WHITE PAPER

ON BROADBAND REGULATION AND POLICY IN ASIA-PACIFIC REGION

FACILITATING FASTER BROADBAND DEPLOYMENT

15 November 2016

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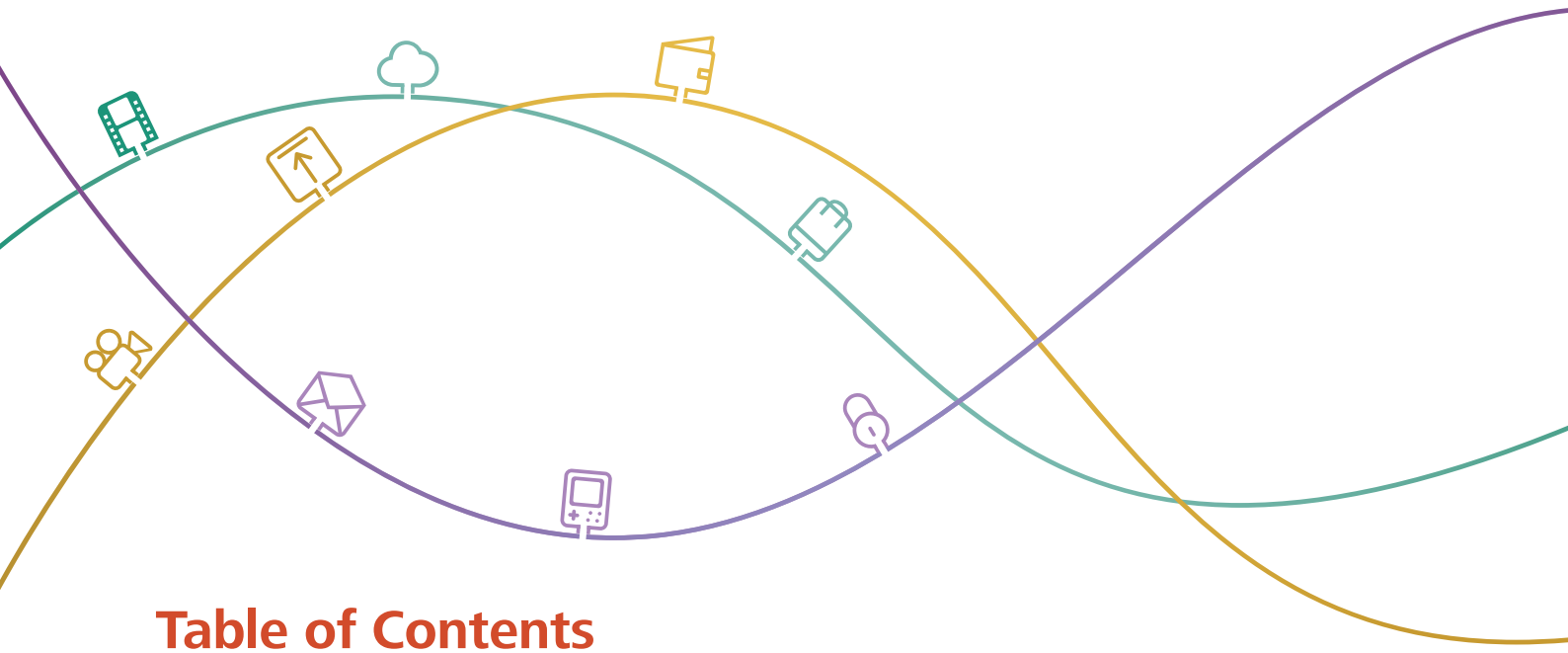

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Importantly, the views and opinions expressed are those of the author and may not necessarily reflect those of ITU or its membership. Any errors and omissions are those of the author.

EXECUTIVE SUMMARY

BROADBAND IN THE APAC CONTEXT

This White Paper strongly endorses the position that Information and communications technology (ICT) has had and will continue to have a profound impact on economies and societies throughout the world. Rapid advances in telecommunications technology, computing, storage and audio-visual systems have allowed countries to leverage existing areas of comparative advantage as well as to establish new industries, develop new skills, drive productivity and competitiveness, and produce new products for consumers.

Aside from its economic contribution, ICT has the potential to create a more inclusive society by creating better access to information and learning resources, access to government, health and financial services, and better-connected communities. Investment in ICT is seen by governments as being essential to improving people's lives, in addition to its economic role in improving growth and productivity.

One of the core themes on this paper is the in-scope countries, Bangladesh, Cambodia, India, Lao PDR, Myanmar, Sri Lanka, Thailand and Vietnam (the APAC 8) face an enormous opportunity to improve their economic performance and social outcomes via improve telecommunication service and, in particular, through better broadband.

The APAC region can learn much from the extensive broadband deployments that have occurred in more advanced nations. But the APAC context is different and the broadband development strategy needs to reflect this.

BEYOND WIRELESS LEAPFROGGING

One of the central narratives of telecommunications and broadband development in the region has been 'telecommunications leapfrogging' - simply put, that later developing countries could avoid the huge cost of landline deployments and use wireless technologies to leapfrog the landline paradigm.

This White Paper argues that the 'leapfrogging era' is drawing to a close. While wireless technologies are undergoing tremendous improvements, they will not be enough alone to be the communications drivers of APAC growth. The economies of the region are growing rapidly and developing more sophisticated services and technology businesses as well as more advanced educational institutions. Wireless alone will not be enough. High speed fibre connections are required for sophisticate enterprises, educational institutions and governments.

In addition, in areas where wireless will continue to carry the broadband load into the foreseeable future, the base stations that serve wireless users will need to support the very high traffic enabled by 4G and, soon, 5G technologies.

THE ADVANTAGES OF COMING LATER TO WIRED BROADBAND

Coming later to broadband deployment – especially optical fibre rollout - provides an excellent opportunity for many Asia-Pacific countries (especially the APAC8).
With rapid growth comes many Greenfields developments which should be fibre from the ground up. to leapfrog ahead and deploy fibre solutions which should provide a degree of technology future proofing especially if done properly in terms of ducts and other infrastructure. The need to upgrade the infrastructure of rapidly growing cities provides an opportunity tightly coordinate road, electricity and water reticulation with broadband deployment.
Fibre technologies are also improving rapidly. By coming later to fibre deployments, APAC can benefit from cheaper and better technology and from the lessons learned in earlier deployments. This is not a message of complacency, the time to develop clear, effective broadband strategy is now and this White Paper is intended to provide the appropriate guidance.

RECOMMENDATIONS

In this context, this White Paper considers that for many Asia-Pacific markets and especially the APAC8 which have been the subject of special study in this paper, an 8 point action plan is needed, namely:

➢ RECOMMENDATION 1

WHILE WIRELESS BROADBAND IS EXCELLENT, FIXED BROADBAND IS THE CRITICAL INFRASTRUCTURE TO DIGITAL ECONOMY

Wireless broadband while excellent and getting better, cheaper and faster is, by itself, insufficient for a modern nation and to underpin a digital economy.

➢ RECOMMENDATION 2

OPTICAL FIBRE NETWORKS ARE NECESSARY TO SUPPORT GROWING DATA TRAFFIC

High speed broadband services, namely delivered through optical fibre are necessary as a minimum for (i) enterprises and Government and (ii) are required for backhaul transmission to support the growing traffic volumes (including especially video content) being delivered over wireless networks now and into the future.

➢ RECOMMENDATION 3

OPTIMAL APPROACH TO DRIVE BROADBAND PENETRATION IS TO CONCURRENTLY FACILITATE BOTH FIXED AND WIRELESS SERVICES

The optimal approach to delivering national broadband services is multi-mode competition. Under this approach the wireless mobile industry which has been very successful in underpining regional and national economic growth would be strongly supported by Government policy while concurrently steps would be taken to accelerate fixed broadband infrastructure.

➢ RECOMMENDATION 4

DEVELOPING A SUPPORTIVE REGULATORY FRAMEWORK WOULD FACILITATE BROADBAND ROLLOUT

Significant effort now needs to be directed by Asia-Pacific Governments and regional institutions like ASEAN and the SAARC to draft regulatory and legal frameworks based on global and regional exemplars to facilitate efficient and optimal fixed broadband deployment which, in part, will support 5G services. This includes inter alia enhanced rights of way (ROW)

access, a new telecommunications code for low impact facilities, establish one-stop centres, and 'dig once' policies. Such measures will materially reduce the costs of optical fibre deployment and hence shorten the investment payback periods.

➢ RECOMMENDATION 5

STRATEGIC POLICY INTERVENTIONS WOULD ENABLE EFFICIENT DEPLOYMENT AND MORE AFFORDABLE BROADBAND

Recommended detailed policy interventions are also needed in Asia-Pacific (including the APAC8 markets) including policies and rules to share essential infrastructure between operators, actively promote infrastructure sharing and re-use of Government assets based on global exemplars, co-ordinate infrastructure construction and formulate standards and rules for fibre deployment, development of greenfields estates and substantially improve international connectivity.

➢ RECOMMENDATION 6

STRENGTHENING AND REFORM OF INCUMBENT OPERATORS IS NECESSARY OR IF REQUIRED, NEW COMPETITORS SHOULD BE LICENSED

It is critical to strengthen and reform incumbent operators (who for the main part continue to remain Government owned especially in the APAC8) in order to secure viable and properly scaled optical fibre deployments. This includes allowing them to more effectively compete by inter alia the relaxation of any restrictions, removal of subsidies, strengthen management etc. In the APAC8, Vietnam, and Thailand (in progress) have already taken steps to make their incumbent operator globally competitive, domestically strong and financially viable.

Should those incumbent operators not be able to perform this role then new licensees should be provided with an opportunity to make the requisite investments. Consideration should also be given, if sufficient funds exist, for national broadband network project given the success of such projects globally and regionally.

➢ RECOMMENDATION 7

MAKE AVAILABLE SPECTRUM FOR WIRELESS BROADBAND SERVICES AT AFFORDABLE PRICES

Ensure the availability of technology neutral IMT spectrum for wireless broadband services including for 4G/LTE, LTE-A and 5G services at reasonable prices. It continues to support the wireless mobile industry which has been very successful story and have helped underpin regional and national economic growth. This is even more important in the shorter term as longer lead time to address the fixed network deployment issues means that wireless networks will continue to do the 'heavy lifting' for some time to come.

➢ RECOMMENDATION 8

STIMULATE THE DEVELOPMENT AND UTILISATION OF LOCAL CONTENT/APPLICATIONS

Formulate programs and policies which will stimulate the development of domestic content and app relevant for Asia-Pacific markets including in local languages. If the above eight steps are done then it will underpin world class multi-mode broadband competition which will lay the foundation for increased economic growth, social inclusion, and a greater integration of Asia-Pacific markets and its citizens. It would also facilitate the successful transition of the APAC8 into a globally connected world and promote their participation in the global app economy. Such an approach minimises country risk, and starts to address significant deficiencies in the availability of high-speed broadband infrastructure found in many APAC8 markets.

1

BROADBAND IN DIGITAL SOCIETIES

1.1 Introduction

➢ BROADBAND: A WORK IN PROGRESS

Broadband appears to be, always and everywhere, a work in progress. Improving broadband access and connectivity is turning out to be a task that is never finished irrespective of the level of a country's economic development.

This paper explores the state of play in broadband in the Asia-Pacific region with a specific focus on Bangladesh, Cambodia, India, Lao PDR, Myanmar, Sri Lanka, Thailand and Vietnam[1]. It examines best practice in strategy, policy and regulation to encourage deployment of broadband infrastructure and increase broadband adoption levels in households and businesses. It has been especially prepared as part of ITU Telecom World 2016 being held in Bangkok, Thailand in November 2016.

Even before the end of the 1990s, at least in developed economies, it was already conventional wisdom that broadband would evolve to be regarded as another utility supplied continuously and reliably like water, electricity and gas. Broadband, however, has turned out to be unlike these older utilities in significant ways. The demand for bandwidth continues to grow rapidly even in the most economically advanced nations. For example, audiences are shifting from terrestrial broadcast television to streaming video while video resolution moves from high-definition to 4K and onto 8K greatly increasing the demand for higher bandwidth.

On the wireless front, which is currently the major and preferred form of access for high-resolution video contents on affordable handheld smartphones is expanding more rapidly than initially expected. New technologies associated with virtual and augmented reality, the Internet of things and autonomous vehicles will create new sources of demand for bandwidth. It appears that, as soon as broadband capacity expands, industry and consumers adapt, fully internalise new possibilities and begin to test the bandwidth limits of the latest technologies and infrastructure.

At the same time the bandwidth demand increases, the technologies for delivering it also change. Landline technologies, such as FTTx and xDSL variations, are being extended and improved while private infrastruc-ture companies and government contend with the high cost of the civil works associated with major upgrade to FTTH and even FTTN particularly in the context of reduced economic growth and associated decreased capacity for government funding of fibre and related infrastructure. On the wireless front solutions continue to evolve rapidly with 4G/LTE and LTE-A now becoming common with soon-to-be-deployed 5G solutions offering speed even beyond many wireline access solutions.

The APAC8 countries that are the focus of this paper have levels of broadband adoption that are well-below world average levels. As is now well-understood, later—developing economies will not follow in the footsteps of developed countries when it comes to their own historical paths for broadband infrastructure and adoption. While it was thought that these countries may not develop the level of 'passive infrastructure' (telecommunications ducts and other telecommunications-related civil works for 'plain old telephone services' ("POTS") infrastructure) that exists in advanced economies this needs to be revisited. It may appear that wireless broadband, while essential, can only go so far in underpinning the app economy and fibre deployments are critical especially for inter alia enterprises, for backhaul and for high-end users. As we will describe below, this means that while there should be a wireless first strategy fixed broadband infrastructure cannot be ignored.

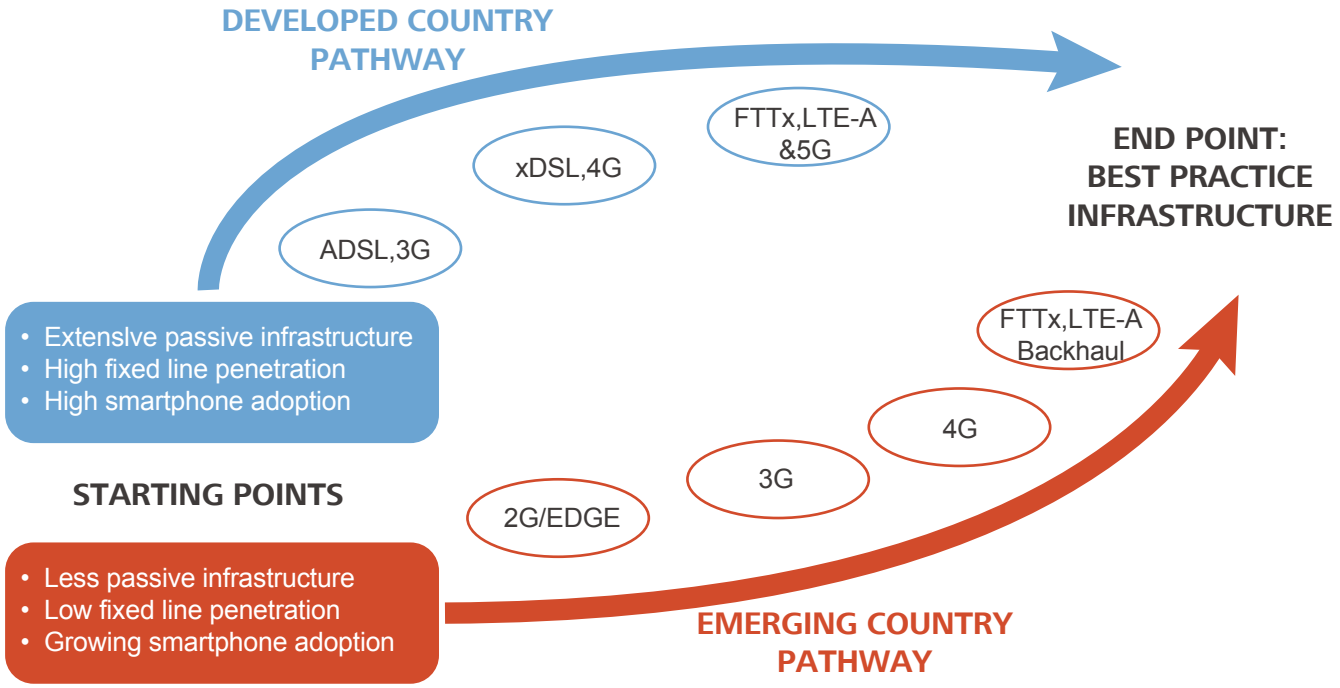
1. This paper will refer to these in-focus countries as the Asia Pacific Countries 8, or APAC8. See Appendix A for a summary of their specific country broadband challenges.

