

Ubiquity and broadband in small island developing states

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Abstract

Small Islands Developing States (SIDS) and territories face risks of natural disasters, climate change and are economic shocks. Markets are small and monopolistic or oligopolistic, with few realistic possibilities of further entry. There is insufficient competition to drive prices down to affordable levels. Without an undersea cable they must use expensive satellite services; with one they have a competitive bottleneck. Servicing outlying islands adds additional expense. Operational costs are high; sometimes partially offset by spending by tourists and migrants. Access networks are predominantly mobile; migrating from GSM to LTE. Markets can extend coverage and inclusiveness through increased competition, targeted regulation and selective state aid. The challenges are to ensure the availability of affordable services and inclusion of the poorest and the disabled through cost-effective interventions that do not further distort markets.

Introduction

The Small Islands Developing States¹ (SIDS) have been working to achieve wider and ultimately universal availability of telephony and to extend Internet services, with a view to achieving ubiquitous access, at ever higher speeds, to a range of social, e-commerce and e-government services. The challenges include ensuring affordability of services and the inclusion of the poorest, the remote and the disabled, through cost-effective interventions that do not distort markets more than is strictly necessary. They also aspire to broader concepts such as the information society and the knowledge society.

Such goals need to be, but seldom have been, adjusted for their particular circumstances. The small markets make them susceptible to economic shocks and there are dangers from extreme weather and the effects of plate tectonics and global warming. Small telecommunications markets, with few operators, mean that options available in larger or in contiguous states are unavailable or inapplicable, at least in their conventional forms.

In this paper the characteristics of the SIDS are briefly described, followed by an analysis of the problems of scaling down technologies, business models and the global regulatory toolkit. Issues of affordability and poverty are then described. The challenges of achieving geographical coverage are discussed. The measurement of the extent of mobile markets and their further possible extension are then analysed. Mechanisms for the achievement of universal access and service are then analysed. Issues arising from the Ubiquitous Network Society (UNS) are then considered. Finally conclusions are drawn and areas for further research identified.

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¹ This term is taken to include territories that are not states, but have responsibility for telecommunications markets, while excluding all continental states.

Small island developing states and territories

While many islands are independent states, others are territories, possessions or colonies of France, the Netherlands, the United Kingdom (UK) or the United States of America (USA).²

Table 1 *Human Development Index for selected islands states in 2007³*

	HDI Rank	HDI Value	Life expectancy (years)	Adult Literacy (%)	Gross enrolment In education (%)	GDP per capita (USD PPP)	Population	Area (km ²)
Iceland	3	0.969	81.7	..	96.0	35,742	311,396	103,000
Singapore	23	0.944	80.2	94.4	..	49,704	4,588,600	705
Kuwait	31	0.916	77.5	94.5	72.6	47,812	2,410,829	17,818
Barbados	37	0.903	77.0	..	92.9	17,956	274,197	430
Bahrain	39	0.895	75.6	88.8	90.4	29,723	960,425	750
Antigua & Barbuda	47	0.868	..	99.0	..	18,691	82,786	443
Cuba	51	0.863	78.5	99.8	100.8	6,876	11,237,916	109,866
Bahamas	52	0.856	73.2	..	71.8	20,253	334,000	13,943
Seychelles	57	0.845	..	91.8	82.2	16,394	85,032	455
Saint Kitts & Nevis	62	0.838	..	97.8	73.1	14,481	38,958	261
Trinidad & Tobago	64	0.837	69.2	98.7	61.1	23,507	1,303,188	5,128
Saint Lucia	69	0.821	73.6	94.8	77.2	9,786	168,338	606
Dominica	73	0.814	..	88.0	78.5	7,893	71,008	751
Grenada	74	0.813	75.3	96.0	73.1	7,344	107,379	344
Mauritius	81	0.804	72.1	87.4	76.9	11,296	1,260,403	2,030
Dominican Republic	90	0.777	72.4	89.1	73.5	6,706	9,492,876	48,671
Saint Vincent & the Grenadines	91	0.772	71.4	88.1	68.9	7,691	103,751	389
Samoa *	94	0.771	71.4	98.7	74.1	4,467	186,649	2,842
Maldives *	95	0.771	71.1	97.0	71.3	5,196	104,869	300
Tonga	99	0.768	71.7	99.2	78.0	3,748	103,289	650
Jamaica	100	0.766	71.7	86.0	78.1	6,079	2,675,831	10,991
Fiji	108	0.741	68.7	..	71.5	4,304	837,271	18,272
Cape Verde Is.	121	0.708	71.1	83.8	68.1	3,041	491,419	4,033
Vanuatu *	126	0.693	69.9	78.1	62.3	3,666	221,417	12,189
São Tomé & Príncipe *	131	0.651	65.4	87.9	68.1	1,638	154,875	964
Solomon Islands *	135	0.610	65.8	76.6	49.7	1,725	495,026	28,896
Comoros *	139	0.576	64.9	75.1	46.4	1,143	575,660	2,235
Papua New Guinea	148	0.541	60.7	57.8	40.7	2,084	5,461,940	462,840
Haiti *	149	0.532	61.0	62.1	..	1,155	8,373,750	27,750
Timor-Leste *	162	0.489	60.7	50.1	63.2	717	1,114,000	14,874
Kiribati *	-	..	..	..	75.8	1,295	92,533	811
Marshall Islands	-	..	..	..	71.1	..	52,701	181
Micronesia (Federated States)	-	..	68.4	..	..	2,802	119,551	702
Nauru	-	..	..	..	55.0	..	10,065	21
Palau	-	..	..	91.9	96.9	..	21,196	459
Tuvalu *	-	..	..	..	69.2	..	10,924	26

*A least developed country. See list at <http://www.un.org/special-rep/ohrls/ldc/list.htm>

The SIDS can be grouped by continent, by ocean or sea, or by (former) colonial power. Yet, each island is different in size (population, economy and land mass), distance from its neighbours, cultures, languages and level of economic development (see Table 1). Many

² http://www.un.org/esa/dsd/dsd_aofw_sids/sids_members.shtml and http://www.sidsnet.org/sids_list.html

³ Source: UN Stats. See <http://data.un.org/Explorer.aspx?d=15> Some land areas are from the CIA World Factbook.

remain in the category of Least Developed Country (LDC). A key difference from small continental states is the lack of contiguous neighbours with whom they and, in particular, their telecommunications operators can share economies of scale.

While many of the SIDS have one or two principal populated islands, some are dispersed archipelagos, creating additional challenges of meeting the costs and inconveniences of inter-island transport and communications. Individually, these outer islands are generally very small markets with limited or extremely limited purchasing capacity, sometimes the population is engaged only in subsistence agriculture and fishing.

The SIDS also face challenges from natural disasters, in the form of:

- Hurricanes, tropical cyclones or typhoons;
- Volcanoes;
- Earthquakes; and
- *Tsunami*.

For example, Haiti was struck by an earthquake of magnitude 7 in January 2010, killing many people, destroying much of the capital, damaging its harbour facilities and other vital infrastructure. The telecommunications networks sustained considerable damage, with initial aid provided by specialised charities and the International Telecommunication Union (ITU).⁴ The government, donors and international investors began to rebuild networks, recognising the need to avoid repeating its history of corruption.⁵ Teleco, the former state-owned incumbent, was supported by Viettel its new majority owner.⁶ Digicel and Viola, the two mobile operators, drew on their own resources, respectively, from other Caribbean islands and the USA.

Climate change is an increasing problem to which the SIDS have limited capacity to adapt and for which the costs can be disproportionate, given the small size of their economies.⁷ For example, it is already causing stronger and more frequent hurricanes, of which one of the effects is increased damage to telecommunications masts and antennae. The forecast increase in sea level is expected to cause considerable damage to infrastructure. While it is believed the sea could entirely cover some lower lying islands, notably the Maldives, recent analysis suggests that only a small number of islands are at risk and that others are growing.⁸

The SIDS are also susceptible to economic shocks, with a limited ability to respond, because of the small size of their economies and their reliance on only one or two of the following economic sectors:

- Agriculture;
- Financial services;
- Fisheries; and
- Tourism (with related construction).

Financial services and tourism were both badly hit in the recent recession.

⁴ Christopher Rhoads "Quake sets back Haiti's efforts to improve telecommunications" *Wall Street Journal* 15th January 2010.

⁵ See, for example, Department of Justice "Two Florida businessmen plead guilty to participating in a conspiracy to bribe foreign government officials and money laundering" 15th May 2009. Washington DC.

<http://www.justice.gov/opa/pr/2009/May/09-crm-476.html>

⁶ Viettel is wholly owned by the Vietnamese Army. <http://www.vietteltelecom.vn/>

⁷ IPCC (2007) *IPCC Fourth Assessment Report: Working Group II Report: Impacts, Adaptation and Vulnerability*. Geneva: Inter-governmental Panel on Climate Change.

⁸ Arthur P Webb & Paul S Kench (2010) "The dynamic response of reef islands to sea-level rise: Evidence from multi-decadal analysis of island change in the Central Pacific" *Global and Planetary Change* in print.

<http://dx.doi.org/10.1016/j.gloplacha.2010.05.003>

While government is another important economic sector, it relies entirely on taxation from the rest of the economy and is highly susceptible to economic downturns. Many islands had structured their tax regimes to be “competitive”, for example, by reducing or eliminating income and corporation taxes in order to attract offshore businesses, but in doing so they increased their exposure to economic shocks.⁹

The SIDS present a set of challenging environments, both physically and economically, in which to develop and to implement policies to achieve universal access to telecommunications.

