.

What is important in terms of market entry are not frequencies in general, but specific frequency ranges for which equipment is manufactured on a large scale and which therefore offers both low costs of network equipment and handsets and availability of handsets and service functionalities. The success of the European GSM standard (900 and 1800) since the mid 1990s has driven down the costs of equipment and made a plethora of functions available on GSM networks. In addition, the networking economies offered by the existence of networks in most countries in the world, with few exceptions such as South Korea, provide additional features such as international roaming. As a result, GSM frequencies are extremely valuable and have in many countries been auctioned for high prices. The CDMA 800 standard, which had a slow start, picked up momentum with massive growth in India and China and has now made CDMA frequencies extremely valuable as well. As these popular frequencies become occupied and/or become expensive, other frequency ranges such as CDMA 450 are likely to attract the attention of manufacturers and service providers.

Governments and regulatory agencies are not the best judges of technology trends and the success of standards. However, piecemeal responses to individual requests for frequencies is not the most transparent or efficient method of spectrum management/market entry. Governments and regulatory agencies will have to maintain some form of technology and

market assessment capability, based upon which ranges of frequencies can be cleared of lower-value uses and auctioned off. The auctions need not be designed with the sole objective of maximizing proceeds, but can be designed to achieve the paramount objective of transparency along with other policy objectives. Indeed, the Hong Kong and Denmark 3G auctions showed that auctions can be designed to discourage excessive bids.

The ITU oversees the allocation of spectrum to various services based on three regions. Yet, equipment is manufactured by companies that see the world as their market and especially with mobile services, handsets do not necessarily stay in one region. Partly because of the rapid pace of technology and market development and partly because of the inconsistency of the allocations and different national spectrum policies and priorities, frequency ranges are not uniformly available for new services. For example, the most common GSM handsets that use the 900 MHz and 1800 MHz frequency ranges in ITU regions 1 (Europe) and 3 (Asia Pacific), cannot be used in ITU region 2 (Americas) where those frequencies have been assigned for different services. An example of technology and market development causing difficulties is the use of CDMA 800 frequencies for AMPS, a now obsolescing mobile telephony standard, in Sri Lanka.

Therefore, the efficient use of wireless requires government action in the form of spectrum refarming, the clearing of frequencies from low-value (by economic and/or social criteria) and reassignment to high-value applications. This is a complex and difficult task in that the occupants of the frequencies to be reassigned are unlikely to be pleased by the change because of disruptions to their activities. In addition, refarming will make the equipment previously used in those frequencies completely unusable, at least in that country. This means that they must be compensated on a replacement-cost basis. The funds for compensation must be raised from the beneficiaries of refarming, ideally as part of auction proceeds. The complexity of the refarming process is illustrated by the hypothetical flowchart in Table 2:

Table 2: Sequence of a hypothetical refarming process for GSM and CDMA

	Main policy actions	Parallel policy actions
Step 1	Government sets overall policy and authorizes negotiations with seven operators (O_1 – O_7)	
Step 2	System and frequency license modifications negotiated (Modifications include removal of technology restrictions from O_1, O_2, etc.; and may include extending license term of O_4 (which will gain no benefits but has to yield frequencies)	
Steps 3 & 3A in parallel	O_4 and O_5 release GSM 900 frequencies; O_1, O_2, and O_3 will also be requested to agree to phased release of frequencies to enable overall ordering of the bands	1800 MHz Tender Board releases funds for band clearing
Steps 4 & 4A in parallel	O_6 assigned GSM 900 frequencies & releases CDMA 800 frequencies	1800 GSM and 1900 CDMA bands cleared
Step 5 & 5A in parallel	O_1, O_2 and O_3 assigned CDMA 800 frequencies	Auction frequency slots that may be used for CDMA 1900 or GSM 1800 to current operators but possibly also to newcomers

The desired end state in this process is for three operators to be assigned a base allotment of 2.5 MHz each in the CDMA 800 band and for four operators to be assigned 7.5 MHz each in the GSM 900 band, with additional requirements being met through auctions in the GSM 1800 and CDMA 1900 bands. The auctions would also to be the source of funds for compensating the displaced users.

Refarming frequencies for use by IEEE 802.11 type technologies poses additional challenges. In the old model of exclusive assignments, there is a clearly identifiable entity that benefits from the refarming exercise and can therefore be used as the source of compensation payments. In the case of unlicensed frequency bands such as 2.4 GHz, there is no identifiable beneficiary. Thus, the government has to find an alternative source of funding for refarming in these instances. In addition, the new unlicensed technologies require a range of frequencies that can be used by many in common, rather than the old discrete frequencies. This also poses a challenge to the spectrum manager.