1.2 Optimal Paths to Faster and Fixed Broadband in Asia-Pacific

➢ UNIQUE BROADBAND DEVELOPMENT PATHS

It is perhaps worth stating the obvious: that advanced nations began deploying their telecommunications infrastructure over 100 years ago. The massive changes in technology of the intervening century mean that not only the definition of 'best practice infrastructure' has been completely transformed but also that the efficient pathway from any starting point to such best practice is highly context-dependent (see Exhibit 1 below).

Exhibit 1: Pathways to best practice infrastructure



Source: WPC, October 2016

The evolutionary development path for telecommunications infrastructure in each of these countries needs to be determined on the basis of the best available technologies, their relative costs and performance characteristics along with the strategic priorities of national government and their capacity to contribute to the funding of infrastructure deployments. Complex questions concerning the extent of public provision of broadband infrastructure, end user access and pricing policy, net neutrality, regulation and competition have led to a wide variety of approaches across jurisdictions. There is no single model demonstrably preferable.

Under such conditions, determining optimal regulatory and policy settings to promote broadband development and adoption is more art than science. The lessons from countries with relatively advanced broadband infrastructure need to be observed but are not conclusive because context is so important. Further, ongoing technological change means that the conclusions that work today may not be best tomorrow. In such difficult conditions for the formation of policy, simple conclusions must be held suspect while more nuanced positions are developed.

As in many fields of endeavour, the conclusion that

'much has been achieved but there remains much to do' is also true of broadband development. But in addition, in the case of broadband, it appears the task will never be finished. This makes it all the more important that countries lagging behind in broadband development catch up as soon as possible and position themselves to keep pace with the rest of the world as economies become more sophisticated and the technology of broadband continues to evolve.

More particularly difficult reforms in relation to incumbent fixed operators which were postponed or sidelined as the mobile revolution took off need to be re-activated. The country rewards of having a quality incumbent operator/s, accelerated fixed (fibre) network deployment and competition are manifold. This is seen in a number of markets including South Korea, Japan, Singapore, Australia and recently Malaysia. Reforms in Vietnam and Thailand are attempting to do similar.

➢DUAL OBJECTIVES OF BROADBAND POLICY: ECONOMIC DEVELOPMENT AND SOCIAL INCLUSION

As broadband becomes increasingly ubiquitous and services and customers become increasingly sophisticated, any country that fall significantly behind in broadband infrastructure, services and adoption will find economic development more and more difficult. The emergence of the app economy with its disruptive challenges to existing businesses and business models, demonstrates the potential productivity and efficiency gains through broadband and wireless technologies. Indeed, for less developed countries, broadband wireless and connectivity in general offer prospect of those countries leapfrogging a whole era of economic development as it occurred historically in more advanced countries. Bottom-up distributed commercial systems are increasingly competing with traditional monolithic institutions and businesses. These connectivity enabled solutions to commercial and economic development were simply not possible at the time countries in Europe and North America, for example, transitioned into advanced economy status. The obvious contribution of broadband to economic development, however, should not cause policy makers to overlook the potential for radical progress to be made in social domains. Broadband has the capacity to facilitate significant social change through greatly increased inclusion and access for socio-economic groups that have traditionally been excluded completely or to some extent in the processes associated with improving living standards. Access to education, medical services in the broader menu of government services can be radically transformed through the introduction of connectivity.

The essential point is that governments are concerned with both efficiency and equity and therefore deployments of broadband infrastructure and services on purely social grounds should be considered alongside those motivated by economic objectives. Having emphasised this distinction, it is important to emphasise also that these two high-level objectives are never hermetically separated from each other – there is significant overlap between them.

Consider, for example, a remote village getting access to real-time information about the prices of agricultural commodities in nearby towns. This not only creates economic efficiencies through better matching of supply and demand and better utilisation of farmland but also enables farmers to increase their incomes and begin the process of creating economic surpluses that can be reinvested to improve agricultural productivity.

The art in developing good national broadband policy consists of balancing the efficiency and equity objectives in the face of the limited resources that are available for developing broadband infrastructure and services. As will describe in the rest of this White Paper, it is critical that the right type of broadband is made available on the basis of the needs of the different target markets versus the cost to serve.

For example, 3G/4G broadband connectivity can make an enormous difference to a remote village that has not previously been connected at all (and requires spectrum) whereas in the cities where more sophisticated businesses are increasingly attempting to compete with the rest of the world. The high speed fibre broadband is much more likely to be a requirement rather than a luxury in terms of gaining a competitive edge.

On the cost side, bringing fibre to remote regions is typically expensive while distances are shorter in urban areas and there is typically passive infrastructure (although not in all places and not in green fields contexts) available to facilitate fibre runs.

Exhibit 2: Broadband policy objectives and regulatory settings

	BROADBAND POLICY FOR ECONOMIC DEVEL OPMENT	BROADBAND POLICY FOR SOCIAL EQUITY
Objective	• Accelerate productivity, global competitiveness • Facilitate sustainable economic growth • Create high skill high income employment	• Improve social equity, access to connectivity • Improve access to government services: healthcare, education • Improve gender equality outcomes and social inclusiveness
Emphasis in broadband policy	• High speed broadband access in high value economic zones • Improve international links • Improve backhaul and backbone capacity • Sharing public/private infrastructure	• Ubiquitous access to basic wireless broadband at affordable prices • Fibre to village connect ing administration offices, school, and clinics should be considered • Provide service coverage to unserved/ underserved areas
Appropriate regulatory settings	• Incentivise investment by ensuring adequate return s on high speed broadband investment, necessary infrastructure capex • Facilitate easier fixed network deployment and fibre read y buildings • Make additional IMT spectrum available at fair & reasonable cost • Promote regulatory certainty	• Access to the sub -1 GHz spectrum (e.g. 700 MHz) at fair & reasonable cost • Subsidies/USO for high per user cost rollout areas • Possible Government focus on fixed network infrastructure/ reforms to facilitate efficient deployment

➢ BROADBAND POLICY AND THE PROBLEM OF FUTURE PROOFING

Clearly, the concept of 'future proofing' is relevant in all decisions about broadband deployment. At the outset it must be stated that future proofing is a very challenging undertaking in the field of broadband because of very rapid technological change. Planners can be confident that the performance price ratio of broadband technology will continue to improve but, within that general improvement, various alternative broadband technologies will move ahead or fall behind alternatives over time.

For example, the performance of legacy copper infrastructure is continuing to improve most recently with the development of the G.fast standard. Depending on the requirements for new users, the improving performance of copper can make FTTx deployments premature and excessively costly compared with

waiting for costs to come down and performance to improve while the demand for bandwidth of end users increase (except in most Asia-Pacific markets including the APAC8 where there is little such fixed legacy infrastructure).

In the case of both fixed and, to a slightly lesser extent, wireless broadband infrastructure deployments, this associated civil works in developing passive infrastructure will almost always represent the major cost component [2] and technological change has a smaller impact on costs in this area.

The high cost of civil works means that it is important to explore ways to reduce these costs (by coordinating the development of infrastructure with other infrastructures such as road and electricity networks) and to ensure that consideration is given to broadband in all types of urban planning. In greenfield situations it is sensible to adopt FTTx solutions and build the associated passive infrastructure at the outset.

Where it is likely that customer access will be wireless for the foreseeable future it will almost always be a good investment to deploy better quality backbone and backhaul fibre links. In general, the judicious development of broadband infrastructure could be characterised as a gradual movement of fibre towards the end user[3], preferably, although not necessarily, using good quality passive infrastructure to meet increased demand for bandwidth and the market density growth.

1.3 What is Broadband?

➢ RECONSIDERING THE ECONOMIC AND SOCIAL DEVELOPMENT FUNCTIONS OF CONNECTIVITY

Much has been written about the definition of broadband and the difficulties involved in creating a useful and durable definition. There are good reasons for stakeholders to agree on an objective definition of broadband. It enables governments and policymakers to articulate quantitative objectives and to assess their progress at any point in time to these specific objectives. It also enables regulators to assess the performance of carriers and undertake interventions where such performance is unsatisfactory relative to objective criteria.

Despite these advantages, forming meaningful and durable definitions of broadband is difficult.

Defining broadband in terms of speed presents several difficulties. First, broadband speed definitions vary widely among countries and international organizations from at least 256 kbit/s on the low end … to faster than 1.5 Mbit/s on the high end (such as in Canada). Second, as referenced in the above-mentioned EU study, definitions based on speed may not keep pace with technology advances or with the speeds services and applications require to function properly. In other words, what is considered "broadband" today may be seen as too slow in the future as more advanced applications technologies develop. Thus, any speed-based definition of broadband will need to be updated over time.[4]

Not only is any useful definition of broadband time and technology dependent, the definition of what broadband is or isn't and the best means by which to achieve it is highly context -dependent. As the ITU puts it:

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2. This is a fact which Google has realized with Google Fiber which is no longer rolling out fibre to any new cities in the US. See www.washingtonpost.com/news/the-switch/wp/2016/10/26/why-google-fiber-is-no-longer-rolling-out-to-new-cities/

3. Perhaps using LTE or 5G services offering for the 'last mile' or part thereof.

4. http://broadbandtoolkit.org/1.2 accessed 22/10/2015. It should be noted that India has increased its minimum speed to 2 Mbps from May 2016. See http://trai.gov.in/WriteReadData/Recommendation/Documents/Letter_to_Secretary_DOT_24_may _2016.pdf

Around the world there does not appear to be a universally optimal broadband technology. Rather, different broadband technologies seem suited to different environments, with relative benefits depending largely on what they are used for. This is corroborated by the fact that a technology that proves successful in some countries may not work well in others, due to economic, cultural, political, geographical, or other factors. Indeed, the medium of choice may depend upon the legacy medium (where existent), the regulatory framework, and the supporting institutional arrangements.[5]

It should be noted that the Broadband Commission had debated earlier on in its life the possible way of defining broadband and conceded that delineations such as upstream/downstream speeds are arguably inadequate due to rapid technological advances. Instead, they believed that focus on core concepts, such as always-on service (the user isn't required to make a new connection to the server each time) and high capacity (capable of carrying lots of data per second) would be preferred alternatives as they would not be as constraining nor subject to frequent revision[6].
These are very important considerations in the formation of broadband policy for Asia-Pacific including the APAC8. Being too focused on quantitated definitions (e.g. see Exhibit 3 below) can lead to inappropriate and wasteful broadband infrastructure deployment decisions, for example, that FTTx broadband solutions should be deployed in remote regions. Fibre connection to villages, especially local municipal administrative office, school and clinic is necessary to carry on public services, e-education and health care programs.
The outcome of such thinking will usually be that once the costs of such deployments become fully appreciated, the original policy objectives will be abandoned over time. This is particularly the case among the APAC8 where broadband costs relative to average incomes are high and the financial capacity of governments is limited. Having said that, the ability to display video is now a key consideration.

Exhibit 3: Entry level broadband definitions

	ENtry broadband definition in practice	
No Definition	Lao,Myanmar,Philippines	
Has Broadband Definition (up/down)	256kbps	Fiji,Pakistan
	512kbps	Bhutan，Cambodia，Idonesia，Nepal，PNG
	1Mbps	Bangladesh，Samoa
	2Mbps	Brunei
	Others	Vanuatu(download 21 Mbps/Upload 12 mbps)

Source: ITU presentation

A more useful focus may be on what broadband does rather than what broadband is. The support for increased broadband access and adoption is based on its capacity to deliver economic and social development goals. As discussed above, a clear focus on economic and social objectives is likely to result in a more effective and achievable broadband development policy.[7] This approach is inherently based on what broadband achieves rather than quantitated definitions of what it is.

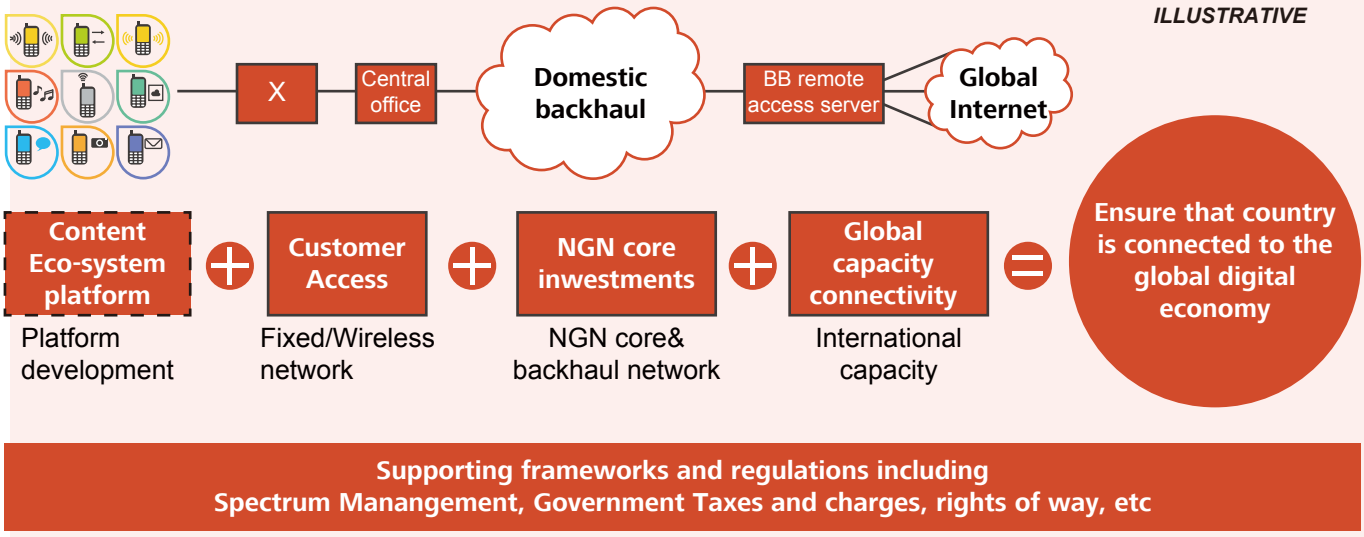
5. *www.itu.int/osg/spu/ip/chapter_seven.html accessed 22/10/2015*
6. *See www.broadbandcommission.org/Reports/Report_2_Executive_Summary.pdf*
7. *For example, this broader social aspect seems to be a priority of the Digital Thailand Plan.*

The relevant question is: what type of broadband will enable immediate economic and social development priorities to be achieved in the particular region or sector being considered. Clearly if a remote village has no connectivity at all, then broadband functionality delivered on 3G/4G mobile infrastructure will be a huge improvement. In another context, a business that is struggling with unreliable ADSL connections will be able to increase its productivity and connectivity to global and regional markets if reliable fibre based broadband becomes available. This approach could be described as a 'value-based approach' to broadband deployment. The objective is to maximise the economic and social development outcomes per dollar spent on infrastructure deployment. In aggregate, planning on this basis will deliver the maximum possible economic and social outcomes for the resources deployed by governments in Asia-Pacific on broadband development.

1.4 The Broadband Ecosystem

It is also important to highlight that broadband services are provided as an ecosystem for connectivity and content to consumers. Broadband policy and the broader regulatory environment must therefore address all aspects of the end to end broadband system including but not limited to devices, content, access network, backhaul, NGN core and international connectivity. This is illustrated in Exhibit 4 below.