Scalability

One of the biggest challenges is to scale global best practice in governance, markets and their regulation, collection of statistics and the application of technology, to the size of micro-states and micro-territories.

The small populations significantly constrain the systems of governance, with only a modest pool of highly skilled individuals to serve on parliamentary committees, ministries, regulatory authorities and appellate bodies. The usually tight-knit nature of an island elite raises serious concerns about the likely independence of individual decision-makers.

Some of the SIDS are willing to fill professional positions with expatriate experts and to use foreign consultants. Others are reluctant to incur the higher costs or fear that foreigners will not reflect local cultural values and traditional ways of doing business or they prefer to develop local expertise. However, this approach runs into a further significant problem of the lack of locally available training and continuing professional development.

The limited revenues and human resources constrain the range of issues that a national regulatory authority can address and the speed with which it can do so. The adoption of more sophisticated approaches, such as market analyses and impact assessments, improves but further slows regulatory processes. Uniquely in the Eastern Caribbean, ministerial and regulatory functions are shared in a common telecommunications authority, within a shared cultural heritage and a common legal system.¹⁰ Some other jurisdictions outsource final appeals to the Judicial Committee of the Privy Council in London.

The lack of scale and the limited resources also affect statistical agencies, so that the data needed for policy-making on universal access are often weak or missing. Censuses are infrequent and limited in scope, while essential surveys are missing that would analyse:

- Disability;
- Poverty; and
- Spending on and use of ICTs by individuals and households.

Decision making is thus overly reliant on data supplied by the operators. These may not accurately represent the patterns of use of individual citizens, households and businesses, reflecting the concerns of financial analysts, rather than policymakers.

Access to telecommunications is predominantly to mobile networks, which have grown significantly in recent years, thanks to the introduction of competition and pre-paid tariffs. One major attraction has been that its cellular structure has proved a relatively cost effective way to construct networks in smaller units.

⁹ Michael Foot (2009) *Final report of the independent review of British offshore financial centres*. London: HM Treasury.

¹⁰ Edgardo Favaro & Brian Winter (2008) “Telecommunications regulation in the Eastern Caribbean” pp 129-154 in Edgardo Favaro (ed.) *Small states, smart solutions: improving connectivity and increasing the effectiveness of public services*. Washington DC: World Bank.

The operators are currently migrating from 2G (GSM and some CDMA) to 3G (UMTS and some cdma2000), with plans to move on to LTE (Long Term Evolution). Those islands with large numbers of tourists have been and will be the first to migrate, to meet the needs of visitors who will pay for the investments through international mobile roaming charges. Both, 3G and LTE require greatly increased capacity for domestic backhaul and international connectivity. This presents problems of higher costs and the development of new business models to fund them, which may yet prove to be existential challenges for smaller operators.

Mobile telecommunications markets in the SIDS are highly concentrated, usually with two players which, together with the ministry and the regulator, know there is little or no prospect of further market entry to check their behaviour.¹¹

It is difficult to use market shares as a measure of competition in a two-player market, since these may not change significantly. It is even less meaningful when a significant number of people carry two handsets or two SIM cards, being customers of both operators. The problems are compounded where wholesale international mobile roaming revenues are not separated from retail domestic mobile revenues. Instead, it is necessary to track the introduction and geographic availability of a range of services and the movement of prices, compared with other islands.

In the absence of prospective market entry, much of the conventional regulatory toolkit cannot be applied, being intended to support a metaphorical ladder of investment.¹² Interventions such as number portability, bitstream access and local loop unbundling are expensive and time-consuming for both regulators and operators, but make little sense if they do not bring in new operators to intensify competition and drive down prices.

Whereas measures such as mast sharing and national roaming can provide cost savings for existing operators and may be agreed commercially or mandated for the benefit of customers.

Most SIDS have very limited fixed networks and no plans to expand them. The islands which do have extensive networks are generally economically developed states or those which remain territories of Denmark, France, the UK and the USA (see Figure 1). Growth occurred mostly in the 1980s and 1990s, with the 2000s seeing expansion stall, in the face of competition from and preference for mobile services.

One of the most expensive items for an island is an undersea cable to connect it to the rest of the world. Yet a cable is also a competitive bottleneck – an essential facility – potentially requiring access to be regulated to ensure fair competition that will result in lower charges for end users. Guam is a rare exception with several cables landing there.

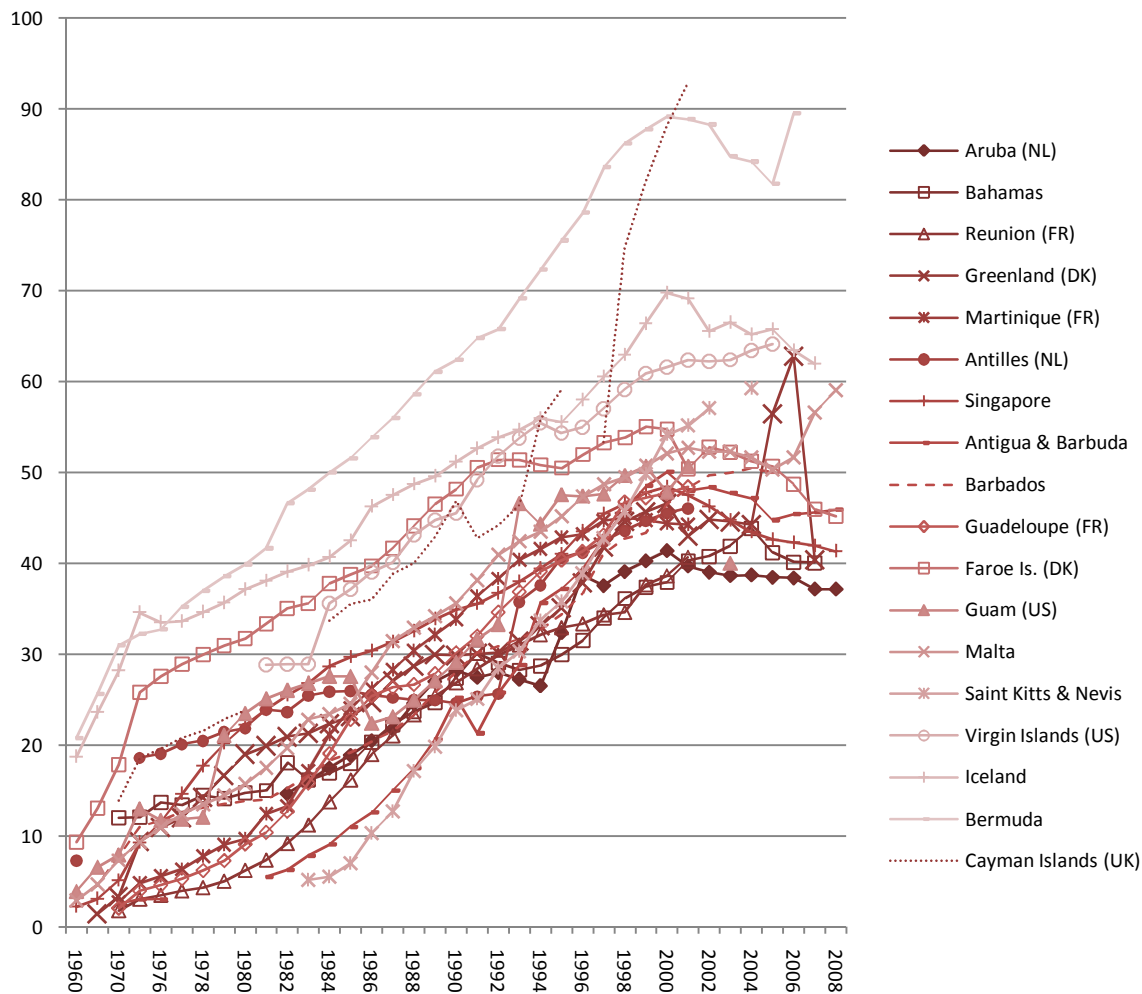
The government of the Seychelles is presently engaged in deciding if it can afford a cable. In July 2009 Samoa and American Samoa were connected for the first time, greatly improving the quality and reliability of telephony and Internet access. A spur, known as American Samoa to Hawai'i (ASH), was added to the PacRimEast cable which runs from Auckland to Hawai'i, at a cost of USD 9 millions. It proved controversial since it has, as yet, failed to generate the number of jobs forecast, in particular the creation of call centres.¹³

¹¹ For example, São Tomé failed to find a bidder for its second mobile network licence.

¹² Martin Cave (2006) "Encouraging infrastructure competition via the ladder of investment" *Telecommunications Policy* 30 (3-4) 223-37.

¹³ "Governor defends ASH-Cable investment", *Samoa News*, 12 April 2010.

<http://www.samoanews.com/viewstory.php?storyid=14246&edition=1271066400>

Figure 1 Fixed teledensities in selected island states and territories¹⁴


With high costs and often “lumpy” investments, with almost no prospect of additional market players and with very limited resources, ministries and regulators have to focus on what matters most, ensuring that they use a few tools which help them deliver affordable telecommunications across the largest socio-demographic footprint.

Affordability and poverty

In nearly all islands there is insufficient rivalry to ensure that prices are driven down to the levels achieved in truly competitive markets. Consequently, it is essential for the authorities and researchers to track and to compare prices, both for individual elements and using the OECD mobile baskets of prices and the charges. Given the preponderance of poorer customers the most important of the baskets is the “low user”.¹⁵

A study of prices in Latin America and the Caribbean compared the cost of a low user basket both as a percentage of GNP per capita and the third decile of income reported in

¹⁴ Source: United Nations statistics.