Management of scarce resources

Supply of telecom services in a rapidly growing market requires both the ability to obtain additional scarce resources needed for increasing supply and the assurance that the assigned resources can be used effectively. These expectations apply to rights of way and towers as well as for spectrum. Given the focus on wireless, emphasis will be placed on spectrum and towers.

As subscribers and coverage areas expand, operators require access to additional frequencies. As explained above, the frequencies must be from particular bands that satisfy the technical requirements of operators. The spectrum manager must manage the resource efficiently, anticipating the operators' requirements as best as possible and refarming the appropriate bands. Given the importance and value of these incremental frequencies, it is generally better to assign them through transparent mechanisms such as auctions.

Because most extant technology standards, with the exception of IEEE 802.11 and similar unlicensed applications, require interference-free, exclusive or shared use of frequencies, it is important that the spectrum be efficiently monitored and that unauthorized use in whatever form (e.g., out of band, excess power) be policed. Generally, the requirements are automated frequency monitoring and management systems, competent staff, and appropriate legislation.

Adequate geographical coverage requires the placement of base stations in areas with significant populations. This requires significant investment and the surmounting of a number of bureaucratic barriers. The building of antenna towers or the placement of antenna on existing structures is on that usually involves multiple authorities, resulting in delay, expense and in some cases bribery.

Ideally, towers capable of supporting multiple antennae will be constructed with transparent, cost-based charging systems that would enable more than one operator to use it. This reduces environmental impact and costs. However, in most developing countries where the governance structures are not strong enough to efficiently regulate common facilities such as towers it may be advisable to leave open a "build" option as an incentive for reasonable negotiation by tower operators.

Tower construction requires multiple layers of approval. If the laws governing this activity could be simplified, the extension of wireless coverage would be easier. Simplification does not mean that local authorities should be stripped of their powers over the placement of visible structures because that is an intrinsic element of managing the living space of a community. Better is the provision of time-bound procedures for resolving disputes with regard to antenna towers and placement. These provisions should extend to street rights of way because the operators may find it necessary to connect base stations with cables rather than wirelessly. In cases where an incumbent has laid underground cables or conduits, it would be necessary for the regulatory body to ensure cost-based, non-discriminatory access. Again, the proviso regarding the utility of a "build" option in countries with weak governance applies.

Interconnection and access

Interconnection and access are critical problems in all competitive telecom environments, whether services are provided wirelessly or not. Therefore, they will not be discussed in detail here. However, the importance of ensuring cost-oriented and non-discriminatory interconnection and access to essential facilities including backbone and undersea cable stations cannot be over-emphasized. The effects of unsatisfactory interconnection and

access regimes can undo much of the benefits of good regulation in other areas. The best spectrum management in the world will not make an operator offer services in a remote area if the costs of backhaul are too high.

Effective enforcement of competition and regulatory rules

The markets within which suppliers of wireless-based services operate are highly imperfect and pervaded by market power and government discretion. Therefore, successful operation is not simply about picking the right technologies, keeping the costs down and making the customer happy. In many countries, skills in negotiating with the incumbent and with the regulator overshadow the usual skills involved in running a telecom business.

If regulatory risk and the consequently higher costs are to be minimized and operators' energies refocused on the provision of services and away from influencing the regulator and negotiating with the incumbent, it is essential that the regulatory agency be effective. A necessary condition for effective regulation is modern, pro-market, discretion-minimizing legislation that also includes provisions for the independence and accountability of the regulatory agency. Requirements for broad consultation and transparency will also contribute.

The sufficient conditions for effective regulation are trained and committed people. There tends to be a dearth of such people in sectors of government in developing countries. Part of the reason why the problem exists is the lack of resources to pay for skilled personnel and in many cases the requirement to recruit from the local labor market or from within the administrative service. To a greater or lesser extent these causes may be remedied. But the intangibles of leadership and commitment cannot be administratively ensured.[11]

Generally it is accepted that spectrum is so integrally connected to the core tasks of regulation in a competitive marketplace that its management should be given to the

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[11] Samarajiva, R. (2001). Regulating in an imperfect world: Building independence through legitimacy. *Info*, 3(5), 363-68.

regulatory agency, unlike for example in India. Government must create the necessary structures to ensure smooth coordination with the non-commercial users of spectrum, primarily the military and also to build in mechanisms to counterbalance the tendencies of such parties to hoard frequencies and be inefficient in frequency use.

In many developing countries, competition law and effective competition enforcement are absent. Even if legislation and an authority exist, there may be merit in assigning most, if not all competition powers to the specialized ex-ante regulatory agency because parallel jurisdiction can create opportunities for delay and gaming and result in increasing regulatory risk. There is also the problem of adequately staffing both a regulatory agency and a competition authority.

In cases where competition law is not yet enacted, it is still possible to enforce competition rules through license conditions and the general provisions of telecom regulatory legislation.