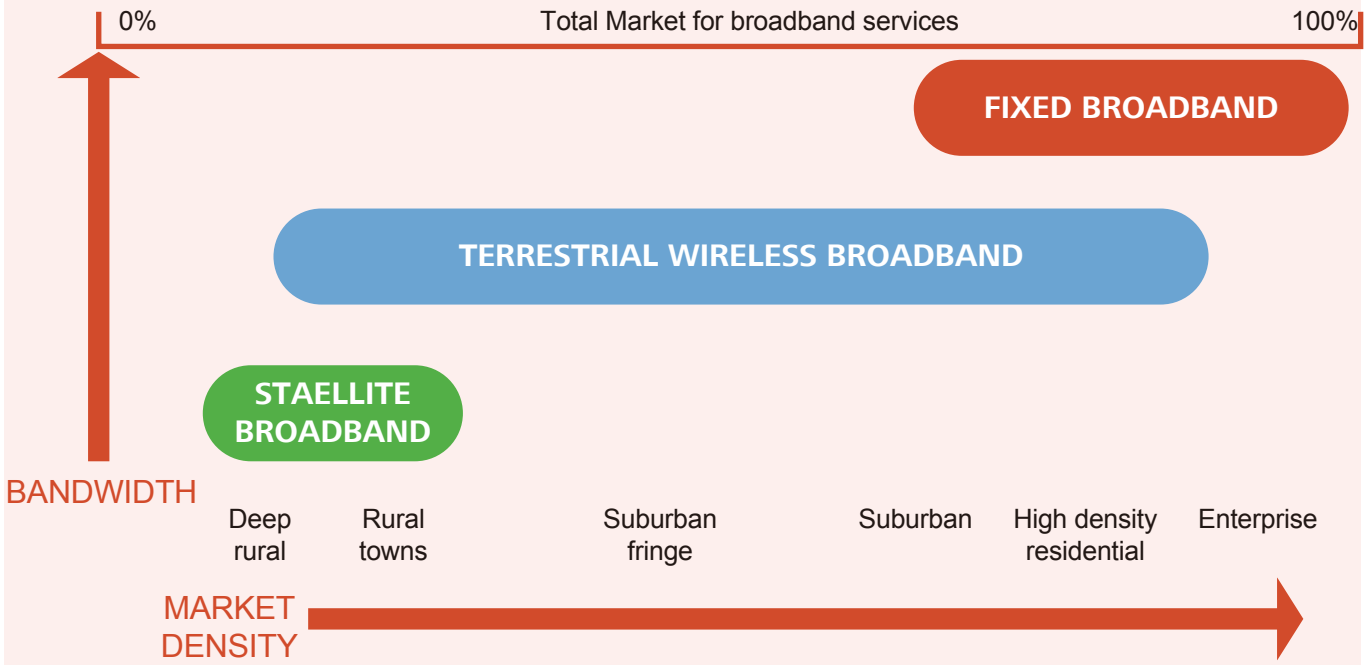
Exhibit 4: Broadband ecosystem



Source: Modified version of ITU, Guidelines for the Preparation of National Wireless Broadband Masterplans for Asia Pacific region, October 2012, page 2.

It should be highlighted that while this White paper encompasses all technologies it focused on faster wireless and fixed broadband services given the existing widespread deployment in Asia-Pacific (including the APAC8 countries) of a wireless broadband services. Such services are mainly provided utilising 3G and 4G technology. The paper does not assess new satellite options. This fact ought to be noted by any government or regulator who may wish to utilise this White Paper to inform its national broadband policy, masterplan and/or regulatory arrangements. It should be noted that depending on the deployment of fixed broadband services, the degree to which wireless broadband services complement rather than substitute for such fixed broadband services in any market will vary as will satellite delivered broadband (see Exhibit 5 below).

Exhibit 5: Overall market broadband provisioning



Source: WPC, 2016

Understanding the relationship between market density (the potential broadband revenue per unit of geographic area), the capacity of various broadband technologies and their relative costs is essential for determining (i) efficient allocations of capital for broadband infrastructure development in a way that maximises utility for users per dollar spent and (ii) for achieving 'fitness for purpose'. For example, inner city areas with high market densities and enterprise users demand high speed broadband both require and support the cost of FTTH/B connections. Likewise each and every wireless base station (or more correctly e-Node B) will require 10 Gbps wavelength services to provide the wireless network's backhaul capacity.

As shown in Section 4.2, there are very large differences in the costs of deploying fixed broadband infrastructure across the APAC8. There are number of policy changes which are discussed in Section 6 which, if adopted would significantly reduce deployment costs in the APAC region and result in higher cost countries coming more into line with regional averages.

In particular, those policy interventions associated with sharing of essential infrastructure, orchestrating infrastructure construction and the efficient assignment of government assets, will all contribute to reduced deployment costs. It is likely that the adoption of such pro broadband policies by regional governments would be a significant positive signal to both internal and overseas investors. And would be likely to attract substantial volumes of funds for investment in broadband infrastructure. Such policies not only a proactive broadband footing on the part of national governments, but would also signal to investors are likely rapid future growth in broadband uptake and a move towards maturity in the domestic broadband market.

2
Broadband Market Overview

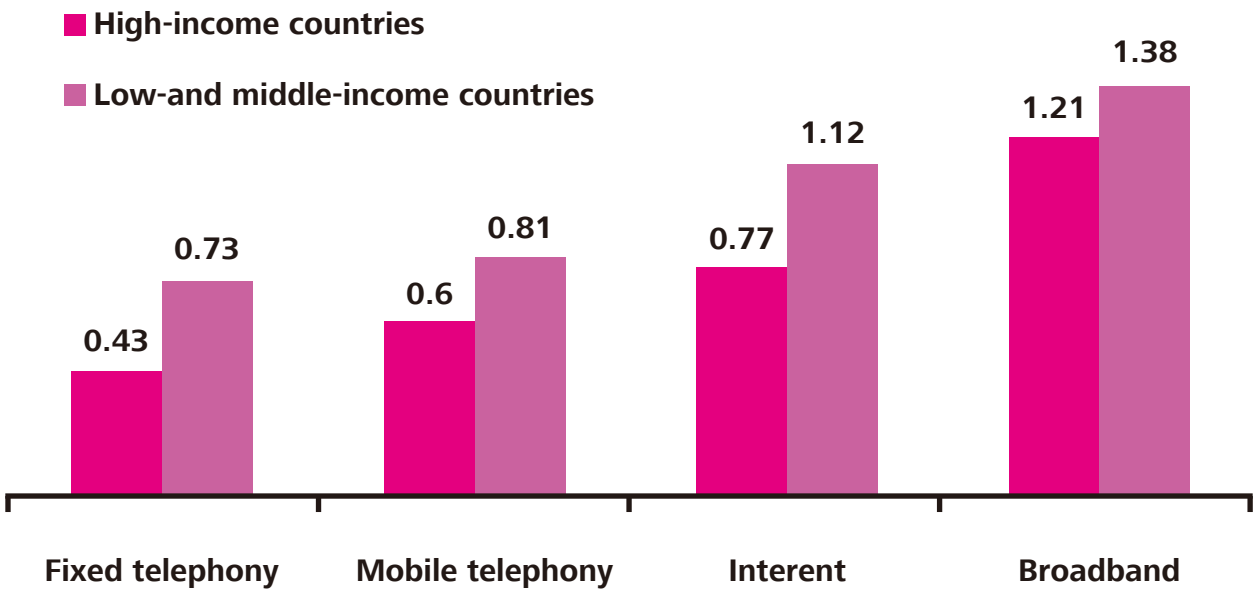
2.1 Socioeconomic impacts

2.1.1 An economic revolution powered by hardware, software and broadband

Studies that indicate the positive impacts of telecommunications penetration on economic growth now go back as far as 2001[8] . This early study examined OECD countries and was for the period 1970 to 1990. This is a reminder that quantitative economic studies that aim to reveal relationships between economic variables require long term data sets in order to establish statistic significance in their analyses. Another of these early studies[9] (2004) was based on data from developing countries in the period 1990 to 2001 and showed that, in these countries, the role of mobile telephony was more important that landline telephony in economic terms in relation to national output.

One of the earlier studies on the contribution of broadband to economic growth by the World Bank[10] estimated that each 10 percentage point increase in broadband penetration accelerated economic growth by 1.38 percentage points in low and middle-income countries (see Exhibit 6). In contrast to the study by Sridhar and Sridhar, the World Bank study finds that the boost to economic activity is greater in less developed economies.

Exhibit 6: Growth impact of telecommunications
(GDP percentage point increase due to 10 percentage-point increase in penetration)



Source: World Bank 2010

8. Roller and Waverman (2001), Telecommunications Infrastructure and Economic Development: A Simultaneous Approach," American Economic Review, American Economic Association, vol. 91(4), pages 909-923, September, page 921

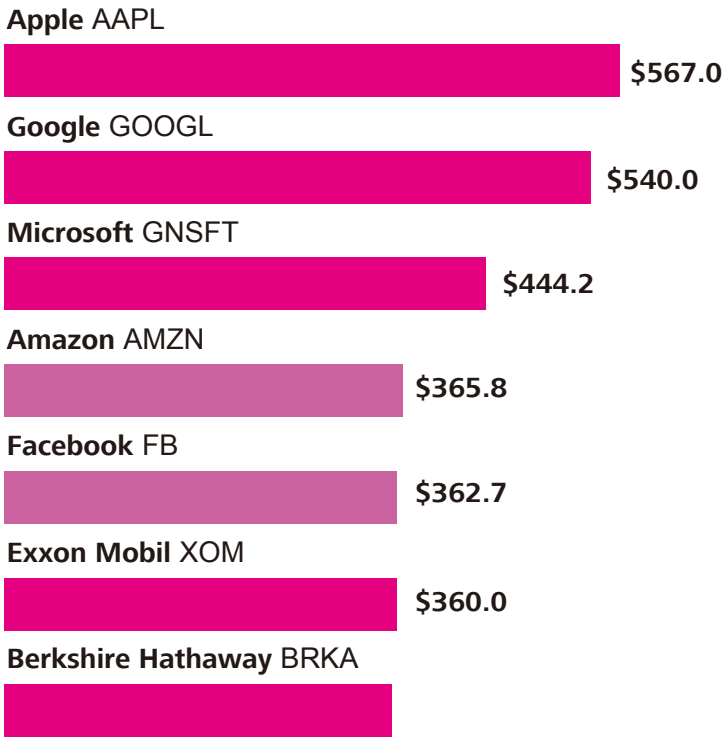
9. Sridhar, Kala S. and Sridhar, Varadharajan. Telecommunications Infrastructure and Economic Growth: Evidence from Developing Countries, National Institute of Public Finance and Policy (New Delhi, India) Working Paper No. 14, 2004

10. Yongsoo Kim, Tim Kelly, and Siddhartha Raja, Building broadband: Strategies and policies for the developing world, Global Information and Communication Technologies (GICT) Department, World Bank, January 2010 and Christine Zhen-Wei Qiang and Carlo M. Rossotto with Kaoru Kimura, Chapter 3 Economic Impacts of Broadband, in World Bank, Information and Communication for Development 2009: Extending Reach and Increasing Impact (IC4D2009).

Another example of the economic benefits of broadband services is the study conducted by Windsor Place Consulting for Telekom Malaysia and Economic Planning Unit (EPU) of the Malaysian Prime Minister's Department in 2007[11]. This report provides a high-level cost benefit analysis of Malaysia's (then planned by now successful) high speed broadband (HSBB) project found that that the deployment of enhanced broadband services will generate significant economic benefits for Malaysia. The cost benefit analysis model projected a 1.12 percent boost to GDP by 2020, the generation of an estimated 150,000 new jobs by 2017 and a benefit cost ratio 6.2. WPC also highlighted that, in addition to the benefits that were quantified in the cost benefit analysis, significant qualitative and social benefits were likely to result from wider broadband adoption.

Following the experience of the dot com crash 2001, there existed significant doubts about the contribution of the information economy to broader economic development and growth. Many argued that the so-called 'new economy' was an illusion and that countries should concentrate on traditional industries such as manufacturing, agriculture and mining. In 2016, however, the economic significance of the information technology sector is beyond any dispute. On 29 July 2016 USA Today reported that the five largest publicly traded companies in the world by market capitalisation were information technology companies: Apple, Google, Microsoft, Amazon, and Facebook. This is an astonishing example of economic and industrial change considering that Microsoft was the only company in the top 10 companies in 2007.

Exhibit 7: The top 5 public traded companies are technology companies (USD billion)



Source: USA Today, July 29

What is the significance of this milestone for assessing the socio-economic impact of broadband? In essence, stock markets create estimates of the capacity of companies to generate future earnings. Leaving aside important questions about the market power of these new technologygiants, the market capitalisation of these companies reflects their capacity to create value for consumers and therefore for society at large. For all these companies, broadband services are a critical component in their value chain. Apple, for example, could not have possibly achieved its current status as the largest publicly traded company in the world, without the iPhone and the iPhone (and hand-held mobile devices in general) could never have

11. WPC, A high level cost benefit analysis of Malaysia's broadband deployment, 17 December 2007, unpublished.

achieved the success that they have enjoyed without widespread fast wireless broadband networks by the mobile network operators. Google's lifeblood of search is delivered through broadband traffic and Amazon's sales are predicated on ubiquitous access to broadband by its customers.

It is also worth emphasising that, while these industry-leading companies are clearly at the centre of the transformational app economy, there are many other smaller technology-based companies that are causing significant industrial disruption. These companies include Uber and Didi Chuxing which is significantly disrupting the taxi business, Airbnb which is doing the same for accommodation. Asian companies creating new businesses include Tencent, Naver Corporation, and others. Industrial disruption driven by information technology and ever-growing connectivity will create relentless ongoing pressure on traditional business models and cost structures leading to lower cost products and services for consumers.

Thus, broadband constitutes an intrinsic and important component of the deep industrial transformation that is occurring in the global economy wherein a growing component of economic activity is being drawn into the information technology and communications industries. This means that developing economies cannot hope to evolve mature and balanced economies without high-quality extensive broadband networks. Further, countries that do not enable technology driven productivity growth will fall further behind nations that do.

The ability of a country to foster a modern economy is more dependent than ever on the quality and reach of its broadband services.

2.1.2 Broadband powered social revolution

In its State of Broadband 2016, the ITU emphasises the role of broadband and ICT in creating a 'human centred approach' particularly in relation to the growth of smart cities

> *The concept of a smart city often highlights the advantages of generating greater economic, energy, governance and mobility efficiency. However, 'knowledge cities' build on this concept by putting human beings explicitly at their centre, and focus on greater inclusion, pluralism, participation, education, diversity, creativity and human well-being*[12].

The ITU notes that, while creating greater productivity and other economic benefits, broadband will also create efficiency benefits in the provision of public services. It also emphasises that the role of ICT extends beyond this to ensuring that "citizens have equitable and affordable access to information and knowledge and that their freedoms are protected, including their freedom of expression." [13]

In particular, broadband and ICT can significantly increase access to education for groups previously excluded. The ITU also sees significant roles for technology and connectivity in the promotion of gender equality, cultural awareness and greater tolerance of diversity.

Along with these benefits, however, challenges and risks including: rising inequality, both in terms of income and wealth as well as a potential widening of the digital divide; job losses to automation; and threats to individual privacy and freedom.

These challenges point to a pressing need for innovative regulatory and policy responses. Since the process of digital disruption is intimately entwined with the ongoing process of globalisation, it will be necessary to develop many of these regulatory and policy responses within the context of international cooperation. This adds significant additional complexity. To address inequality, for example, it will not be possible simply to develop new redistributive policies within particular national borders-higher marginal personal income tax rates or hire company tax rates are likely to lead to an exodus of talent and capital from nations that impose them. Just as nations have made considerable economic and social progress from cooperating on trade agreements, similarly international agreements in the areas of redistribution, taxation, regulation and the environment will be necessary to achieve significant and durable progress.

12. *Broadband Commission, State of Broadband 2016, Geneva, page 65*
13. *bid, page 66*

2.2 Broadband growth drivers

At the national level, many factors exert an influence on the growth of broadband penetration and its quality. These drivers of broadband growth fall into two broad categories: fundamental economic and commercial drivers and government policy settings.

2.2.1 Contextual economic and commercial drivers of broadband growth

Most countries in the world are still only two decades into the deployment of broadband infrastructure and services at the mass-market level. There is a very broad divergence between the most advanced and least advanced countries of the world in terms of broadband infrastructure deployment and adoption. The fundamental drivers of these differences are the historical and economic conditions within each country at the beginning of the broadband era. More specifically, these include:

1. Historical, political and institutional factors (political instability, prolonged periods of conflict, under-developed institutions/rule of law)
2. Historically and contemporary levels of GDP per capita
3. Aggregate levels of GDP which influence the capacity of the private and public sector to fund broadband infrastructure development
4. The levels of passive communication infrastructure (civil works, telecommunications ducts, etc.)
5. Historical and contemporary levels of POTS landline penetration
6. The distribution of population between urban, suburban and rural areas which significantly determines geographic market density and the cost per userof providing broadband infrastructure.

These factors are pervasive within national economies and are typically very difficult for governments to materially change in the short term. Nonetheless, many countries in the Asia-Pacific region, pre-eminently China, have shown that rapid economic development and ambitious development of broadband services can be achieved in a one to two-decade timeframe.

These contextual economic and commercial drivers of broadband growth exert their influence in myriad ways on both the demand and supply side of the broadband market. In a traditional economic analysis, countries with low GDP per capita have less advanced industrial structures with fewer high-tech companies demanding fast broadband. Those citizens also have a low capacity to pay broadband charges and so, at least from a commercial perspective, the demand is low.

On the supply side, the governments of less developed countries typically have limited resources to deploy broadband infrastructure either by themselves or in partnership with private providers. Advanced economies are a mirror image: high-tech businesses demand fast broadband and depend on their customers having access to it to sell digital products. Customers want both fixed and wireless broadband services (including video content) and have the capacity to pay for it while governments spend tens of billions of dollars of taxation revenue on deploying public broadband infrastructure.

Within the context of these embedded economic fundamentals, government policies and regulation play a highly influential role in the pace and extent of broadband infrastructure development. There is a strong argument that there is an important role of government in promoting broadband inclusion in emerging countries not only in economic terms but also social inclusion and digital equality grounds.