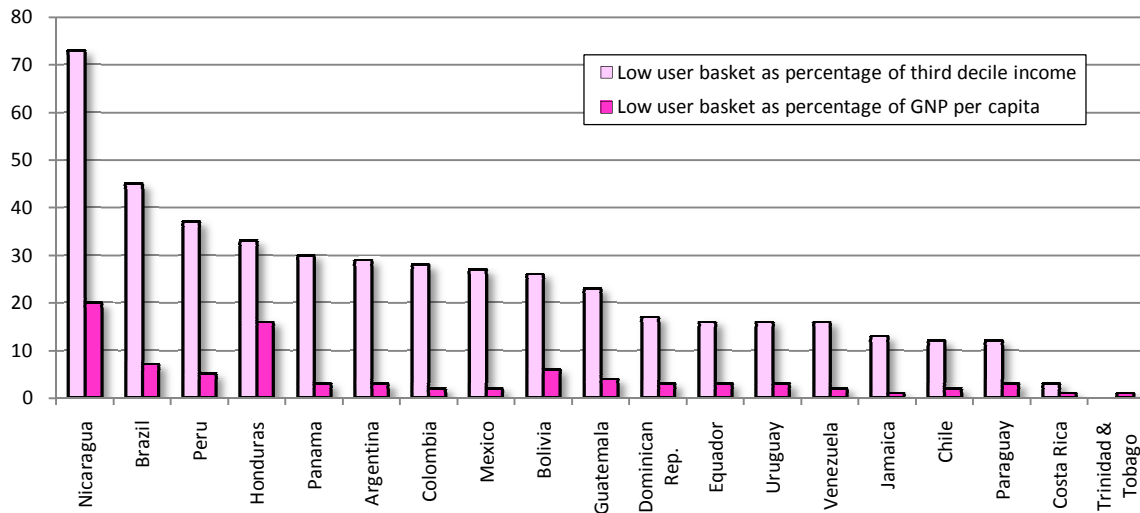
¹⁵ The low user basket comprises: 360 calls, 396 SMS, 8 MMS and 529 minutes of voice.

http://www.oecd.org/document/5/0,3343,en_2649_34225_43877509_1_1_1_1,00.html

The baskets were recently revised, see OECD (2010) *Revision of the methodology for constructing telecommunication price baskets*. Paris: Organisation for Economic Cooperation and Development.

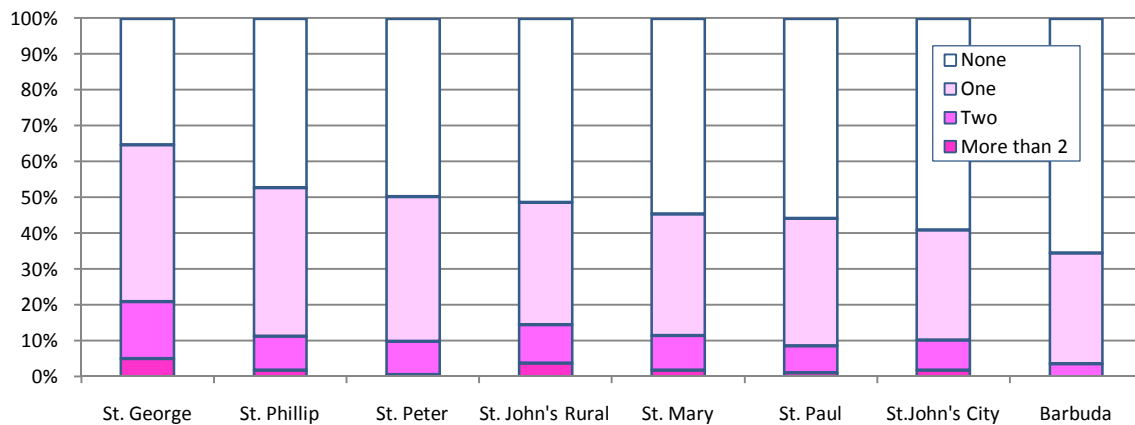
national household surveys (see Figure 2).¹⁶ This highlights the lack of affordability for even a modest level of use for the poor in most countries, including Dominican Republic and Jamaica. A similar exercise for all the SIDS is now required and should be repeated to show the trends over time.

Figure 2 *The prepaid low user basket in selected Latin American and Caribbean countries in 2009*



There are relatively few studies of the use of ICTs amongst the poor in the SIDS. Two studies from 2007, for Jamaica and Trinidad, point to relatively high levels of availability.¹⁷ This is confirmed by a further study in Trinidad.¹⁸ However, much more work is required to identify the true constraints on use, including the mitigating effects of incoming remittances. It is important to match such studies with the work on prices comparisons and baskets, to ensure that true levels of affordability are identified.

Figure 3 *Household ownership of computers by parish in Antigua & Barbuda in 2008¹⁹*



¹⁶ Hernan Galperin "Tariffs and the affordability gap in mobile telephone services in Latin America and the Caribbean" *Proceedings of the 4th ACORN-REDECOM Conference*, Brasilia, D.F., 14-15 May 2010.

¹⁷ Ewan Sutherland (2010) "Telecommunications in the Small Island States and Territories of the Caribbean" *Proceedings of the 4th ACORN-REDECOM Conference*, Brasilia, D.F., 14-15 May 2010. <http://papers.ssrn.com/abstract=1608329>

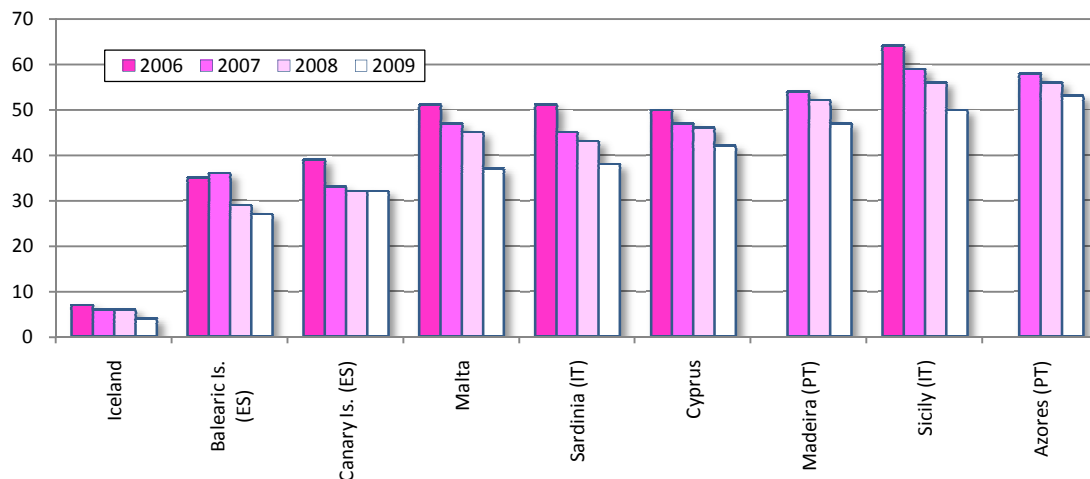
¹⁸ Bheshem Ramlal & Patrick K Watson (2010) "The digital divide in Trinidad and Tobago 2007" presented at the *11th Annual Conference of the Sir Arthur Lewis Institute of Social and Economic Studies (SALISES)*, 24-26 March, Jamaica.

¹⁹ Roger de Peiza (2008) *Antigua and Barbuda National ICT Household Survey*. Government of Antigua and Barbuda.

A household survey in Antigua and Barbuda identified, down to enumeration district level, the variations in the ownership of computers (see Figure 3).

By comparison, in Europe there is much more extensive data collection by national agencies, coordinated by Eurostat. For example, Figure 4 shows the declining numbers of people living on islands who have never used a computer.

Figure 4 Individuals who have never used a computer in selected European islands ²⁰



For the SIDS there is a significant shortfall in survey data on household and individual use of ICTs and in particular of voice telephony and the Internet. Until that is closed it is not possible to understand the gap between availability, willingness to use and the ability to pay for services. There is very little data on what might be an appropriate level for the affordability of services and devices. Until the barriers to wider use are better understood, interventions are condemned to be less effective than they should be. Capacity building in statistical agencies will be required to improve the data gathering on ICTs, with funding for survey work being paid for either directly from the treasury or from the money raised by the regulator from users of telecommunication services.

Geographical coverage

Ensuring adequate geographical coverage by service providers presents significant challenges. Operators face rugged terrain and the absence of passable roads in remote areas, plus the distances and limited transport between islands. Regulators and ministries need to, but seldom fail to, track, map and publish the availability and quality of service, showing the progress made.

The lack of mains electricity for base stations and microwave relays is being addressed by work on renewable energy sources. Slowly, there is commercial availability and limited deployment of:

- Pico-hydro-electric systems;
- Photo-voltaic panels; and
- Wind turbines.

While these technologies require little maintenance, they are expensive to install, creating choices for operators over whether to invest in extending coverage or renewable energy sources or to reduce prices in order to increase network utilisation. Otherwise, the alternative power source is diesel generators at individual base stations, refuelled from

²⁰ http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/database

trucks or boats by the mobile operator or a contractor. This has both high operational costs and significant greenhouse gas emissions, though the latter can be reduced by use of locally produced bio-diesel.

Rural and remote areas tend to have lower population densities and lower income levels. In extreme cases people may be engaged only in subsistence farming and fishing with little cash. Such areas will generate low levels of revenue for the operators, making the sharing of infrastructure more important and possibly requiring the provision of subsidies towards network construction.