Examples of wireless-related anti-competitive practices that can be addressed under formal competition legislation or under the specific provision in licenses are the preferential treatment of a mobile affiliate by an incumbent in terms of interconnection and access to essential facilities, including sharing of antenna towers. Refusal to deal with ISPs that use wireless in the access network (in terms of not providing leased lines) or discriminatory pricing are very common, though rarely challenged. As the momentum builds toward convergence, anti-competitive practices such as tied sales are likely to increase.

Concluding comments

Wireless matters. In the Asia-Pacific it matters; throughout the world it matters. The extraordinary expansion of connectivity that is being witnessed across the world, especially across Asia, would not have happened if not for wireless. The most powerful illustration is Afghanistan a country devastated by 23 years of war, which had no mobile and where the number of fixed phones was decreasing every year. If not for wireless, Afghanistan's two private mobile operators could not have added in excess of 170,000 new mobile customers

in two year, almost catching up with Bangladesh, which had mobile for more than 10 years, on a per capita basis.[12]

The Indian and Chinese booms are far from over. New entry and new investments in Bangladesh and Pakistan, two countries with large populations and enormous unmet demand, will drive Asia-Pacific growth even faster in the coming years, unless there is active effort by the regulators. Throughout the Asia-Pacific, operators are learning not only how to live with hitherto unthinkably low ARPUs [Average Revenue per User], but to keep their investors happy with good returns. The popularity of pre-paid mobile, in many Asia-Pacific countries accounting for as much as 80 per cent of customers, has lowered the barriers to telecom use by the financially constrained. Pre-paid is now moving over to the fixed sector as well. The driving down of per-line costs of networks and the growing availability of low-cost handsets will bring additional millions into the ranks of telecom users. Almost all of them will conduct at least a part of their communications over wireless; many of them will do so entirely over wireless.

But wireless is not the only thing that matters. The technological and business innovations that make possible the current levels of participation and that will enable millions more to participate are not new. What has held back their deployment has been the lack of investment; what has held back investment for the most part has been the unsatisfactory policy and regulatory environment.

As Figure 7 shows, both the richer East Asian and Pacific regions, as well as the poorer South Asian region have attracted far less private investment than have other regions, barring Africa and the Middle East. The figure does not distinguish between wired and wireless, but as discussed above, wireless plays a key role in all telecom these days. The good sign, in this somewhat dated Figure, is that investment has increased in South Asia, even after the end of the Bubble. Anecdotal and impressionistic evidence suggests that investment increased substantially in South Asia after 2003, with the entry of Etisalat, Orascom, Telenor, Singtel and others to the large South Asian markets, the refocusing of

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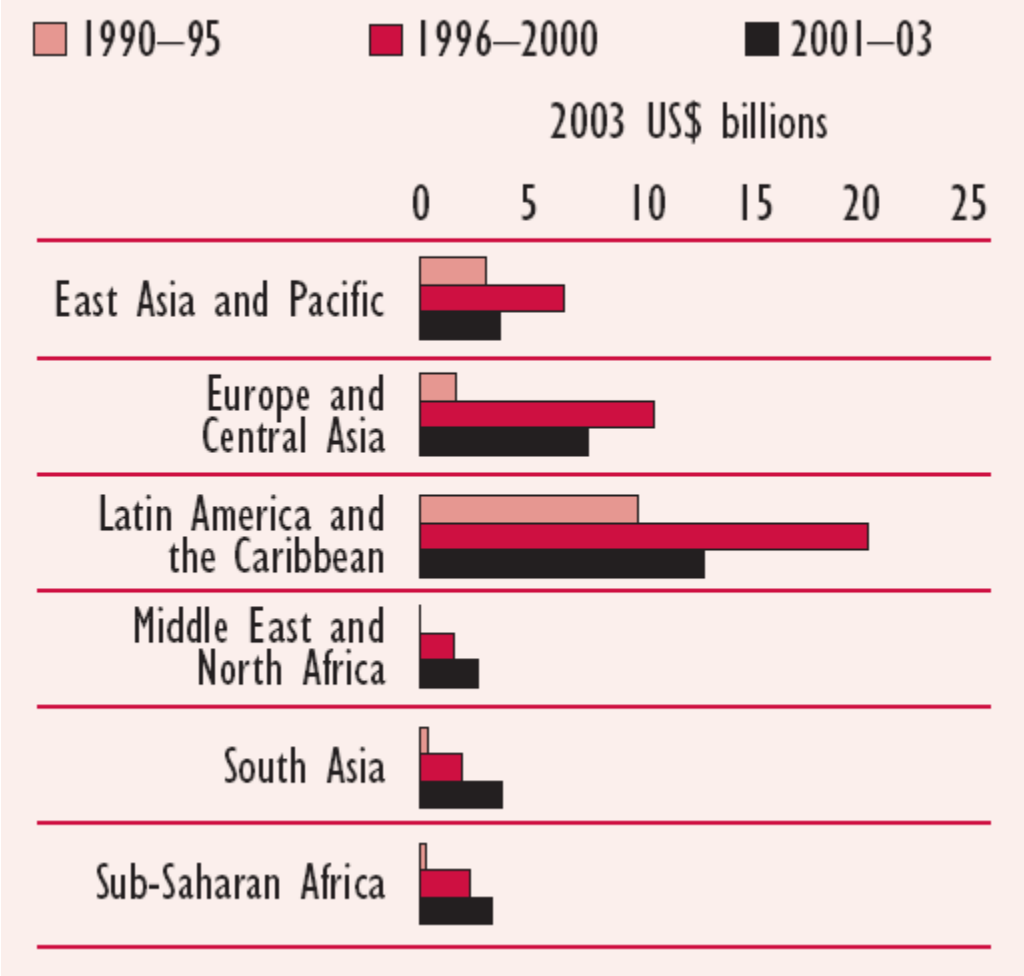
[12] Zita, Ken (2004). Afghanistan telecom brief (prepared for USTDA). http://www.export.gov/afghanistan/pdf/telecom_market_overview.pdf