2.2.2 Government policy and broadband growth

Are broadband plans effective? The Broadband Commission notes that there is "… evidence that adopting a NBP increases both mobile and fixed broadband penetration, but debates continue as to the efficiency and effectiveness of NBPs" and cites an independent report undertaken by Nokia and Diffraction Analysis and highlighting the strong benefits.[14]

14. Nokia/ Diffraction Analysis, Government broadband plan: 5 key policy measures that proved to make a difference, 2016

Before exploring that report it is worthwhile to highlight that a range of reports highlight the economic benefits of broadband including the ITU's Impact of Broadband on the Economy Report of April 2012,[15] the Communications Alliances in Australia[16] and the OECD. [17]

Exhibit 8 shows the number of countries in the Nokia/-Diffraction Analysis report that adopted various broadband promoting initiatives.

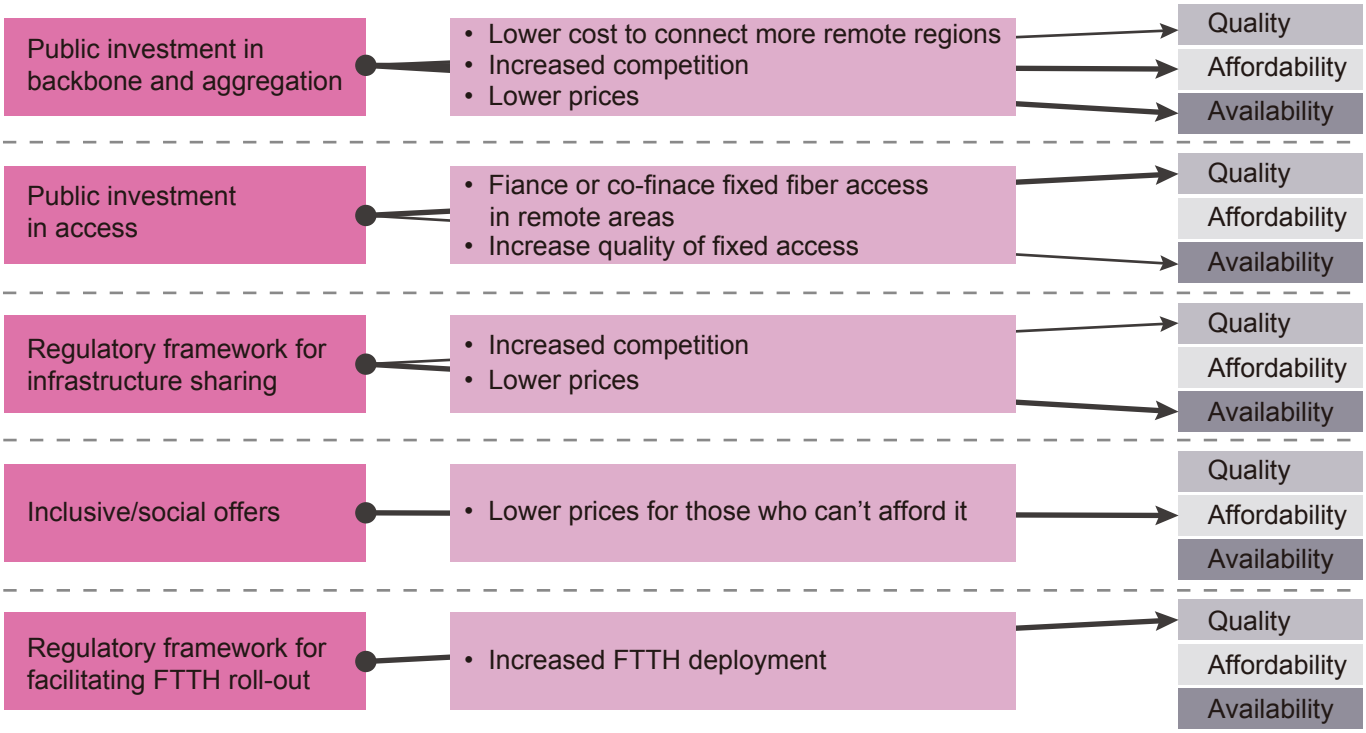
Exhibit 8: Number of countries in the sample that included each initiative in their broadband plan

Initiative	Number of countries
1. Public investment in backbone ande aggregation	15
2. Public investment in access	15
3. Framework for infrastructure sharing	15
4. Inclusive/social offers	15
5. Framework for fiber-to-the-home (FTTH) deployment	15

Source: Nokia/Diffraction Analysis

Exhibit 9 provides details of the expected impact of these initiatives on the quality, affordability and availability of broadband services.

Exhibit 9: Expected impact of five main policy measures



Source: Nokia/Diffraction Analysis, 2016

15. *Available at www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf*

16. *Communication Alliance, Economic Impacts of Broadband for Australia and Globally December 2008 Possibilities and opportunities in a digital world, December 2008, Available at www.commsalliance.com.au/__data/assets/pdf_file/0016/8413/Economic-Impact-of-Broadband-final.pdf*

17. *OECD, Broadband and the Economy, Ministerial Background Report, DSTI/ICCP/IE(2007)3/FINAL. Available at www.oecd.org/sti/40781696.pdf*

2.3 Broadband market status and forecast

2016 is a watershed year when broadband services will reach more than 50% of global population. This is indeed a significant milestone, and one that has been reached in a little over two decades, notwithstanding the fact that the pre-existing telecommunications infrastructure in some markets where it existed in a relative advanced form made this rate of progress possible. From the glass half empty perspective, however, half of the world's population still does not have access to broadband. But this is changing rapidly.

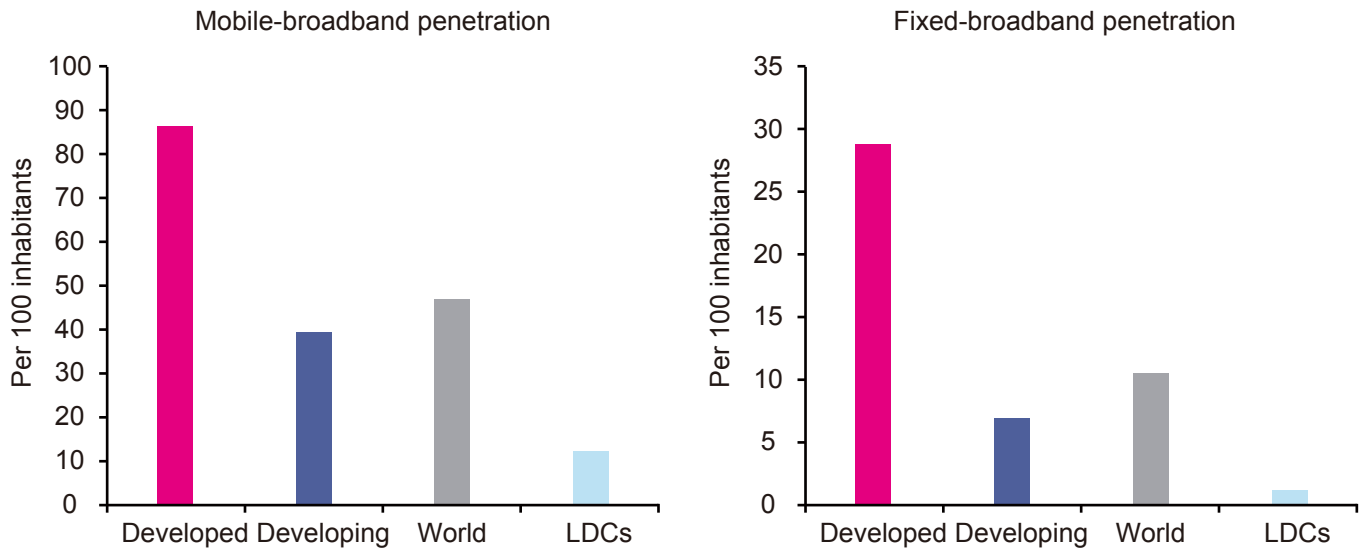
> *Indeed, GSMA (2015) notes that India overtook the U.S. in Q1 2016 as the second largest market in the world for smartphones (with over 260 million smartphones). Mary Meeker (2016) notes that India has overtaken the U.S. in number of Internet users (with an estimated 277 million Internet users) as the second largest Internet market, second only to China. WeAreSocial/Internet World Stats forecasts that mobile will help push Internet penetration beyond 50% of the world's population during late 2016, with 2.7 billion added smartphone "connections" worldwide (it is unclear whether this refers to subscriptions or actively used phones).*[18]

Exhibit 10 and Exhibit 11 show that mobile broadband is more important to Less Developed Countries (LDCs) than is fixed broadband. As discussed above the development path for broadband infrastructure and access for LDCs will inevitably be quite different from that of developed countries. It may seem, from this perspective, that the future of broadband in developing economies is all about mobile. This is, however, relatively simplistic assumption based on the assumption that the future will look like the past. As we discussed below (see Section 3.3.1, Rethinking telecommunications 'leapfrogging') it is likely that many of the developing countries that have relied almost entirely on mobile to achieve gains in broadband penetration. However, they are now entering a period where fixed broadband will play an increasingly important part.

Per capita incomes in such countries are now increasing significantly (and a middle income group is forming), general quality of infrastructure is also improving and governments have greater resources for developing communications infrastructure. Moreover, as these economies mature they will increasingly become reliant on sophisticated modern industries and businesses for that economic growth in these businesses will require the type of broadband (higher speed, always on etc.) that only fixed infrastructure can deliver.[19] Middle and upper income families also typically have more leisure time and can afford broadband services for education, social networking and online entertainment.

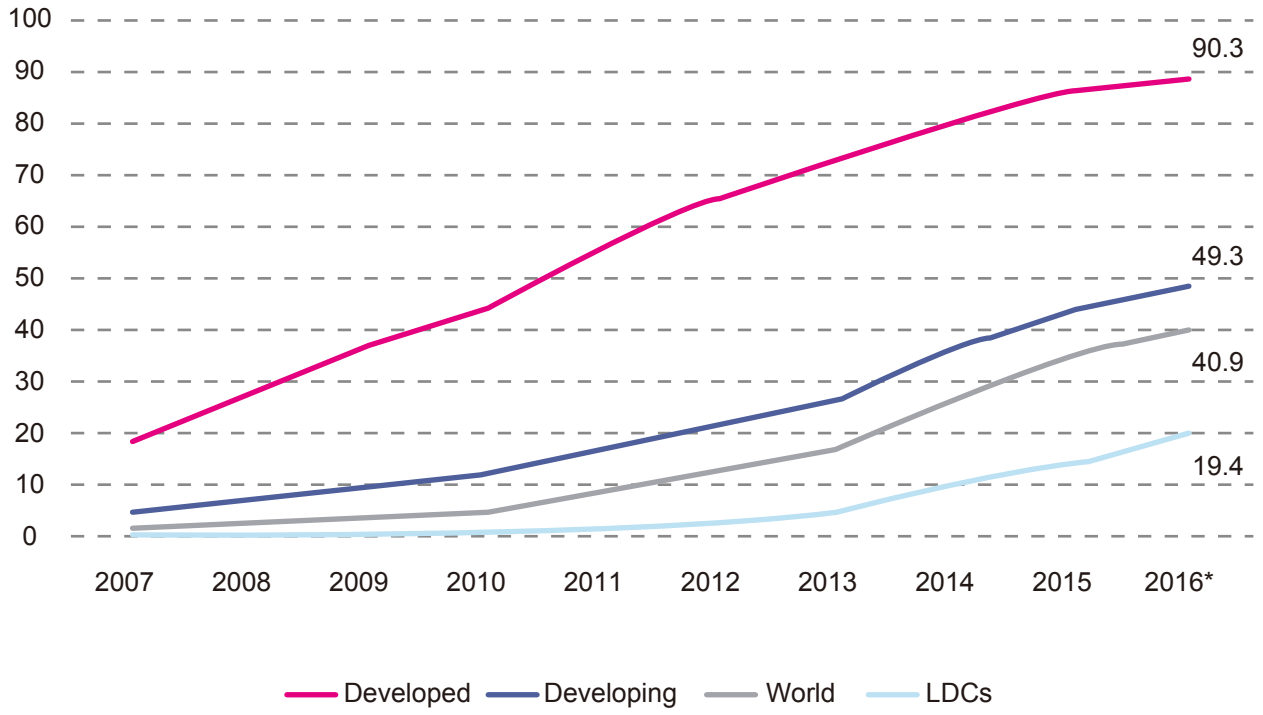
18. *Broadband Commission, State of Broadband 2016, page 22*
19. *Although as stated elsewhere in this White Paper, that fixed infrastructure may be to the last mile or closer – with LTE or 5G techno logy being used for final connectivity.*

Exhibit 10: Estimates of mobile-broadband and fixed-broadband penetration, 2015



Source: ITU, Measuring the Information Society Report 2015

Exhibit 11: Mobile broadband penetration, 2007-2016



Source: Broadband Commission, State of Broadband 2016

In relation to fixed broadband services. Ovum forecast that global fixed broadband subscriptions will achieve 920 million by 2019,[20] while IHS/Infonetics Research estimated that fixed broadband will reach 1 billion worldwide in 2019, driven by growth in South Asia and key emerging markets.[21]

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20. See Ovum, "Global Fixed Voice and Broadband Outlook: 2014-2019", available from http://ovum.com/knowledge- center/

21. See "FTTH, DSL, and Cable Subscribers report", HIS/Infonetics Research, published 9 April 2015, available from: www.marketwired.com/press-release/-2008335.htm

3

Global and Regional Broadband Development Frameworks

3.1 Global frameworks -Broadband Commission

ITU and UNESCO set up the Broadband Commission for Digital Development was established in May 2010 with the aim of boosting the importance of broadband on the international policy agenda, and expanding broadband access in every country as key to accelerating progress towards national and international development targets. The Commission's emphasis is on meeting the UN's Sustainable Development Goals (SDG's) adopted in 2015.
In October 2011, the Commission adopted a set of four broadband targets to be achieved by 2015:

1. All countries should have a national broadband plan / strategy or include broadband in their universal access / service definitions
2. Entry level broadband services should be made affordable in developing countries through adequate regulation and market forces (for example, to be less than 5 per cent of average monthly income)
3. Forty per cent of households in developing countries should have Internet access
4. Internet user penetration should reach 60 per cent worldwide, 50 per cent in developing countries and 15 per cent in least developed countries. [22]

The data in this White Paper indicates that, by 2016, some of these targets have been reached while others have not but in most cases significant progress has been made. The Broadband Commission has a relatively somber interpretation of these developments:

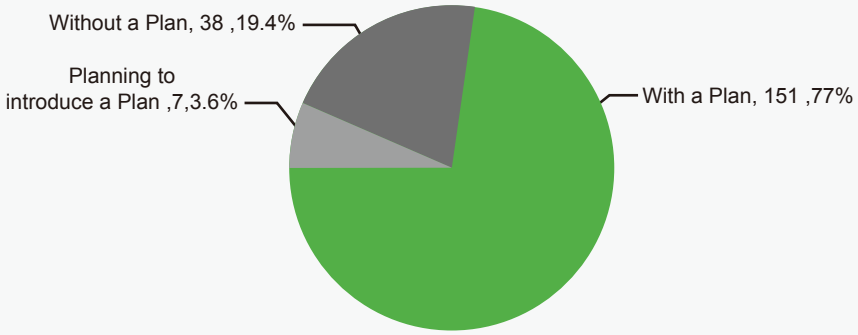
> *Today, in mid-2016, progress in the growth of Internet towards meeting these targets has been mixed, with most targets not yet achieved over the initial timeframe. The third target and target 4 (for LDCs) will be achieved by 2016, with good progress in the first and second targets. The fourth target has not been achieved in the original timeframe (except for LDCs). Regrettably, there seems to be backwards progress in the fifth target calling for gender equality in access to broadband Internet* [23]

In the 2016 annual State of Broadband report the Broadband Commission's emphasis is clearly on the positive effects of increased broadband availability and adoption on "promoting development and empowering each and every individual and society". To this end the Commission specifies five Advocacy Targets:

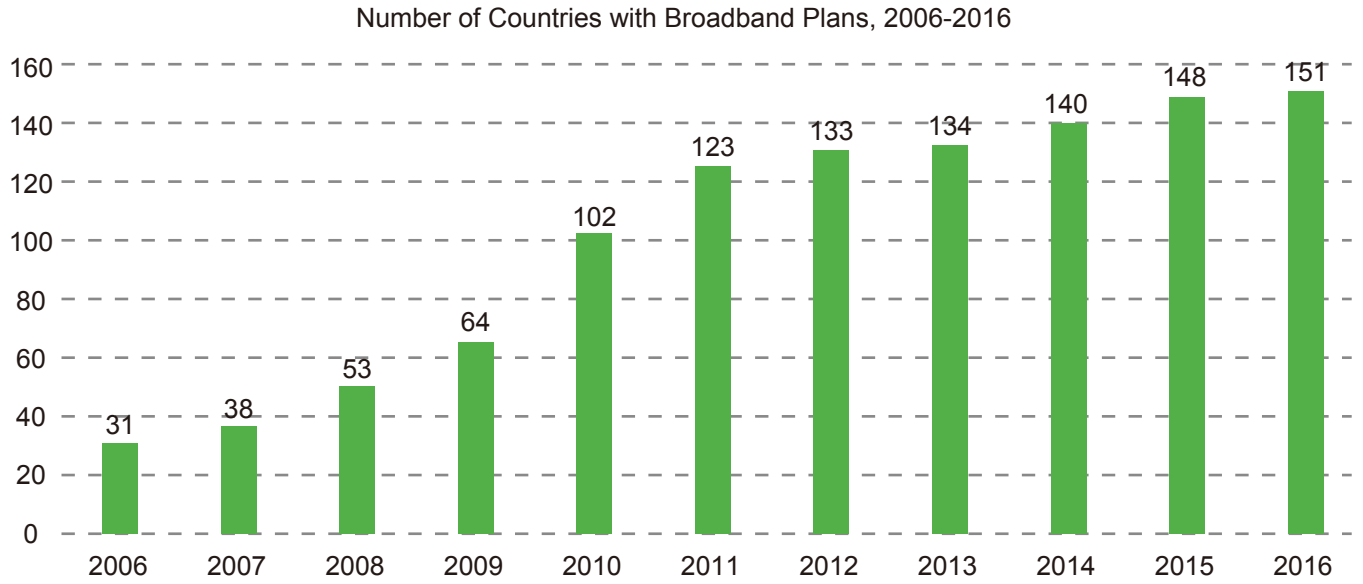
- Advocacy Target 1: Making broadband policy universal
- Advocacy Target 2: Making broadband affordable
- Advocacy Target 3: Broadband homes
- Advocacy Target 4: Getting people online
- Advocacy Target 5: Achieving gender equality in access to broadband by 2020.