Although geographically large, Iceland has an almost uninhabited interior. The first generation of mobile service used the Nordic Mobile Telephone (NMT) standard, operating in the 450 MHz band.²¹ Its good propagation characteristics meant it covered most of the interior and the surrounding seas to distances of 50-150 kilometres, much further than either GSM or UMTS, in their higher frequency bands. The Icelandic Telecommunications Fund was established in 2005, with ISK 2.5 billion (€14.6 million) to support wider access. It has paid for GSM coverage of Highway 1 (the national ring road), five hundred kilometres of mountain roads and nine hundred kilometres of trunk roads. The result is that even in unpopulated parts of Iceland, there is good 2G coverage.

A challenge for many SIDS is to extend network coverage to outlying islands. Sometimes this requires a simple link, for example from:

- Comoros: Grande Comore, Mohéli to Anjouan (60-100km);
- Mauritius to Rodrigues (570 km).
- Samoa: Opolu to Savai'i (18 km); and
- São Tomé to Príncipe (140 km);

Such links are typically constructed using digital microwave links. Exceptionally, the Cape Verde Islands, an archipelago stretching over tens of kilometres, has an optical fibre ring. Initially with foreign aid, but later funded by the incumbent operator, this links all the inhabited islands and interconnects with trans-oceanic cables to Brazil and Portugal.²²

In the Pacific Ocean, several of the SIDS are archipelagos, stretching over tens or hundreds of kilometres (see Figure 5), presenting severe problems for the construction and maintenance of links between the inhabited islands.

²¹ Ewan Sutherland (2010) "Telecommunications in the small island states and territories of Europe" presented at *ITS European Regional Conference*, 13-15 September, Copenhagen. <http://papers.ssrn.com/abstract=1583970>

²² Ewan Sutherland (2010) "Telecommunications in the African Small Island Developing States" presented at *CPR Africa*, May, Cape Town. <http://papers.ssrn.com/abstract=1583441>

Figure 5 *New Caledonia, Vanuatu, Marshall Is., Solomon Is. and Federated States of Micronesia*


The Rural Internet Connectivity System (RICS) provides two-way Internet access to Pacific islands, using a 1.2 metre Ku band antenna, with two beams for the South Pacific (see Figure 6).²³ This initiative was launched in early 2008 by the Secretariat of the Pacific Community (SPC), as part of the Pacific Plan digital strategy.²⁴ Funding, until the end of 2009, was provided by AusAid. RICS offers:

- Internet services from 256 and 2,048 kbits/s;
- Unlimited downloads or capped services;
- Optional content filtering; and
- Online billing and payment.

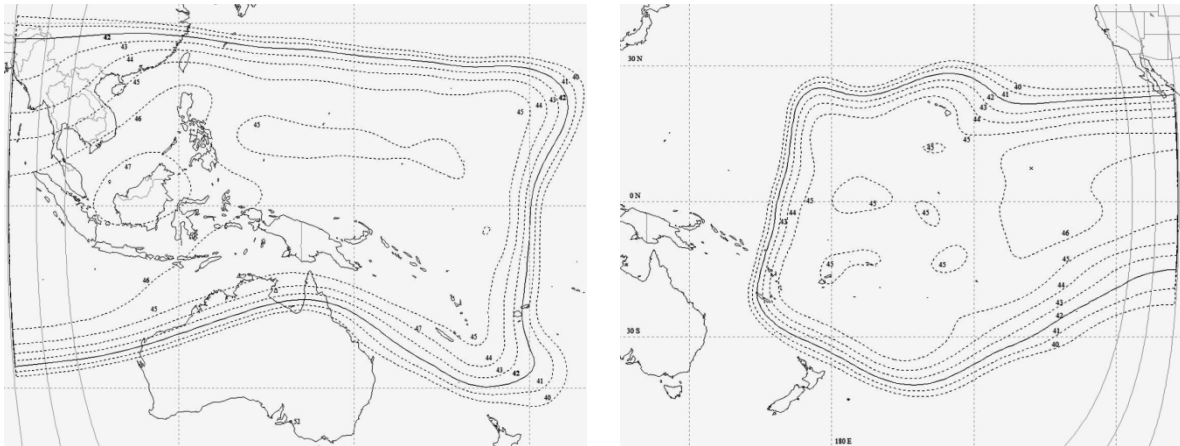
Among the more extreme cases are the British territories in the South Atlantic: Ascension Island, Falkland Islands and St Helena.²⁵ Cable & Wireless is the monopoly provider, with local PBXs connected to the UK by satellite using SS7. In the case of St. Helena there is no airport, so that it takes over a month to ship equipment, making reliability critical.

²³ <http://www.pacrics.net/>

²⁴ The Pacific Islands Forum leaders endorsed the original Regional Digital Strategy in 2005. It was reviewed and a new strategy adopted in June 2010 in Samoa:
<http://www.forumsec.org.fj/pages.cfm/newsroom/press-statements/2010/review-of-regional-digital-strategy.html>
 see also <http://tinyurl.com/35ndswk>

²⁵ <http://www.wtl.be/>

Figure 6 Footprint of the GE-23 satellite South-East and South-West Pacific transponders



For ships which operate outside of coastal waters, whether between islands or further, are forced to consider the use of satellite communications as the only relatively reliable means of communications.²⁶

While satellite solutions have decreased in price, they remain sufficiently expensive to present problems of limited competition, lack of affordability for individual customers and doubts about long term economic sustainability. With rare exceptions, inter-island fibre cables are not economically justified.

Mobile networks

The introduction of a second mobile operator in most SIDS and, in a few, a third operator has caused sufficient rivalry to spur greater access and availability, though the authorities have seldom mapped or measured this systematically. The limits to geographic coverage provided by operators relying on revenues from the market are caused by increasing costs and the limited ability of remoter and poorer customers to generate sufficient revenues to cover those costs. Given the higher costs for devices, network equipment and backhaul links for 3G and LTE these limits are likely to be more severe than with 2G.

A significant part of the competition that is seen today is the result of support from the international financial institutions (see Table 2).

²⁶ <http://www.inmarsat.com/>

Table 2 Development loans to network operators in the SIDS²⁷

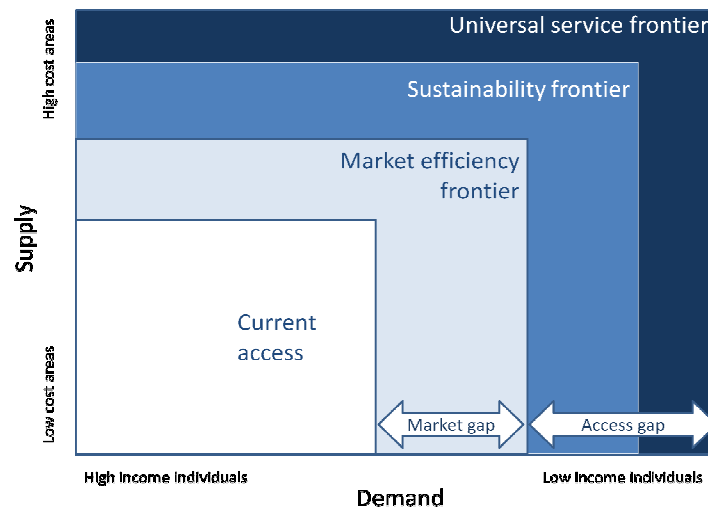
Country	Operator	Amount USD (M)	Dates	Notes
Bermuda	Digicel	56	2001-02	IFC Project 2770
Cape Verde	Cabo Verde Telecom	-	1995-2008	IFC Project 1553
Cape Verde	T+ Telecom	16	2007	IFC
Cuba	Etecsa	-	1994-2049	IFC Project 1154
Cuba	Telefonos Celulares de Cuba	-	1993-2002	IFC Project 1155
Dominica	Orange		2005-2008	IFC Project 4432
Dominica	Cable & Wireless	-	1998-2008	IFC Project 1150
Dominican Republic	Orange	35	2000	IFC Project 2851. Also USD 15M in quasi-equity.
Dominican Republic	Orange	94	2000-06	World Bank
Fiji	Digicel	-	2008-2023	IFC project 5087
Fiji	Vodafone	-	1994	IFC project 1442
Fiji	Fintel/Cable & Wireless	-	1994	IFC project 1443
Haiti	COMCEL			IFC project 2336
Haiti	Digicel	15	2006	IFC Project 4408
Jamaica	Cable & Wireless	12	1992	IFC Project 1198
Jamaica	America Movil/Oceanic Digital	30	2001-2016	IFC Project 2775
Jamaica	Digicel	30	2001	IFC Project 2770 Also equity of USD 8 M
Kiribati	Telecom Services Kiribati	-	1988	IFC Project 3824
Kiribati	Telecom Services Kiribati	-	1990-2001	IFC Project 1751
Mauritius	Cellplus	-	2001-2008	IFC Project 2872
Mauritius	Yello	1	2003-2018	IFC Project 3251
Mauritius	MTNL		2004-2019	IFC Project 3483
Maldives	Wataniya	20	2005-2020	IFC Project 3835. (24480) USD 7 million from others
Papua New Guinea	Digicel	-	2007	IFC Project 4896
St Lucia	Cable & Wireless		1980	IFC Project 1498
St Lucia	Digicel	-	2003	IFC Project 3848
St Vincent	Digicel	-	2003	IFC Project 3849
Samoa	Digicel/Telecom Samoa	11	2007	IFC Project 1778
Seychelles	Telecom Seychelles	-	1997-2012	IFC Project 2117
Seychelles	Cable & Wireless		1995	IFC Project
Solomon Is.	Solomon Telecom	-	1989-2018	IFC Project 2159
Tonga	Digicel	-	2001	IFC Project 3026
Vanuatu	Digicel	-	2008	IFC Project 5223

In many countries the authorities have examined ways in which to extend coverage and access both of and beyond the market (see Figure 7).²⁸ Reaching the market efficiency frontier is a matter of better regulation and improved conditions for investment, while closing the access gap is likely to require subsidies, possibly from taxation, from existing users or from foreign donors.