Telekom Malaysia's investments in South Asia following withdrawal from Africa, and the raising of the FDI cap in India.

Figure 7: Private investment in telecom by region, 1990-2003



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Source: Izaguirre, Ada Karina (2005) Private Telecom Projects, Public Policy for the Private Sector, World Bank. At: http://rru.worldbank.org/Documents/PublicPolicyJournal/288izaguirre.pdf

The core question then is why the technology and business innovations centered on wireless were not effectively and fully applied to meet the unmet demands of the people of the Asia Pacific. The answer is institutions: a poor policy and regulatory environment that has not only driven up the costs of supplying telecom services by wireless or otherwise by increasing

regulatory risk and through rent seeking, but which has actually barred investment the deployment of wireless technologies.

Until a government decides to permit entry by competitors, it is simply not possible for companies with the capital and the technology to participate in the market. For example, take Bhutan which is a rugged and isolated Asian country that had a total of 30,285 fixed connections at the end of 2004, for a population reported as 734,340.

In November 2003, B-Mobile, a fully owned subsidiary of the fully government owned monopoly provider, started offering mobile service for the first time. "Much before the launch, B-Mobile registered about 2,255 subscribers and has almost sold out its 900 cell phones. Within just a little more than a year of operation, the subscribers have increased to around 20,000 (Feb, 2005)."[13] What this suggests is that the monopoly provider failed to anticipate and meet the expressed demand in the form of registered customers, either because of a lack of capital or a lack of imagination. In light of the reports of near riots by customers so eager to obtain service that accompany competitive market entry in not very different countries such as Bangladesh and Pakistan, one can only imagine what would have been the uptake had the Royal Government chosen to allow competition.[14] Alternatively, compare the uptake in Bhutan with that of Afghanistan, now with more than 170,000 subscribers. In Bhutan, the lackadaisical incumbent monopolizes the entire industry, including fixed, mobile and even the provision on Internet services. Inserting wireless into this setting will not increase access or contribute to development, other than as a by-product of realizing an objective of the incumbent.

Allowing suppliers to supply is fundamental. But in the telecom industry, that by itself is not enough. Unless the policy and regulatory environment is right, investment will not flow in, or where it does come, it will be skewed in various ways (quick returns, urban, tied to rent-seeking opportunities, etc.). Policy and regulatory reforms that cover market entry,

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13 Dorji, Wangay (2005). Promotion of universal access to telecom and other ICT services in Bhutan. Masters thesis, Technical University of Denmark.

14 BBC (2005). "Mobile phone riot in Bangladesh." 31 March. http://news.bbc.co.uk/2/hi/south_asia/4398493.stm. Nasarullah, Nusrat (2004). "Stampede over free cell phones," *The Dawn*, 22 August. http://www.dawn.com/2004/08/22/fea.htm

management of scarce resources, interconnection and the effective enforcement of regulatory and competition rules are essential. In all cases, paper reforms must be followed by credible implementation.

A glance back over the past decades is instructive as we assess the potential of another technology to advance development. In the 1960s and 1970s satellites were supposed to deliver development; tele-health and tele-education were all the rage; village phones, multi-purpose telecenters, the Internet, the list goes on. Satellites have made certain things possible as have all the other technologies. But there was no silver bullet. In all cases, the application of the technology was mediated by institutions, primarily the incumbent monopolies. Now with a majority of the world's countries abandoning the monopoly supply model, the conditions are better for greater participation, innovation and contribution to development. But there remain many institutional barriers. Their removal must be the focus if we wish to see wireless contribute to development.