All of these advocacy targets are relevant to the formation of best practice policy that is the focus of this White Paper. Achieving the objective of increased broadband adoption begins with the development of National broadband objectives, strategies and policies.

Exhibit 12:
Policy Leadership in National Broadband Plans, 2006-2016



22. *www.broadbandcommission.org/Documents/Broadband_Challenge.pdf accessed 22/10/2016*
23. *Broadband Commission, State of Broadband 2016, page 32*

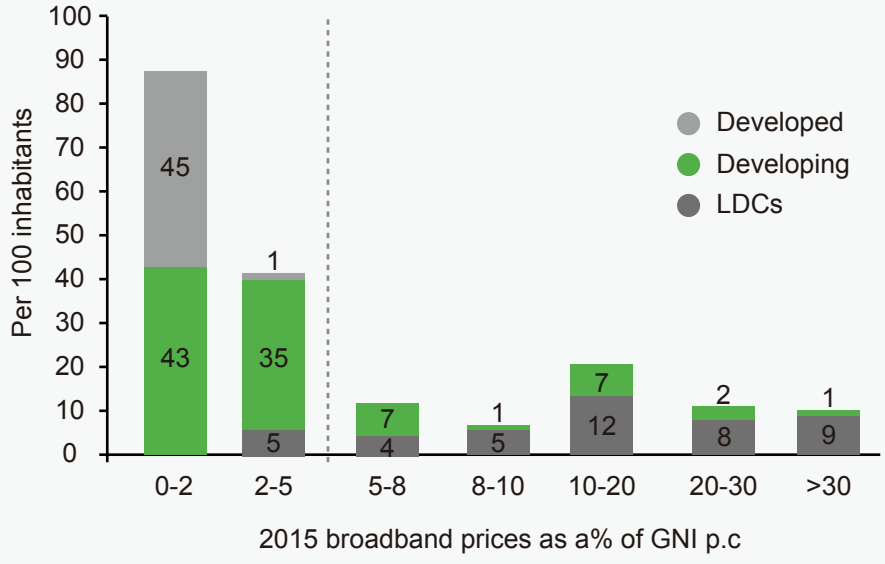


Source: ITU, State of Broadband 2016. Note: Bottom chart based on data for 196 countries. National Broadband Plan or strategy includes: a plan, strategy or policy specific to broadband; digital plan, agenda, strategy or policy; ICT plan, strategy, or policy; or a communication plan, strategy, or policy.

The Broadband Commission states that "Growth in the number of countries with National Broadband Plans (NBPs) has shown good progress over an eight-year period, but has effectively stabilized over the past three years. The number of countries with a NBP currently stands at 151, with 38 without. "[24] It should be noted that this emphasis on the development of broadband plans is not restricted to LDCs with the USA engaged in a recent "flurry of policy activity around broadband".

As Exhibit 13 shows, Advocacy Target 2, Making broadband affordable, is still some way from being achieved. While in all developed economies, broadband charges are between zero and 5% of average income, in LCDs they may be 30 percent of average incomes making them prohibitively expensive even if access is available.

Exhibit 13: Broadband sub-basket, 2015



Source: ITU, State of broadband 2016

24. *Broadband Commission, The State of Broadband, 2016, page 32*

In relation to Advocacy Target 3, Broadband homes, the Broadband Commission reported that:

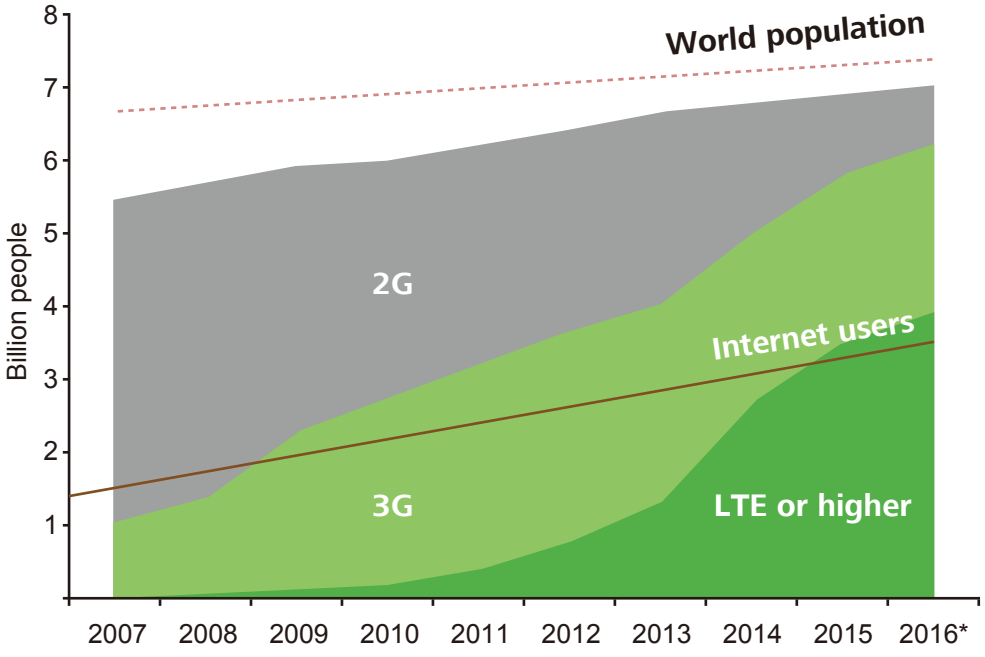
> *Household Internet access shows strong gains. Globally, 52% of total households will be connected to the Internet by the end of 2016, up from 49% in 2015. Internet access for households in developed countries is close to saturation, with 84% or over four-fifths of households connected to the Internet. The proportion of households in developing countries with access to the Internet has increased from 37.6% in 2015 to 41.1% in 2016. This means that the Broadband Commission target of 40% has been achieved. However, this is a global average, which masks strong regional disparities in access.* [25]

Advocacy Target 4, Getting people online, has fallen short of the 2011 objectives. By the end of 2016 about 3.5 billion people or 47.1% of the world's population will be online. "The target of 60% Internet user penetration is unlikely to be achieved until 2021 at the earliest. In the developing world, Internet penetration will reach 40.1% by end 2016 (up from 24% five years earlier)."[26] Interestingly, the target for LCDs to reach 15% should be achieved this year.

Recent data indicates some cause for optimism. 7 billion people or 95% of global population now live in an area that is covered by a mobile cellular network. Broadband capable mobile networks which are defined as 3G or above now reach 84% of global population with the Exhibit 14 rural population means 67%.

Perhaps more surprisingly LTE networks which are highly broadband capable now reach almost 4 billion people. It needs to be emphasised, of course, that coverage does not mean that individuals have the resources to purchase broadband equipment including smart phones or have sufficient resources to pay for broadband fees. Nonetheless, the falling price of handsets including second hand handsets (in some parts of Asia 3G smartphones are priced at USD25 and USD40 will secure a LTE smartphone) coupled with generally rising incomes in the region indicates that significant gains in broadband adoption are likely in the relatively near future.

Exhibit 14: Mobile Network Coverage and Evolving Technologies



Seven billion people (95%of the global population) live in an area that is covered by a mobile-cellular network.

Mobile-broadband networks global population but only 67% of the rural population.

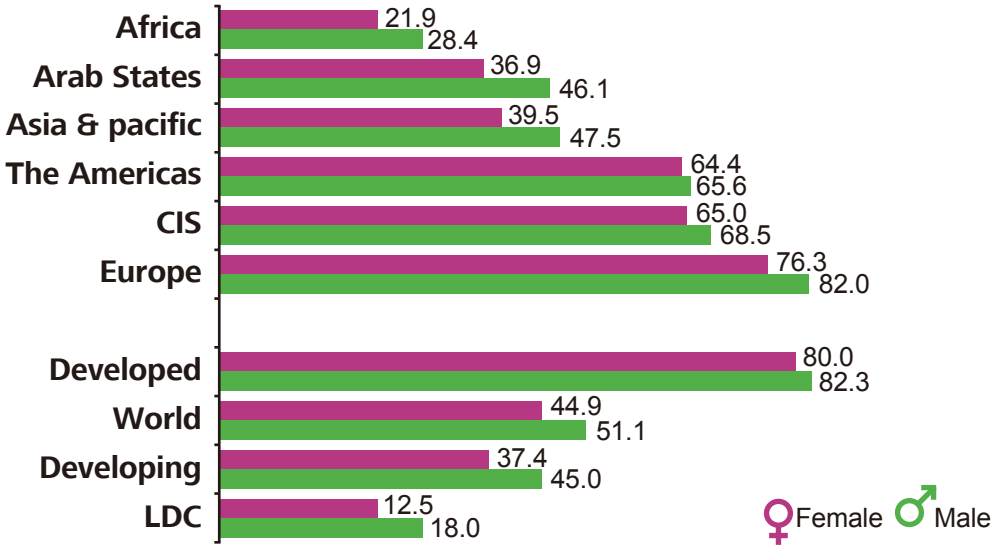
LTE networks have spread quickly over the last three years and reach almost 4 billion people today (53%of the global population), enhancing the quality of Internet use.

Source: ITU presentation.

25. *ibid, page 42*
26. *ibid, page 45*

Advocacy Target 5, Achieving gender equality in access to broadband by 2020, it is obviously a new target and is intended to address the situation illustrated in Exhibit 15.

Exhibit 15: Gender Gaps in Internet Usage (internet penetration rates)



Source: Broadband Commission, State of Broadband 2016

3.2 Regional frameworks

In Asia-Pacific there are two main regional frameworks namely Association of South East Asian Nations (ASEAN) and South Asian Association for Regional Cooperation (SAARC) which may have an influence on domestic broadband regulation. Of our APAC8 countries, 5 are members of ASEAN (ie Cambodia, Lao PDR, Myanmar, Thailand and Vietnam) and 3 are members of SAARC (ie Bangladesh, India and Sri Lanka). We examine each of these below.

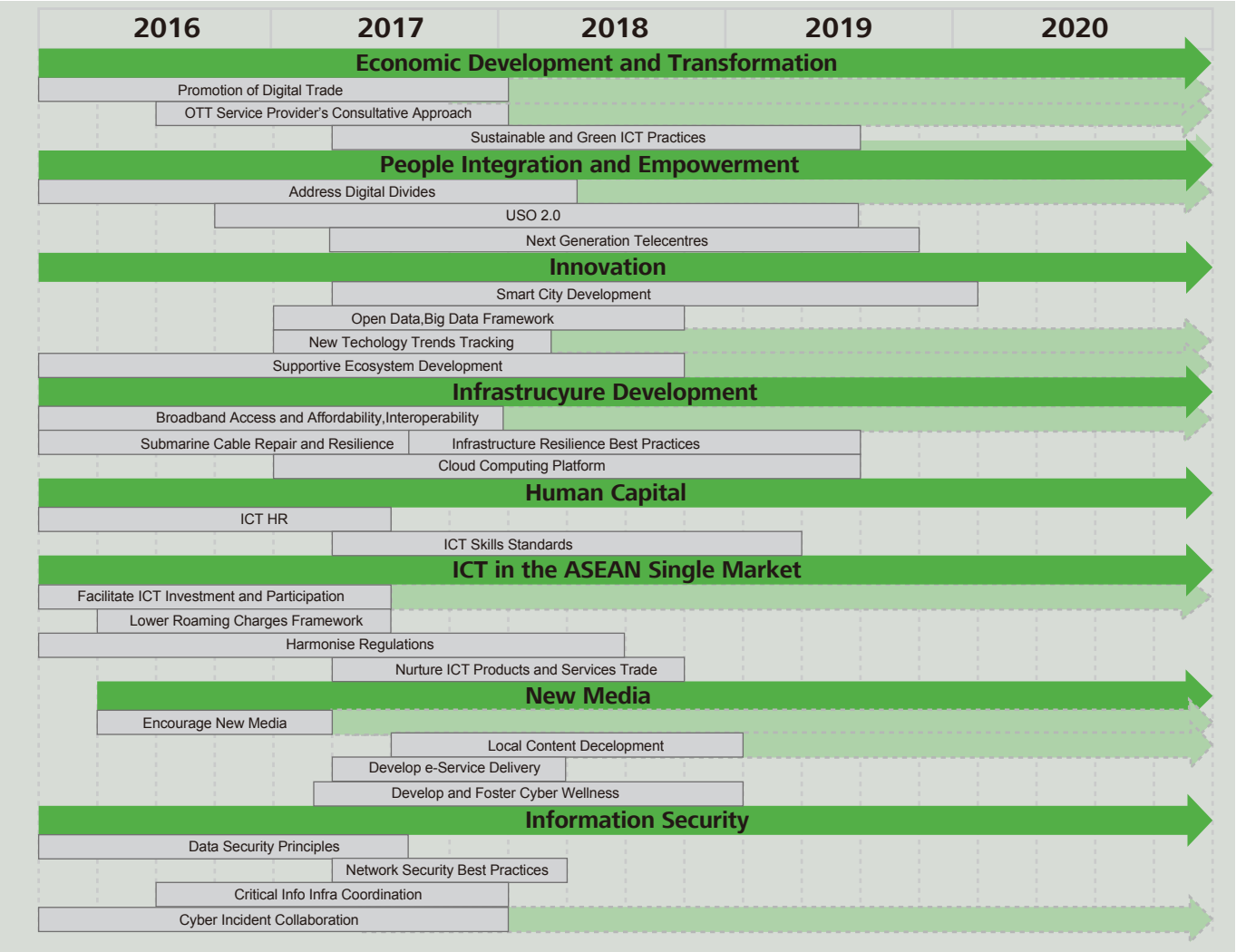
3.2.1 ASEAN Framework

The most recent statement of the ASEAN strategic thinking on broadband is contained in the ASEAN ICT Masterplan 2020. The Masterplan identifies eight strategic thrusts:

1. Economic Development and Transformation
2. People Integration and Empowerment through ICT
3. Innovation
4. ICT infrastructure development
5. ICT in the single market
6. New media and content
7. Information security and assurance.

This Masterplan represents an expansion and deepening of objectives that builds on the 2015 Masterplan. Exhibit 16 provides details and timelines for the ASEAN framework.