²⁷ IFC and World Bank data from: <http://ppi.worldbank.org/>

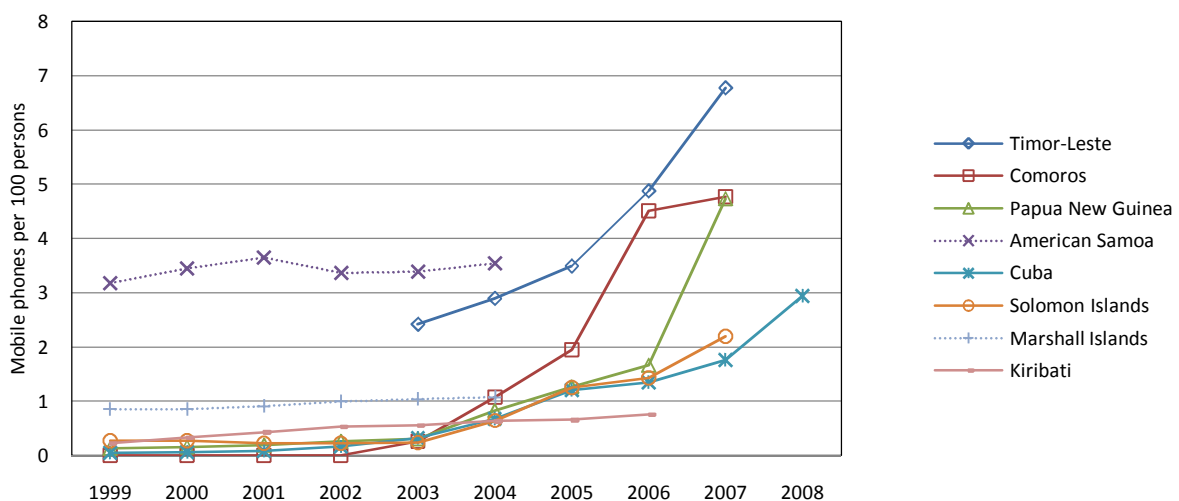
²⁸ Björn Wellenius (2000) *Extending telecommunications beyond the market: Toward universal service in competitive environments*. Washington DC: World Bank. Public policy for the private sector Note No. 206. <http://rru.worldbank.org/documents/publicpolicyjournal/206welle.pdf>

Figure 7 *The limits of current and maximum market provision (source: World Bank)*



The poorest performing SIDS had mobile teledensities of five or less per 100 persons in 2008, though some were showing signs of improvement (see Figure 8). While these are amongst the poorest islands, some have yet to introduce competition, preferring to retain a monopoly provider at a cost of much lower teledensity. Consequently, improvements can be expected from the introduction of competition, as has already been seen in Papua New Guinea and as is planned in the Solomon Islands.

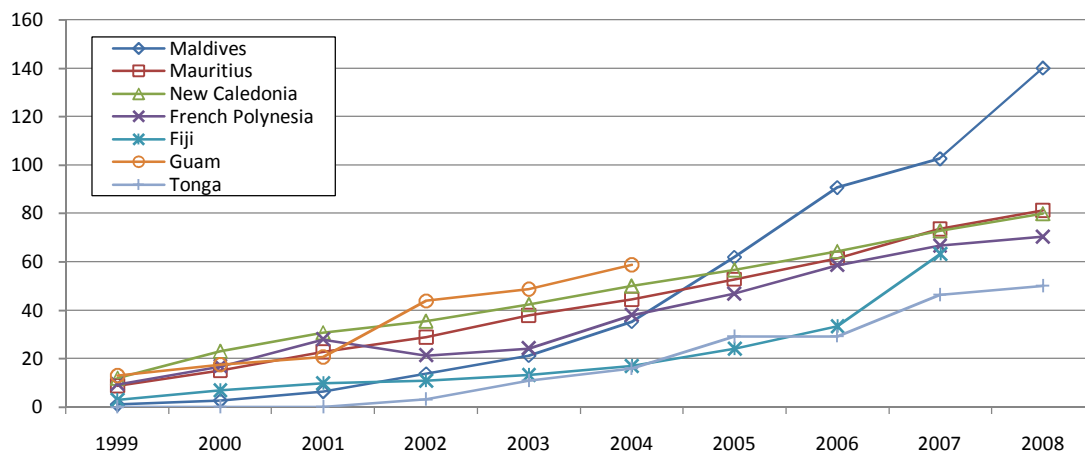
Figure 8 *The lowest mobile teledensities amongst the SIDS²⁹*



The very high numbers claimed for mobile teledensity in some SIDS in the Caribbean and the Maldives are largely meaningless, for example, 120 to 160 mobile phones per 100 persons.³⁰ It is more difficult to interpret the numbers in the Pacific which are plausible, but are likely to be overstated to some degree (see Figure 9).

²⁹ Source: UNSTAT. See <http://data.un.org/Explorer.aspx?d=ITU>

³⁰ Ewan Sutherland (2010) "Telecommunications in the Small Island States and Territories of the Caribbean" presented at ACORN REDECOM Conference, 14-16 May, Brasilia. <http://papers.ssrn.com/abstract=1608329>

Figure 9 *High mobile teledensities in the Indian and Pacific Ocean SIDS*

Not everyone has a mobile phone, rather:

- Some residents carry two phones or two SIM cards:
 - to separate business and personal calls,
 - to make cheaper on-net calls,
 - to take advantage of special offers, and
 - to obtain better coverage;
- Some tourists and owners of holiday homes buy local SIM cards to avoid exorbitant roaming charges; and
- Some returning migrants have a local SIM card to allow family members to call them more cheaply.

These factors help to explain how there can be up to two “subscribers” for every resident.

The challenge for policy-makers is, in the short term, to identify a factor to use to reduce the operator data closer to the real number of customers, and, in the medium term, to conduct the surveys necessary to determine the exact extent of use and access, identifying those individuals and households without access or with only intermittent access. It requires expensive survey work to identify those who do not have access to a mobile network and those whose use is significantly constrained by the cost of calls.

Internet access has generally been formulated as the use of a computer, for example, in the statistical indicators for the Millennium Development Goals. This can be owned personally or located in a telecentre. However, there is increasing evidence of access to Internet services from handheld devices connected to mobile networks. This requires careful monitoring and updating of policies, plus the collection of data on the availability of mobile broadband, its geographic scope, the speeds available to users in addition to monitoring the patterns of its use.

Singapore is much the most advanced island, in addition to universal fibre to the home, it has extensive coverage with GSM, 3G (UMTS), HSPA+. Moreover, all three operators have committed to migrate to LTE. Additionally, a set of Wi-Fi networks has been introduced, with some modest subsidies.³¹

One obvious way to increase competition would be to introduce Mobile Virtual Network Operators (MVNOs), which have proved a useful means to extend the market in other

³¹ See the iDA’s in2015 Masterplan <http://www.ida.gov.sg/About%20us/20070903145526.aspx>

countries.³² Forcing existing operators into long-term wholesale access contracts for their networks would seem likely to be easier than introducing a new infrastructure-based operator. If an MVNO could use a global brand name it would help in the market.³³ The challenging question is whether one or more MVNOs might reduce operator revenues and incentives to the extent that they limited their investment in infrastructure.

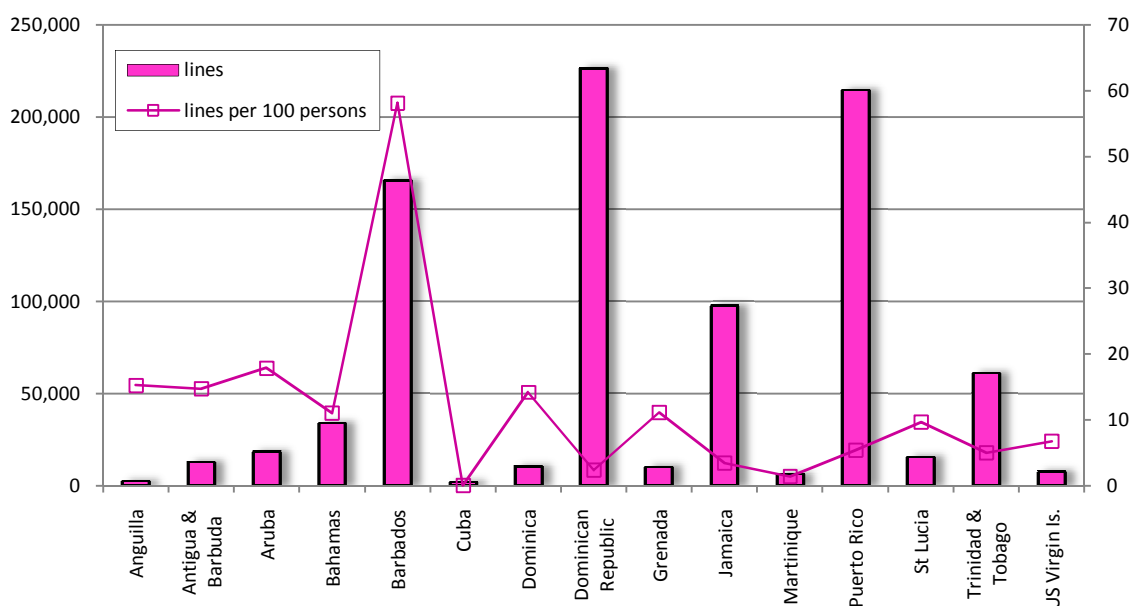
Performances vary enormously across the SIDS, requiring further detailed analysis, once data on the real teledensities become available. Nonetheless, it is clear that improvements have been made where a second operator has been introduced, though the influence of a third is less certain. Finding additional operators has been a relatively random process, with few players interested by such small and often remote markets.

Broadband

The availability of broadband in the SIDS is very uneven, in part because of the differences in the fixed networks that might be used to provide DSL. Adoption is limited because of the lack of affordable offers, due to the cost of backhaul and international connectivity, plus the small numbers of households and individuals owning computers.

The leader is Singapore which will shortly achieve fibre to every residence and all business premises, with service-based competition offering speeds of up to one Gigabit per second. The prices are also relatively affordable, with special offers available to poorer families to purchase computers. Its closest rival is Iceland, one of the leaders in the OECD, which has significant use of both DSL and FTTH. By comparison, the poorest performing islands have little more than GPRS or Wi-Fi access networks with satellite for backhaul.

Figure 10 Broadband lines in selected Caribbean islands in 2009³⁴



³² Livio Cricelli, Michele Grimaldi & Nathan Levialdi Ghiron (2010) "The competition among mobile network operators in the telecommunication supply chain" *International Journal of Production Economics*. In print. <http://dx.doi.org/10.1016/j.ijpe.2010.02.003>

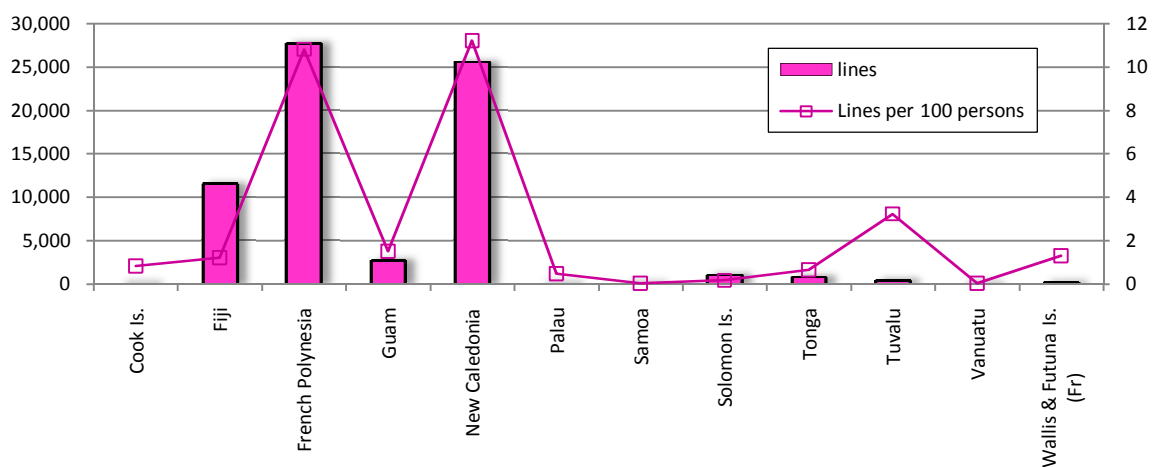
³³ The Vodafone brand is used in the Faroe Islands and Iceland by an operator in which the Vodafone Group owns no shares.

³⁴ Source: ITU Telecommunication Indicators Database.

Some of the Caribbean islands are already well served by fixed incumbent operators and challenged by a few WiMAX providers (see Figure 10). For example, LIME (formerly Cable & Wireless) offers DSL on several islands, with a menu of tariffs with download speeds from 0.5 to 4 Megabits per second, at prices from €40 to €75 per month. Whereas, in the remoter Falkland Islands, it offers a rather expensive broadband service to Stanley and the principal populated areas, plus a handful of Wi-Fi hot spots.³⁵

The Pacific islands are even more differentiated in their adoption of broadband (see Figure 11). The various French colonies, including those in the Caribbean, have broadband services at prices that echo those of France itself, from €20 to 50 per month, though without the expansive bundles of television channels and voice telephony. The exception is the higher prices, from €55 to €200 per month, charged in St Pierre and Miquelon.

Figure 11 Broadband lines in selected Pacific islands in 2009³⁶



The only non-French success in the Pacific is Fiji where a small number of providers compete with ADSL and WiMAX, the latter limited to areas of Viti Levu island, around the capital in the South-East and the tourist and airport zone in the West. The speeds are relatively slow, starting at 128 kbps at €15-20 per month but rising steeply with speed.

In Tonga TCC has very few customers despite offering broadband for €35 to 75 per month, using:³⁷

- ADSL in urban areas;
- WiMAX in outer areas (including the islands of Vava’u and Ha’apai); and
- VSAT in the remotest areas.

Many operators in SIDS offer 3G as “mobile broadband”, but this is different from fixed and while it has the advantage of being accessible at many locations, the speeds are not as fast. The biggest difference is the absence of an uncapped monthly offer, with a secondary difference being the service is personal rather than for a household.

Over a number of years operators have rolled out broadband services in the SIDS with DSL, WiMAX and, exceptionally, FTTP, seeking to make offers that are attractive on the market, with speeds that are not untypical of developing countries. In many SIDS mobile broadband is seen as a competitive offer, despite its obvious limitations. The use of WiMAX is relatively

³⁵ <http://www.cwfi.co.fk/>

³⁶ Source: ITU Telecommunication Indicators Database.

³⁷ <http://www.tcc.to/index.php/2009/06/10/dataanywhere-service/>

limited, possibly because of the expense of consumer equipment. Wi-Fi is limited by the shortage of computers.

Universal service and access

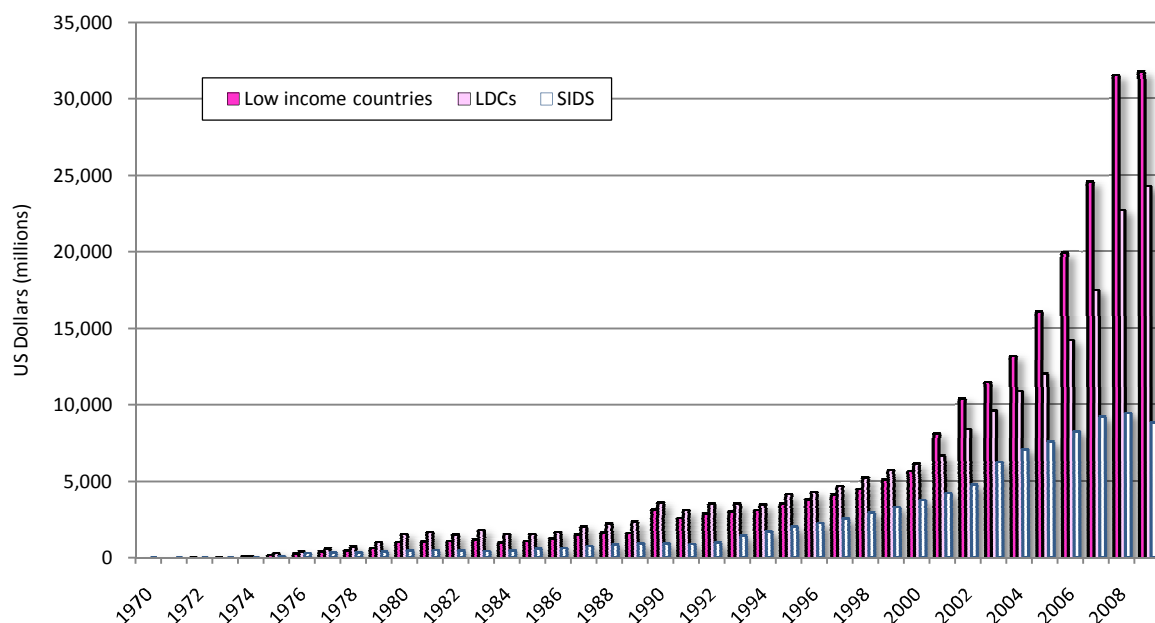
The origins of universal service lie a century ago in a commitment made by AT&T to interconnect with all other operators in the USA, something that was transformed over time into an apparent but never realised commitment to reach all customers requesting a fixed line.³⁸ It has been revised, revisited and reshaped in the light of changing socio-economic aspirations and technologies.

The factors that influence the shape and scope of universal service are:

- Externalities which make it economically efficient to subsidize prices for those unable to afford a service at its true cost;
- Services considered to be “merit goods”, which everyone should have, regardless of their ability to pay or additional costs to overcome any disability; and
- Political factors or economic development goals which cause governments to transfer resources to rural or low-income households and individuals.

For some islands externalities include a significant non-resident population of political refugees and economic migrants, absent for shorter or longer periods, remaining connected to their home island. The growth of remittances, mostly to their families, has been remarkable in the last decade (see Figure 12). One factor in that increase has been greatly improved access to telecommunications.