Exhibit 16: Details of ASEAN 2020 Masterplan



Source: The ASEAN ICT Masterplan 2020

3.2.2 SAARC

SAARC Members (Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka), are committed to a regional ICT policy aimed at increasing penetration, quality and harmonisation of ICT services. A 'Plan of Action' for telecommunications services has evolved over three SAARC conferences in 1998, 2004 and 2008. The following aspirational goals and objectives were formulated:

- To promote cooperation in the enhancement of telecommunication links and utilization of information technologies within the SAARC region
- To minimize disparities within and among Member States in the telecommunications field
- To harness telecommunication technology for the social and economic upliftment of the region through infrastructure development by optimal sharing of available resources and enhanced cooperation in technology transfer, standardization and human resource development;
- To evolve a coordinated approach on issues of common concern in international telecommunications fora.[27]

27. *www.saarc-sec.org/areaofcooperation/cat-detail.php?cat_id=56 accessed 22/10/2016*

At subsequent SAARC conferences, Member States committed to implementing fellowships and training programmes for telecommunications human resources staff as well as R&D and adopting uniformly applicable low tariffs for intra-SAAR phone calls. In addition, Member States were directed to 'give priority to universal access' and 'cooperate in the development of plans and for the utilization of ICT in ecommerce, health care education and other areas by the exchange of information and expertise'.

In 2009, a meeting of the Working Group on Telecommunications and Information and Communications Technology agreed in principle to a proposal regarding upgrading of national and regional telecommunications infrastructure.

3.3 Potential future frameworks

3.3.1 Overview

There are two major trade agreements which may have an impact on future regulatory frameworks for future broadband development in Asia-Pacific, in they come into force. These are the Regional Comprehensive Economic Partnership (RCEP) and the Trans-Pacific Partnership (TPP) Agreement. The TPP and RCEP as mutually reinforcing parallel tracks for regional integration. These are highlighted and summarised below.

3.3.2 Regional Comprehensive Economic Partnership (RCEP)

RCEP is a proposed FTA between the ten member states of the ASEAN (Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam) and the six states with which ASEAN has existing FTAs (namely Australia, China, India, Japan, South Korea and New Zealand). As such five of APAC8 countries would be subject to the RCEP.

RCEP negotiations were formally launched in November 2012 at the ASEAN Summit in Cambodia with the ber 2012 at the ASEAN Summit in Cambodia with the target to complete the negotiations by the end of 2016 or early 2017. The 14th round of RCEP discussions took place in Tianjin, China from 17 to 22 October 2016.

Unfortunately, no details and/or the draft text relating to telecommunications issues is available at the date of the drafting of this paper but the RCEP will deal with telecommunications and related issues.

3.3.3 Trans Pacific Partnership

The TPP was negotiated in an environment where a range of free trade agreements (FTAs) have been negotiated globally and specifically by Asia-Pacific. [28] This is as a direct result of the inability of the multilateral fora such as the World Trade Organisation ("WTO") to advance global free trade. The strategy is about building momentum for global trade reform through this means. Both the TPP and the RCEP have involved negotiations with multiple parties and sectors and are a possible pathway to an Asia-Pacific free trade area. The complete text of the TPP is extensive but available online. [29] For the purposes of this report it is important

28. Note the TPP will enter into force 60 days after all 12 signatories have ratified it through their parliaments or whatever other domestic process is required. If this has not happened within two years, it will enter into force 60 days after the two-year period, but only if 6 original signatories, which must account for 85 per cent of combined GDP of the 12 original signatories, have ratified the agreement. If the US does not ratify, the TPP could collapse. It will definitely collapse if both the US and Canada do not ratify.

29. See www.mfat.govt.nz/Treaties-and-International-Law/01-Treaties-for-which-NZ-is-Depositary/0-Trans-Pacific-Partnership-Text.php

to note that the TPP includes Vietnam which is one of the APAC8 but Thailand another of the APAC8 has also expressed an interest to join.[30]
There are two main Chapters of the TPP dealing with sector issues of importance to the sector namely Chapter 13 Telecommunications and Chapter 14 Electronic Commerce. These are summarised in Appendix B. There are also a number of other horizon tal measures. It should be noted that Chapter 13 on Telecommunications embraces competition and is based on the general objective that there should be more regulatory certainty for telecommunications service providers operating and investing in the TPPA countries. The key element of the TPPA is the support of the liberalisation of telecommunications sector in all member markets. As such, the TPPA countries have agreed to:

- Ensure access to telecommunications facilities under fair and reasonable terms;
- To allocate scarce resources (such as spectrum) in a non-discriminatory manner; and
- To be transparent in their regulatory process.

Chapter 14 is premised on the basis that the TPPA Parties recognise the economic growth and opportunities provided by electronic commerce. It emphasises the importance of frameworks that promote consumer confidence in electronic commerce and of avoiding unnecessary barriers to its use and development.

30. See www.nationmultimedia.com/news/business/macroeconomics/30287110

4

ICT & Broadband Development Status of the APAC8

4.1 Comparisons and levels of development

Exhibit 17 below shows the basic population and GDP per capita data for the APAC8 countries. Although there is a high rate of urbanisation occurring in these countries, their levels of urbanisation are still low relative to the rest of the world. On average, only 46 per cent of persons live in urban areas globally. Only Thailand approaches this figure at 50 per cent but in Cambodia and Sri Lanka around 80 per cent of the population is still rural. This has important implication for the nature and pace of broadband infrastructure deployment because, on a per person basis, it is much more expensive to provide access to rural populations than it is for urban populations. This creates a significant barrier to achieving higher levels of broadband penetration and points to the need to optimise mix of technology so that broadband services can be brought to as many people as possible on a cost-effective basis.

➢ *Exhibit 17: Population, GDP and GDP per capita*

	Total Population (millions)	Rural Population (millions)	Rural to total ratio	GDP ($US millions)	GDP per capita ($US, 2015 PPP)
WORLD	**7,325**	**3,367**	**0.46**	**73,433,644**	**15,638**
India	1,282	862	0.67	2,073,543	6,162
Bangladesh	160	105	0.66	195,079	3,607
Vietnam	93	62	0.66	193,599	6,024
Thailand	67	33	0.50	395,282	16,097
Myanmar	54	36	0.66	64,866	5,469
Sri Lanka	22	18	0.82	82,316	10,566
Cambodia	16	12	0.79	16,778	3,487
Lao PDR	7	4	0.61	11,997	5,309

Source: World bank (from https://en.wikipedia.org/wiki/List_of_countries_by_GDP_(PPP)
Note GDP figures are nominal GDP in $US. GDP per capita is in Purchasing Power Parity (PPP) given in units of International Dollars (Int$). PPP provides a better measure of living standards because they are adjusted for local prices.

With respect to their level of broadband development, the countries of the APAC8 can be regarded as falling into two broad groups with Vietnam and Thailand being relatively more advanced than the rest of the group. To some extent, Sri Lanka is an intermediate case between the more advanced and less advanced cases.

The ITU, Measuring the Information Society Report (2015) provided the following measures for each country's overall Information Development Index (IDI). The IDI incorporates measures of broadband penetration and development.

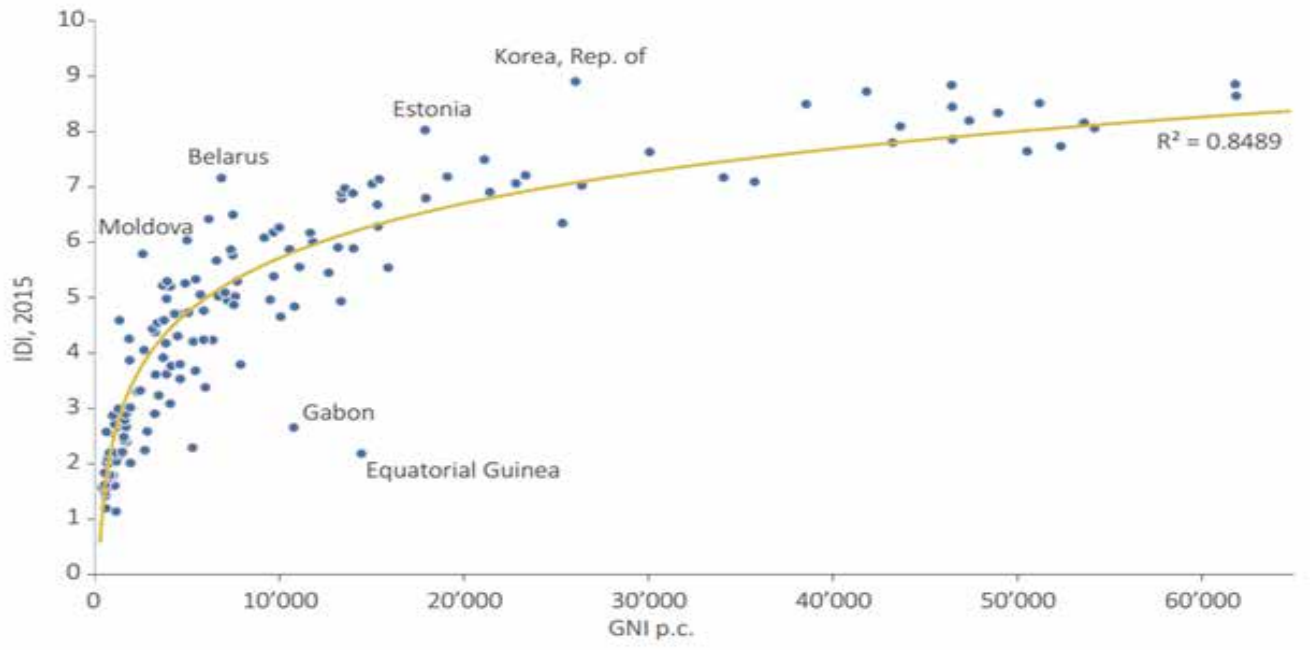
➢ *Exhibit 18: IDI indexes and world rankings, 2015*

Country	IDI 2015	IDI rank 2015	IDI 2010	IDI rank 2010
Thailand	5.36	74	3.62	92
Sri Lanka	3.64	115	2.97	115
Vietnam	4.28	120	3.61	94
Cambodia	2.74	130	1.98	131
India	2.69	131	1.98	131
Lao PDR	2.45	138	1.92	135
Myanmar	2.27	142	1.58	150
Bangladesh	2.22	144	1.61	148

Source: ITU, Measuring the Information Society Report 2015

It should be pointed out that these index values and rankings are characteristic of countries that at the level of economic development common to these countries. Exhibit 19 shows that the value of the IDI and income per capita are strongly correlated. Therefore, the extent to which any particular country is under-preforming or over-preforming should only be evaluated by how far it is above or below this curve. It is also important to keep in mind that there are long lags in building broadband infrastructure and achieving higher penetration levels. As well as current practices for encouraging broadband deployment, each country's history and recent economic development play important roles in determining relative levels of broadband development.

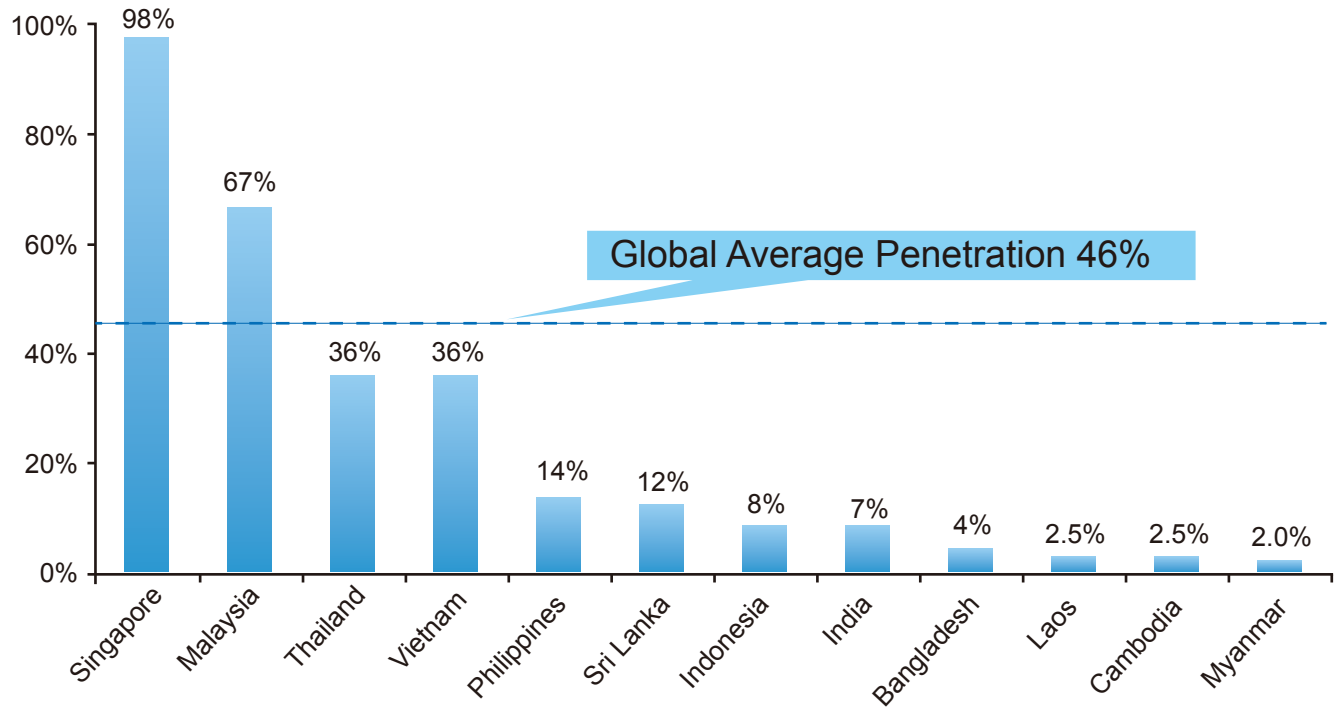
➢ *Exhibit 19: IDI and GNI p.c., 2015*



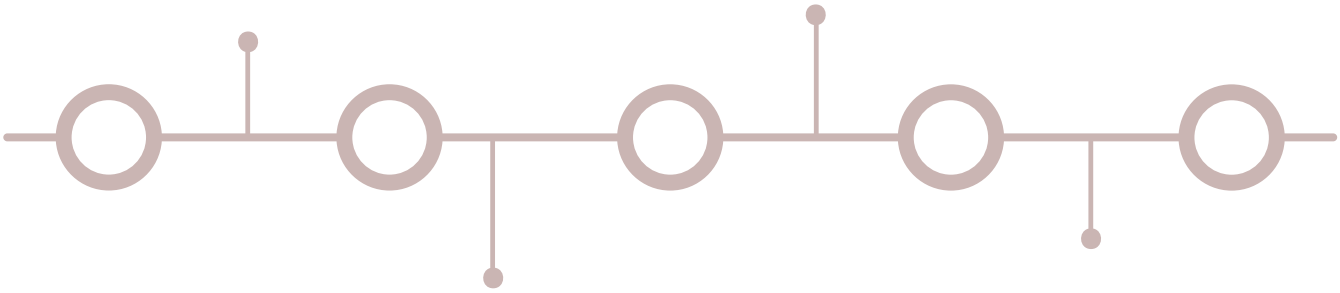
Source: ITU, Measuring the Information Society Report 2015

Exhibit 20 provides country by country indications of household broadband penetration and also illustrates differences between the APAC8 and their regional neighbours. Clearly, Singapore has advanced economy levels of broadband penetration and benefits from its earlier economic development and its relatively small size and high levels of urbanisation. Malaysia has pursued a relatively aggressive public private partnership with the HSBB network rollout of fixed broadband infrastructure and is now reaping the benefits in terms of significantly higher than regional average broadband penetration. [31]

➢ *Exhibit 20: Fixed-broadband penetration (Households), 2015*



Source: Huawei, Proposal of APAC Exchange on Broadband Regulation and Policy, Bangkok 14-17 November 2016