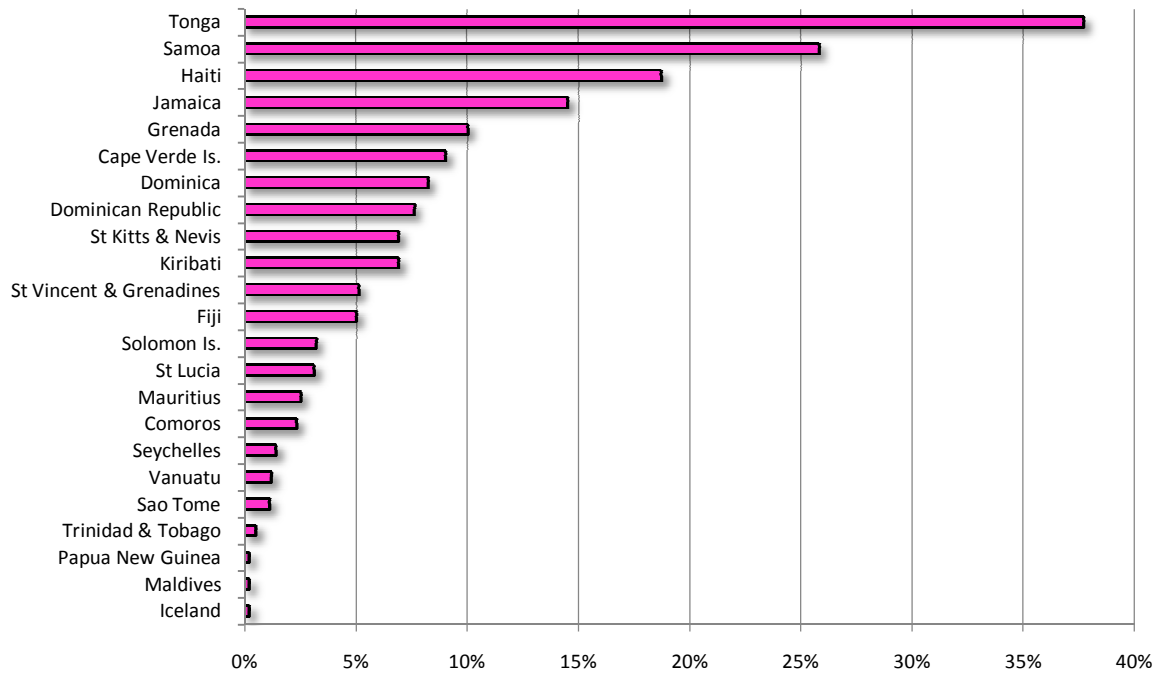
Figure 12 Growth of remittances received by developing countries³⁹



Remittances can be extremely important to island economies, with some remarkable levels of contribution to GDP (see Figure 13).

³⁸ Milton Mueller (1998) *Universal service: competition, interconnection and monopoly in the making of the American telephone system*. Washington DC: AEI Press.

³⁹ <http://go.worldbank.org/QOWEWD6TA0>

Figure 13 *Remittances as a percentage of Gross Domestic Product in 2008⁴⁰*

There can be charges of up to twenty per cent on individual transfers, creating a disincentive to remit smaller sums.⁴¹ Further competition and technological innovation, including m-banking, should be able to reduce these costs and increase the benefits.

There is a wide range of policy instruments used to address universal service and access (see Table 3). These have general problems of limited transparency, of market distortions and of longer term sustainability or of the lack of exit strategies. For individual countries it requires a careful evaluation of the plausible options with an impact assessment to weigh the costs and benefits in order to arrive at an appropriate selection of measures.

⁴⁰ Source: World Bank. See <http://go.worldbank.org/SSW3DDNLQ0>

⁴¹ John Gibson, Geua Boe-Gibson, Halahingano Rohorua & David McKenzie (2007) "Efficient remittance services for development in the Pacific" *Asia-Pacific Development Journal* 14 (2) 55-74

Table 3 *Methods to achieve universal access and service*

<i>Technique</i>	<i>Obstacle</i>	<i>Problems</i>	<i>Description</i>
Access Deficit Charge (ADC)	High operational costs	Complex calculations, requiring detailed data. Lack of transparency. Disincentive to be efficient.	Compensation for services where revenues do not cover operating costs
Increased interconnection rates	High operational costs	Calculation of costs. Disincentive to be efficient.	Setting a higher termination rate, based on calculated or estimated costs for a rural or remote area
Facilities sharing	High investment costs	Avoiding anti-competitive effects	Access for all operators to passive infrastructure (masts, poles and ducts) to reduce network deployment costs
National roaming	High investment costs	Avoiding anti-competitive effects	Allowing or mandating operators to have wholesale access to existing networks in rural or remote areas
Licence obligation	Limited coverage in rural areas	Measurement. Effective penalties.	e.g., within three years must provide coverage of 96% of population
Rural licences	Insufficient interest by larger operators	Lack of technical expertise	Engaging local entrepreneurs in the provision of telecommunications services
Reverse auctions	Service in areas that are not considered viable	Auction design. Finding sufficient bidders. Studies of demand.	Rural or remote areas assigned to the operator requiring the lowest level of subsidy
Telecentres	Lack of services and equipment in rural and remote areas	Medium-term viability.	Community access to a place (or bus/truck) with devices (especially computers), with support for users
Anchor tenant	Lack of demand	Limited budgets	Aggregation of demand from public sector: local government, schools, hospitals, etc.
Low user tariff	Individuals unable to afford services	Market distortion. Lack of transparency.	Offering poorer users a tariff with lower prices.
End-user subsidy – poverty	Individuals unable to afford services	Long term sustainability. Grey market in vouchers.	Providing financial assistance to individuals that need support to be able to use telecommunications.
End-user subsidy – disability	Individuals unable to use services	Long term sustainability.	Providing financial assistance to individuals that need support to be able to use telecommunications e.g., deaf and blind
Reduction or elimination of import duties	High cost of equipment for operators and consumers	Replacement of tax revenues	Reducing the cost of equipment and thus of network services. Cheaper mobile handsets help poorer users.

Of the SIDS only Cuba, Dominican Republic, Haiti, Puerto Rico, Papua New Guinea and, perhaps, Jamaica have sufficiently large populations to consider options such as the creation of separate rural operators. In many other SIDS the whole population is smaller than the scale required for such initiatives. Approaches such as the famous telephone ladies of Grameenphone may be applicable, though the insights from this appear to have entered mainstream marketing by operators.⁴²

Funding mechanisms for the various possible interventions can be:

- Universal Service Fund drawn from:
 - Tax on use of telecommunications,
 - General taxation revenues, and
 - Donor aid;
- Pay or play; and

⁴² Maung K Sein, Irtish Ahmad & G Harindranath (2008) "Sustaining ICT for development projects: the case of Grameenphone CIC" *Telektronikk* 2.2008 pp 16-24.

<http://www.telenor.com/telektronikk/volumes/index.php?page=ing&id1=75&id2=206&id3=1012&select=>

- Obligation on operators (a hidden cross-subsidy).

In 2005, the Organisation for Economic Cooperation and Development (OECD) recognised that significant changes in competition, technology and the scope and nature of services on the market required a review of universal service in terms of:⁴³

- Obligations;
- Coverage;
- Financing; and
- Responsibility for provision.

In most developed countries and many SIDS access to voice telephony has become ubiquitous and relatively affordable. For many operators voice revenues are declining and are becoming only one of many applications and services carried over their networks, some of which they have yet to “monetize”.

Following modifications to its legal framework for telecommunications, the EU held a debate about the scope of universal service and the means necessary to achieve that. While it was accepted that mobile services could be used, it was unclear whether mobility should be part of the definition. There was considerable debate about the inclusion of broadband, the appropriate speeds, the means to achieve this without creating obstacles to the migration towards fibre to the premises, especially in rural areas. Where net costs are incurred in providing universal service there remain challenges as to how they can be evaluated and how the indirect and intangible benefits of providing universal service can be offset against them. Following a public consultation a communication will be adopted in mid-2010, building on the review in 2008.⁴⁴ Any policy changes would be subject to an impact assessment and would aim to minimise market distortions. Additional state and regional and municipal funds continue to be permitted in the EU, subject to compliance with the state aid rules.

In the USA there has been a long debate about universal service because of the large rural areas to be covered, the continuing heavy cost, the inefficient and sometimes corrupt use of the funds and the need to add broadband Internet access. There has been no shortage of proposals and counter-proposals, including a plan for “truly ubiquitous broadband”.⁴⁵ Mandated by the US Congress, the official national broadband plan was developed by the FCC, but remains the subject of political divisions over the role of government and subsidies for rural areas.⁴⁶ A US Senate Committee conducted a hearing in June 2010 looking at the use of “High-Cost Fund” for broadband.⁴⁷

In the Caribbean a number of countries have followed the global trend to legislate for a Universal Service Funds (USF), though few of these have been implemented.⁴⁸ They are also being introduced with legislation in Pacific islands to support liberalisation, pushed by

⁴³ Patrick Xavier (2005) *Rethinking universal service for a next generation network environment*. Paris: Organisation for Economic Cooperation and Development. DSTI/ICCP/TISP(2005)5/FINAL

⁴⁴ EC (2008) *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the second periodic review of the scope of universal service in electronic communications networks and services in accordance with Article 15 of Directive 2002/22/EC*. Brussels: European Commission. COM (2008) 572.

⁴⁵ Kevin Werbach (2009) “Connections: beyond universal service in the digital age” *Journal on Telecommunications and High Technology Law* 7 67-94.

⁴⁶ <http://www.broadband.gov/>

⁴⁷ <http://tinyurl.com/34vzdl2>

⁴⁸ Carlos Miranda Levy (2007) *Information Society and public ICT policies in the Caribbean: a review of advances and challenges, policy instruments and country experiences*. Port of Spain: UN Economic Commission for Latin America and the Caribbean.

donors such as the World Bank and AusAid. As yet, there is almost no evidence of their successful implementation.

A levy on operators, usually both fixed and mobile, is the primary source for universal service funds, though sometimes initial capital is provided by the government or an international agency. Such levies are not paid by the operators, but passed through to customers, and thus can have a counter-productive or regressive effect from the higher charges incurred, making services less affordable. Moreover, the tax is seldom disclosed to customers.⁴⁹ In some countries, but not in any of the SIDS, there is an option for operators to deliver something towards universal service, known as “play or pay”.

The universal service funds are usually administered by the regulator or another independent agency. Unexpectedly, there is a problem with disbursement of funds, with fifteen developing countries having spent only 26 per cent of the available monies, apparently due to bureaucracy and lack of expertise.⁵⁰ Monies are often used inefficiently by incumbent operators, having no incentives to do otherwise.

Based on alleged successes with reverse auctions in Chile, the World Bank became a keen promoter.⁵¹ Unfortunately, this case study required a less visible but substantial subsidy through a significant market distortion in higher, asymmetric termination rates. Experience shows that reverse auctions can reduce subsidies substantially, but that, as in all auctions, the rules are vitally important.⁵² The challenge is to fashion specific rules for an auction that will ensure a competitive outcome.

The issues for administrations in islands in updating policies for universal service are the appropriateness of:

- Measures of affordability;
- Levels of subsidies;
- Play or pay option;
- Reverse auctions;
- Potentially regressive sector taxation for a universal service fund;
- Mobile-only delivery; and
- Inclusion of broadband Internet access.

Ubiquitous Network Society

The concept of the Ubiquitous Network Society (UNS) originated in Japan and South Korea, it is a very broad framework within which are a variety of networks, services and applications, not only to devices used directly by human beings, but extending this to consumer electronics, to infrastructure and to objects (see Figure 14).⁵³ It is an impressive vision used to help drive economic growth through industrial policy, to which has been added consideration of the environment and climate change.⁵⁴

⁴⁹ Operators in the USA are unusual in making a line item charge for universal service on invoices.

⁵⁰ Heather E Hudson (2010) “Defining universal service funds: are they accelerators or anachronisms?” *Intermedia* 38 (1) 16-21.

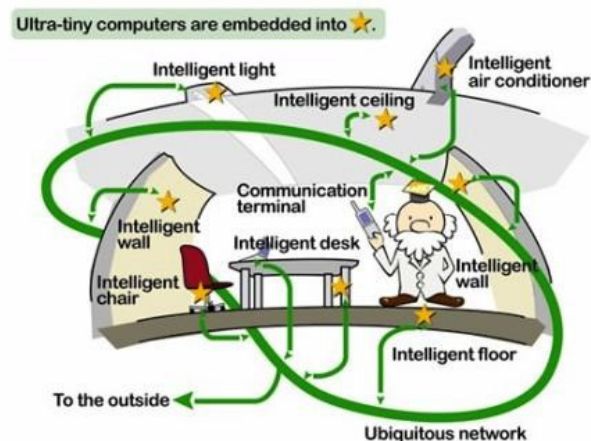
⁵¹ Bjorn Wellenius (2002) *Closing the gap in access to rural communications: Chile 1995–2002*. Washington DC: World Bank. Discussion Paper No. 430.

⁵² Scott Wallsten (2008) “Reverse auctions and universal telecommunications service: lessons from global experience” *Federal Communications Law Journal* 61 (2) 373-94.

⁵³ Teruyasu Murakami (2005) *Japan’s National IT Strategy and the Ubiquitous Network Society*. Tokyo: Nomura Research Institute.

⁵⁴ Takao Shino (2009) *Using the ubiquitous network to achieve a sustainable society*. Tokyo: Nomura Research Institute.

Figure 14 Ubiquitous network society



Migration from the PSTN to multiple IP networks in Japan is considered in terms of universal service, with one survey suggesting an increased willingness to pay toward a USF.⁵⁵ The policies are relatively conventional and unrelated to the UNS concept, which is used to develop industrial policy.

By comparison, most of the SIDS have relatively modest visions of technology. Concepts such as the information society or the knowledge society have seldom been adjusted to fit local social and economic realities. A possible exception is in the Cape Verde Islands. Otherwise, the documents look like “boilerplate” text with a few national names inserted, rather than addressing the specific challenges of small scale and remoteness, with a focus on a very few economic sectors.

For the summer of 2010, one promoter of parties and concerts announced that Ibiza (one of the Balearic Islands) was to have an Augmented Reality (AR) service, providing information about events.⁵⁶ It is an early example of the practical application of the UNS concept, albeit of a rather hedonistic nature, in a sector of vital importance to SIDS. There is scope for more serious applications in:

- Architecture;
- Archaeology;
- History; and
- Literature.

However, this requires the provision of high quality seamless networks and a considerable effort to develop applications. It will, in time, be an implementation of the UNS.

Conclusion

Very few island micro-states or micro-territories have the statistical basis, either in terms of demand or of supply, to specify the policies and actions required to achieve truly universal service. This requires surveys of their populations, especially of the poor and the disabled, covering their use of ICTs, their levels of spending and their views of the affordability of charges and any limitations in their use of devices and services from disability and illiteracy. In particular, there is a need to map the availability of network services, which for 3G and

⁵⁵ Hitoshi Mitomo & Nobuyuki Tajiri (2010) “Provision of universal service and access over IP networks in Japan” *Telecommunications Policy* 34 (2) 98-109.

⁵⁶ *Pacha to bring augmented reality to Ibiza in 2010*. PRNewswire, 12 May 2010.

<http://www.prnewswire.com/news-releases/pacha-to-bring-augmented-reality-to-ibiza-in-2010-93582554.html>
See also <http://www.pacha.com/>

LTE requires measures of quality of service and experience, for example, jitter, delay and transmission speeds.

The phenomenon of people carrying two phones or two (or more) SIM cards is the result of unaddressed market failures. Operators seem content to share revenues through carrier selection by physical device, which is far from being economically efficient. Regulators and researchers need to analyse the underlying market failures and to identify the costs and benefits of forcing operators to accept inter-operator calls at affordable rates. Rather than spending years in litigation to grind down mobile termination rates it may be easier to follow the example of Hong Kong SAR and, after a brief delay, switch directly to bill and keep.

Geographical coverage by mobile network operators can be extended through national roaming and mast sharing, helping to close the market gap. Where it is necessary, to help close the access gap, subsidies can be provided for the construction of additional masts, subject to their being open access to avoid damaging competition.

Broadband coverage is at a much earlier stage, so that the appropriateness of interventions is less certain. The licensing of additional operators, especially using wireless technologies can clearly help, with further benefits from the sharing of passive infrastructure such as ducts and masts. However, measures such as local loop unbundling and bitstream access are less likely to be effective, give the absence of economies of scale in most SIDS markets and would require very careful consideration. For the present, measures are being taken to close the market gap much more than the access gap. There is considerable scope for research on the provision of broadband access and backhaul in very small markets.

As with the problems of scaling other regulatory interventions, it is neither simple nor straightforward to reduce universal service funding mechanisms down to the size of the SIDS. While reverse auctions are conceptually interesting, they have no application, since very few SIDS have sufficient plausible bidders and thus the outcomes are too predictable. For all the complexity of the processes followed in Singapore, the outcome of its selection of operators for its FTTP network was rather predictable at least in terms of the players, if not the prices.⁵⁷ There is no obvious reason to expect auctions would prove more disruptive elsewhere.

A universal service fund is increasingly being introduced into legislation by SIDS, seemingly at the instigation of aid donors, rather than based on examples of best practice. Despite this, it seems much less frequently to be operational. Transfers amongst the customers of two or three operators could easily incur more costs and inefficiencies than the net benefit for customers without access to a service. Unfortunately there are no impact assessments to indicate the contrary, though this creates an opportunity for further research.

A tax on users to supply a universal service fund, even dressed up as a levy on operators, risks having significant regressive effects, by reducing the affordability of services for the very poor. This requires an impact assessment, evaluating how sensitive users are to price levels in general and to specific charges.

Disbursement of the monies raised for universal service funds has proved surprisingly difficult, with risks of corruption, inefficiency and delay. Given the small number of players it is easier and, arguably, more efficient to set targets for operators in terms of accessibility, affordability and coverage. Where governments have access to revenues which have been raised in a non-regressive way (e.g., charges on the financial services sector or fees to drill

⁵⁷ Ewan Sutherland (2009) "Optical fibre networks and the recession" presented at *8th Conference of Telecommunication, Media and Internet Techno-Economics – CTTE 2009*, Stockholm, 15-16 June 2010. <http://papers.ssrn.com/abstract=1523648>

for oil), the fund can usefully be supplemented by state aid, in order to close the access gap. The use of the fund must be transparent and competitively neutral.

Many mobile network operators use tourists and migrants as informal alternatives to a universal service fund, transferring money from international mobile roaming and incoming international calls to pay for network construction and to subsidise local charges. For the most part those paying would not object, though it would help such charges explicit and to ensure that the prices are optimised and that the revenues are not used to inflate profits or whittled away in competitive pricing of mobile handsets.

In particular, it is important for governments and regulators to understand the likely effects of economic downturns on tourist numbers and how this might affect mobile network operators. While measures such as a tax on incoming international calls might seem attractive as a way to raise money for network construction, it also creates opportunities for avoidance through use of an illegal termination market, corruption to avoid paying the tax and arbitrage using callback, facilitated by remote top-up of stored credit for mobile customers. Higher international calling rates are likely to reduce remittances, which could have a very much greater economic effect than any tax revenues raised. The links between the costs of international telephony and the flows of remittances require further research.

From the menu of options, governments have to select the most likely options and to subject them to formal evaluation through an impact assessment, before selecting the most appropriate solution. Then they must review progress after two or three years of operations.

Acknowledgements

To Svetoslav Tintchev of the World Bank and to colleagues at LINK (University of the Witwatersrand) and CRID (University of Namur). To SOAS for use of its excellent library.