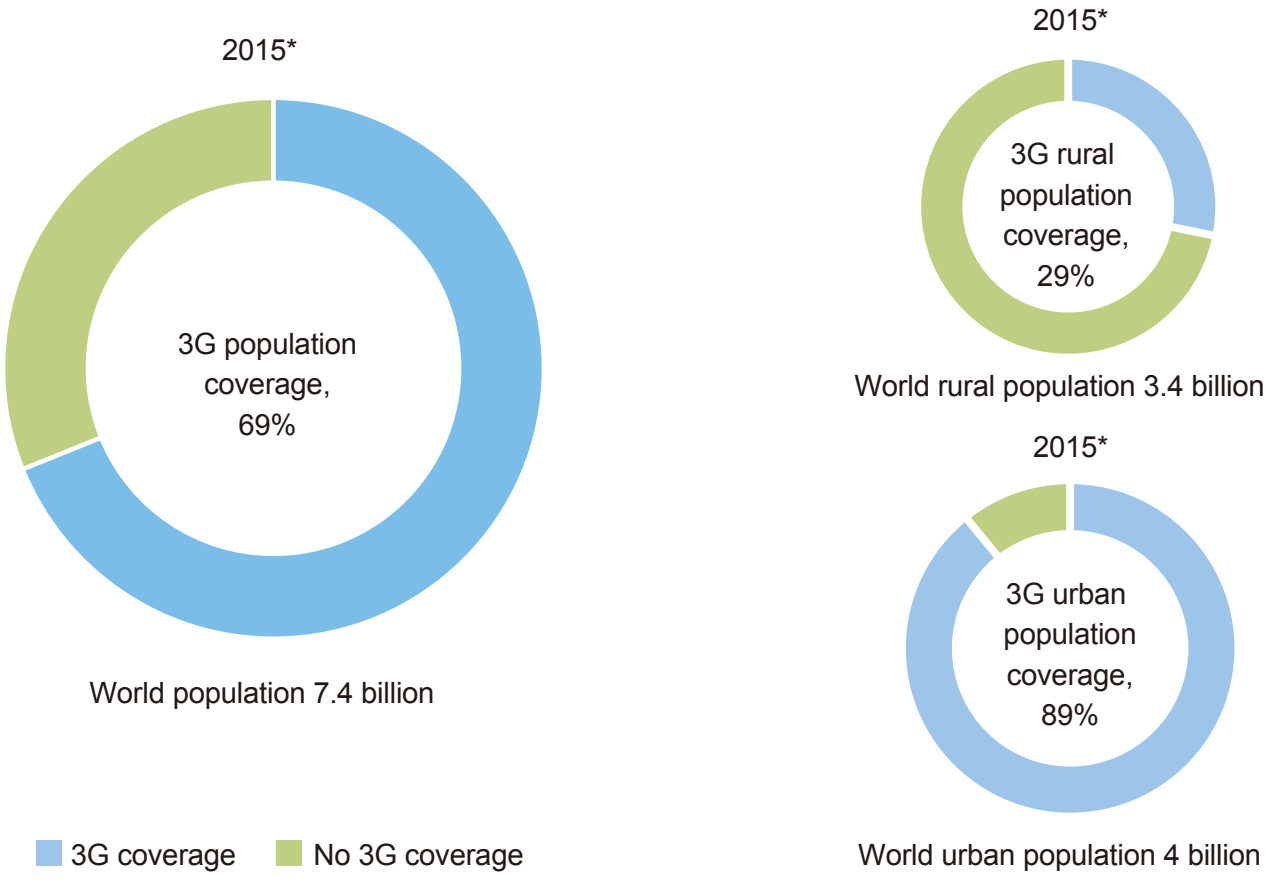


31. A case study on the Malaysian HSBB success story is included later in this White Paper.

One of the important consequences of the relatively low income per capita of the APAC8 is that mobile broadband costs (where broadband is accessible) makes up a relatively high proportion of end users' available income. This problem is exacerbated by the fact that rural incomes are typically lower than urban while, at the same time, providing broadband connectivity to rural users is much more expensive than it is for those in the cities.

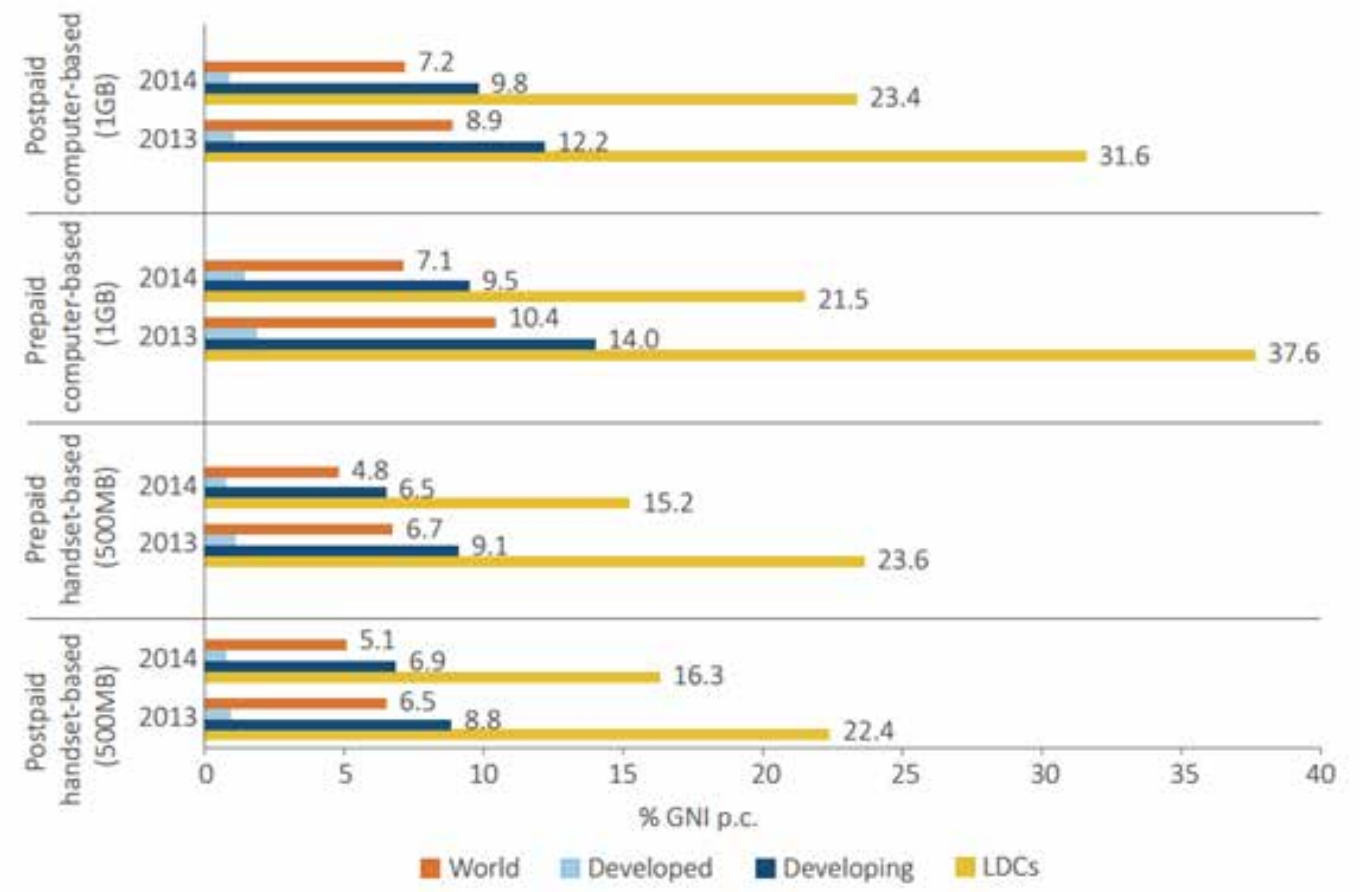
Exhibit 21 shows the challenge for broadband connectivity in rural regions. In 2015 there was only 29% of rural population with broadband capable 3G coverage compared with 89% in urban areas. While this is concerning, there are grounds for optimism because 4G/LTE-A deployments are increasingly attractive to carriers and, particularly in the sub-1MHz range of spectrum, had the capacity to rapidly upgrade broadband services in rural regions. Exhibit 22 illustrates the problem of cost of broadband in LDCs but also indicates significant falls in cost as measured by the per cent of GNI per capita metric even from 2013 to 2014.

➢ *Exhibit 21: Population coverage by 3G networks, urban and rural areas, 2015**



Source: Measuring the Information Society Report 2015

➢ **Exhibit 22: Mobile-broadband prices, developed and developing countries and LDCs, 2013-2014**



4.2 Costing comparisons

Without doubt, one of the major factors determining the pace at which broadband infrastructure can be rolled out are the costs of doing so including in particular the required capital expenditures. The extent of variation in this cost between different countries is significant. Exhibit 24 summarises the data provided by Huawei on capital expenditure costs per line for a range of global markets.

These range from USD1,642 US per line in Saudi Arabia down to USD200 per line in China. These differences become even more marked when comparing capex per line relative to GDP per capita with India at 86.8 percent down to Singapore at 0.8 percent.

Exhibit 23 provides a more granular analysis. It shows cost differentials in four different countries, Thailand, India Myanmar and Sri Lanka for various components of broadband infrastructure. Again, the cost differences are significant and it is easy to see how these would impact the commercial returns to infrastructure deployment by commercial operators and Government lead national broadband projects.

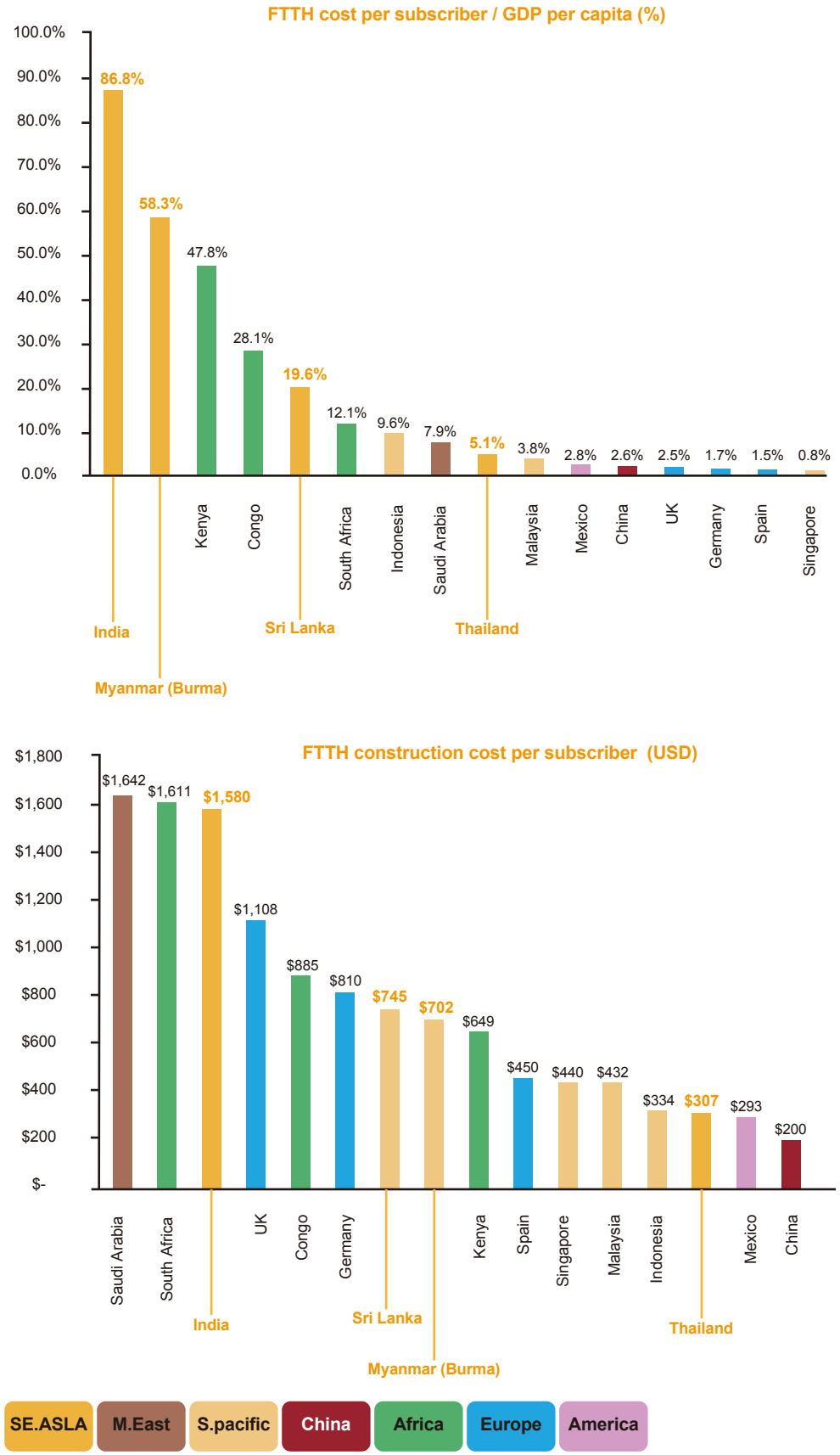
➢ *Exhibit 23: Cost of various components of broadband infrastructure in for selected countries: Thailand, India, Myanmar and Sri Lanka*

	Item	Thailand	India	Myanmar	Sri Lanka
OSP	Device	Low	Middle	Middle	Middle
	Fibre cost	Middle	Low	High	Low
	Civil work (including ducting deployment)	Low	High +	High -	High
	Fibre splicing	Middle	Middle	High ++	Unknown
	Rights of way	Low	High ++	Middle	High -
ISP	Fibre	Low	Low	Middle	Low
	ONT installation	Low	High	Unknown	Middle
	Civil work	Low	High	Unknown	High

Low/Middle High - High/High +/High ++

Source: Industry sources, 2016

➢ *Exhibit 24: FTTH capex per line and capital expenditure per line/GDP per capita*



Source: Towards a connected Cambodia, Smarter ways to develop broadband, CHEN, KUAN-HONG (Arthur), Director of Fixed network, Huawei

Importantly, some of the results of this costing analysis are counter-intuitive. The highest costs are found in countries where labour costs are relatively low which should result in deployment costs being proportionately lower as the civil works relating to fibre optic trenching and related works relatively cheaper.

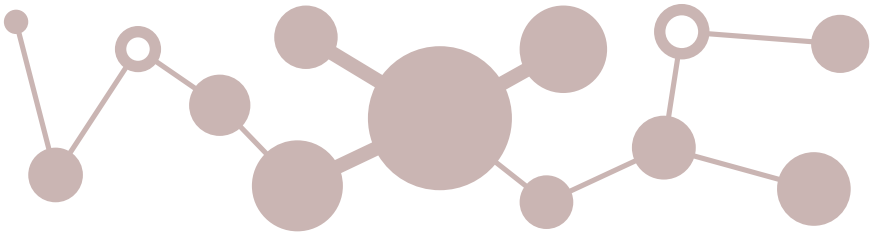
While beyond the scope of this study (and entire White Paper could explore this very issue) It would be useful to undertake further research to better understand these cost differentials, but it is evident is quite clear from our study that the rights of way acquisition fee and home connection fee account for the majority. Other differences are due, in part, to the cost of development approvals, and other administrative processes. Such costs do seem to be higher in many emerging markets.

If this is the case it points to an urgent need in those countries, where costs are high for governments to reduce 'red tape' costs and remove barriers to more rapid and less costly broadband infrastructure deployments. It is worth emphasising that these bureaucratic costs will, to some degree, be passed on to consumers of broadband services and hence negatively affect affordability. Therefore, red tape barriers not only slow infrastructure development and therefore broadband access, but also retard levels of adoption by pricing some users out of the market. See Exhibit 25 below.

➢ *Exhibit 25: FTTH costs per connection and payback periods (USD)*

Characterisation	Costs per home passed	ROI
Outstanding	< USD600	< 5 years
Middle	USD600 to USD1,000	5 to 10 years
High	>USD1,000	> 10 years

Source: Industry sources



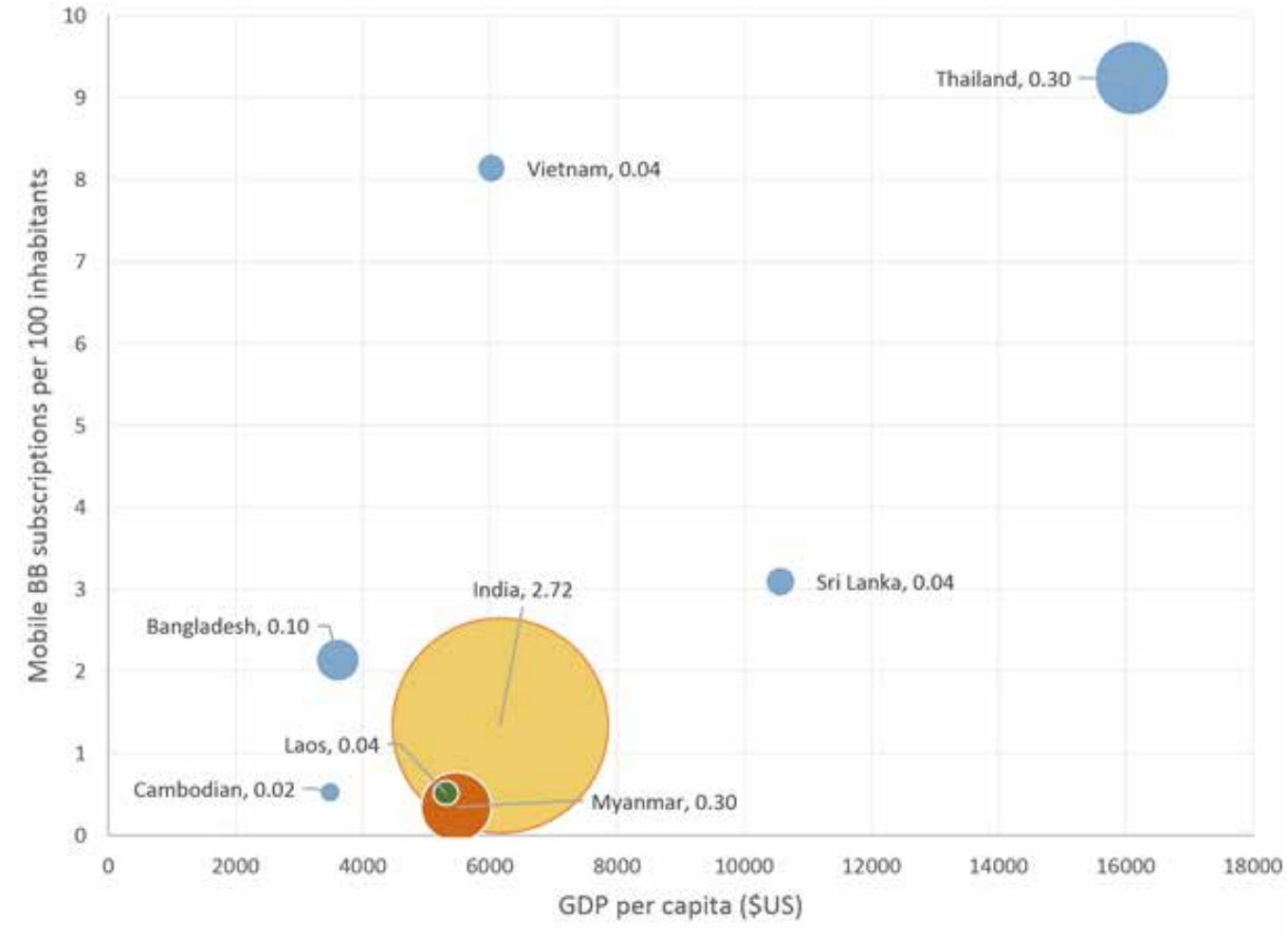
4.3 Broadband growth potential index

As discussed above, there are many factors that influence and emerging economies capacity for growth in the broadband sector. It can be difficult to draw all these factors together to create some quantitative assessment of the relative development opportunity size in these various jurisdictions.

For the purposes of this White Paper have developed a broadband growth potential which combines the following factors:

1. The current level of mobile broadband penetration
2. The level of a country's GDP relative to world GDP
3. The level of a country's GDP per capita relative to world GDP per capita
4. The level of a country's urbanisation

➢ *Exhibit 26: Broadband growth potential*



Source: Windsor Place Consulting

These factors are combined in a simple non-weighted multiplicative index and in Exhibit 26, the APAC8 are plotted on a grid of GDP per capita and mobile broadband subscriptions per capita. The size of the balloons for each country represents the value of the index. India is by far the largest because of its absolute population size (notwithstanding its low income per capita) and Myanmar and Thailand are next in terms of index value, the former because of the very low level of broadband adoption and the later because of its relative high GDP per capita.

4.4 Regulatory and market challenges in deploying broadband in Asia-Pacific countries

4.4.1 Rethinking telecommunications 'leapfrogging'

It is a common observation that the telecommunications industries of developing countries have been able to use rapidly developing mobile technologies to leapfrog the need for fixed communications infrastructure. While this has clearly been true in relation to voice communications and to moderate speed data communications, it may turn out to be significantly less true for broadband. This is likely to be the case for a number of reasons:

- Mobile systems are unlikely to have sufficient capacity, particularly in areas of relatively high population density, to deliver the increasing bandwidth demanded by the next generation of broadband users;

- New high growth industries, tend to be knowledge and information rich and demand high levels of connectivity and high bandwidth broadband services with low latency;

- The overall growth in broadband use (both mobile and fixed) significantly increases the requirements for backbone and backhaul bandwidth to levels significantly beyond those which are necessary to support voice only traffic. Thus, even if wireless systems predominantly meet the needs of broadband users into the medium term future, these will need to be serviced by relatively high speed fibre connections to mobile base stations almost everywhere and by high capacity backbone links.

As economies in the region develop, they will become more urbanised and more sophisticated high-growth industries will become more important. If these countries want to enjoy ongoing economic growth they will need to support the growth of these more sophisticated industries and this will require broadband services that are unlikely to be able to be provided solely by wireless networks.

Investments in fibre to service mobile base stations are likely to be valuable into the long-term future even if landline broadband is made available in these areas subsequently. Trends in advanced economies indicate that the demand for wireless bandwidth continues to grow in spite of improvements in the capacity of fixed broadband delivery.

This logic suggests that broadband policies that are aimed at economic development should have, at least as one important emphasis, a focus on improving fixed broadband connectivity for new growth industries. Another focus should be investment in very high capacity backbone and backhaul to better service next generation mobile services and increasing deployment of landline services.

4.4.2 Technology, broadband solutions and policy - constantly moving target

Determining optimal settings for broadband regulation and policy would be difficult enough if the objective could be defined by a simple parameter for example, maximise household broadband penetration. But of course, in practice, broadband policy has several goals and, to some extent, goals that compete with each other. For example, goals include broadband policy to achieve economic development and broadband policy prescriptions directed at improving social outcomes. Governments must face trade-offs between the rates at which these various objectives are pursued - to what extent should higher speed connection for urban-based businesses be deployed instead of pursuing higher levels of access for basic broadband in rural areas?

These are difficult questions to answer in their own right but the policy in regulatory settings must also deal with other complexities. One of the main complexities is the ongoing high rate of technological change in communications and the associated difficulty in choosing future proof strategies and solutions for broadband. Other complexities include the difficulty of forecasting future use patterns. For example, the rapid increase in the consumption of video content on smartphones surprised many observers and placed unprecedented demand on the capacity of mobile networks. Another recent change in consumer behaviour has been the rapid shift to streaming media content for home entertainment accompanied by a shift away from the consumption of linear broadcast content.

4.4.3 Considerations for designing broadband policy and regulation

At this point, several higher-level themes are emerging that provide important guidance for the formation of broadband policy and regulation in Asia-Pacific.

MOBILE BROADBAND HAS BEEN IMPORTANT AND WILL REMAIN SO BUT MORE FIXED BROADBAND WILL BE NECESSARY IN THE FUTURE

As described above, mobile broadband and mobile telephony had been important factors in enabling emerging economies to leapfrog the requirement for fixed telecommunications infrastructure. As these economies continue to develop, however, it is unlikely that mobile capacity will be enough. More mature economies contain more sophisticated business enterprises and they have a need for more sophisticated education systems to support the development of new skills.

Policy and regulatory settings need to support the deployment of high-speed fixed broadband in urban areas particularly for broadband to enterprise/Government users. This does not include only high-technology businesses but also traditional businesses such as garment manufacture and agriculture that need to be connected to international marketplaces. Governments also need to modernise and become more efficient at service delivery.

There are likely significant economic gains in terms of competitiveness, market access and productivity from enterprises/Government been able to use better quality broadband services. These improve broadband services also need to be supplied to universities and schools to support skills development, something that will have a range of positive social impacts as well.

BROADBAND SOLUTIONS NEED TO BE CHOSEN CAREFULLY ON THE BASIS OF COST, CAPACITY OF USERS TO PAY FOR SERVICES AND MATCHING CAPACITY WITH NEED

Governments in the region have limited resources to pay for broadband deployments and it is therefore critical that they choose solutions that are appropriate for each distinct user group in their jurisdictions. The primary considerations are:

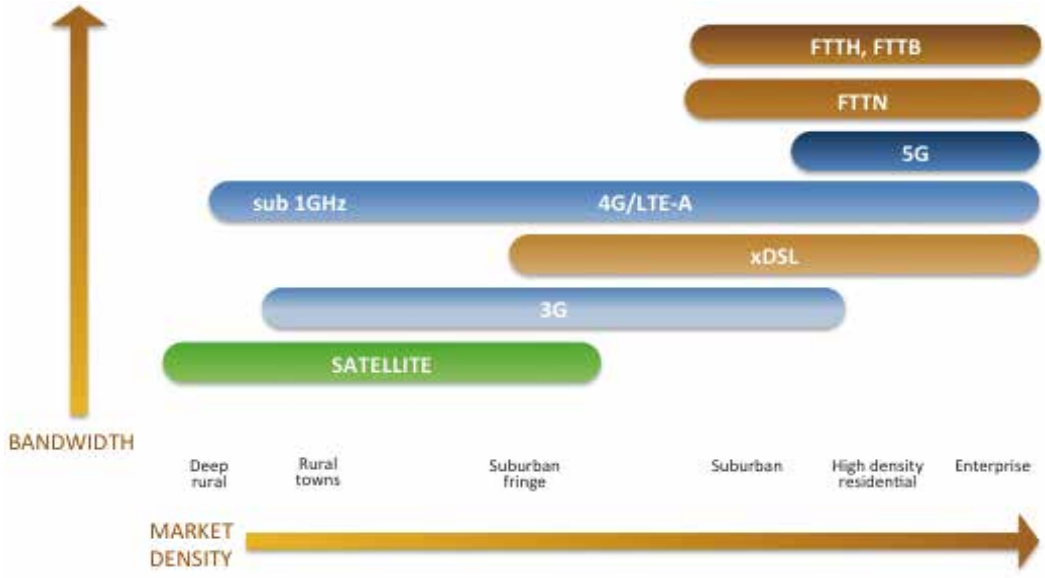
- The costs of provision including consideration of the solution fixed costs or shared costs compared with the per user costs (for example, satellite is very high shared costs but low per user costs);

- The capacity to pay and the bandwidth requirements of specific user groups-the specific characteristics of each user group need to be carefully considered in order to optimise solutions for each group;

- The future proofing characteristics of each solution -to what extent do particular solutions represent investments that can be repurposed to accommodate future technologies and service enhancement?

Exhibit 27 illustrates how various broadband technology solutions meet varying requirements for bandwidth and market densities.

➢ *Exhibit 27: The relationship between broadband solutions, bandwidth capacity and market density*



Source: Windsor Place Consulting, October 2016

REGULATORY INSTITUTIONS AND EXPERTISE ARE AN IMPORTANT PART OF THE BROADBAND STRATEGY AND SOLUTION

The experience in more advanced economies has demonstrated that some of the most difficult challenges involve regulatory settings and developing high-quality regulatory institutions and expertise. Governments cannot do everything and it is critical to harness the potential of competitive markets focused on the needs of customers to deploy and develop broadband solutions.

Investments by carriers are far more likely if they believe regulatory settings are workable and are likely to be certain into the future. This not only involves developing appropriate revelatory settings early but also investing in improving in institutions that operationalise regulatory strategy and in proving the level of expertise in regulatory practitioners.

It is important to emphasise that the regulatory challenges of combined fixed and mobile markets are more complex than those where mobile dominates strongly. Even in countries with what may considered to exemplar regulation have struggled to find models that work effectively and sustainably in the face of ongoing technological and market dynamics. This includes the EU, Singapore and Australia. Further, as mentioned above, context is highly important and therefore the example of other jurisdictions in previous times is arguably only of limited use.

REGULATORY SETTINGS AND STRUCTURAL CHANGES TO INCUMBENT FIXED NETWORK OPERATORS ARE CRITICAL AND CHALLENGING TO OPTIMISE

Many jurisdictions have incumbent fixed operators and in many cases these are wholly or partially owned by governments. To varying degrees, the explosion of mobile services has created deep commercial challenges for these organisations. Shifting the emphasis towards fixed solutions in the context of broadband will, again, require significant review of both the applicable regulatory settings and the applicable corporate governance and structure of such organisations.

In particular, there is a need for re-capitalisation, reforming ownership either through the securing a strategic equity investor and/or allowing the public to invest in the company (see Exhibit 28). Globally there are many global precedents for the reform of state-owned or state-operated telecommunications companies.[32] Most countries other than North America have at some point transitioned from state run telecommunications monopolies, to competition between state owned companies and private market entrants, to eventual privatisation of the government companies and an entirely private competitive market. This is the journey which has already been followed in a number of Asia-Pacific markets. Arguably critical to that process is a fully competitive market overseen by a competent industry regulator. [33]

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32. These include Europe – BT in the United Kingdom, DT in Germany, Australia – Telstra, Singapore – Singapore Telecom, Malaysia – Telekom Malaysia, Indonesia – Telkom Indonesia, Japan – NTT etc.

33. A useful resource on such steps, even if somewhat dated is Bjorn Wellenius, et al, editor, Restructuring and Managing the Telecommunications Sector, World Bank Symposium, Washington 1989.

➢ *Exhibit 28: Summary of current reforms in relation to incumbent operators in the APAC8*

Country	Comments
Bangladesh	Government had previously committed to a sale of a stake in BTCL and IPO but given no progress has recently awarded a large contract to ZTE for the upgrade of the BTCL fixed network
Cambodia	Government and MPTC considering reforms to Telecom Cambodia
India	Government's think-tank Niti Aayog may consider state-owned BSNL and MTNL for strategic disinvestment. Turn around of both companies is being attempted
Lao PDR	In September 2016, the Government sold a majority stake in ETL to foreign investor Jiafu/Comba Holdings. Government shareholdings in LaoTel and Beeline Lao currently being retained.
Myanmar	Foreign partners have been secured for MPT (namely KDDI and Sumitomo) and other state companies including YTP partnering with foreign and local companies. Other new investment partners like Viettel for Myanmar SOEs
Sri Lanka	After earlier privatisation of Sri Lanka Telecom in 1997 (to NTT but which is now owned by Global Telecommunications Holdings[34]) reforms to transmission networks and submarine cable landing stations are needed.
Thailand	Proposals for the structural separation of the network infrastructure assets of TOT and CAT as part of Digital Thailand Project proposals. Subsequent future reforms to telco SOEs are likely.
Vietnam	(i) VNPT restructured with the separation of Mobifone. Still addressing capitalisation and related issues of VNPT (ii) The Government considering the equitisation of Mobifone with strategic equity investor and possible IPO and Viettel considering a future IPO.

Source: Author

34. *The ultimate parent company is Usaha Tegas of Malaysia who also owns Maxis, ASTRO etc.*

Concurrently there is a need to strengthen management and technical capabilities of incumbent operators. This can be done either as part of focused uplifting of skillsets or a part of broader reforms of state owned enterprises (SOEs). For example, from 2006 onwards Malaysia undertook a major program of reforming and transforming its Government Linked Companies (GLCs). As part of this process the committee in charge, with the assistance of expert consultants, prepared a GLC Transformation Manual whose purpose was to provide an overall guide to the reform process and a metric against which reform success could be measured. In addition to the initial Manual the committee responsible has now prepared a 10 year Graduation Report on the success of the transformation program and the Manual.

This Manual identifies nine key aspects of enterprise reform which are applicable to incumbent operators.[35] These are:

1. Enhancing Board Effectiveness;
2. Strengthening Director Capabilities;
3. Improving the Regulatory Environment;
4. Clarifying Social Obligations;
5. Reviewing and Revamping Procurement;
6. Improving Capital Management;
7. Managing and Developing Human Capital;
8. Intensifying Performance Management; and
9. Enhancing Operational Improvements. [36]

Any improvements which can be made in these areas will necessarily increase an incumbent operator's contribution to society and the economy, as well as increase their value in any whole or partial privatisation.

BUILDING MAJOR INFRASTRUCTURE IS EXPENSIVE AND COMPLEX AND REQUIRES EFFECTIVE VERTICAL AND HORIZONTAL CO-OPERATION

Notwithstanding the challenges, the Asia-Pacific region has the advantage of rapid growth rates and extensive greenfields development. The deployment of broadband fixed infrastructure can be made vastly more cost-effective and rapid if different levels of government and different silos across national government's collaborate and cooperate effectively.

USE WIRELESS BROADBAND FOR RAPID AND COST-EFFECTIVE DEPLOYMENT WHERE POSSIBLE

Given the relatively low levels of broadband penetration particularly in rural areas within Asia-Pacific countries (including the APCA8), there are significant benefits from deploying wireless customer access networks because of their relatively low (shared) cost and because they can be deployed quite rapidly. There are many situations in which wireless will be an efficient solution even in the longer term but in situations where fixed solutions may ultimately be deployed, wireless can be an efficient intermediate solution.[37] There should be a focus on high-capacity fibre to wireless base stations and in the backbone transmission networks.

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35. The final area of reform relates specifically to Government Linked Investment Companies ('GLIC').

36. See www.pcg.gov.my/trans_manual.asp for overview of the Manual's structure.

37. For example, one Huawei study suggests that when population density is lower than 5 people/household per km2, and bandwidth requirement less than 5Mbps, LTE have cost advantage than FTTC.

WHERE FIXED BROADBAND IS DESIRABLE THE TRADE-OFFS BETWEEN xDSL AND FIBRE MAY BE VERY DIFFERENT IN THE APAC REGION COMPARED WITH MORE ADVANCED ECONOMIES

As mentioned earlier, APAC nations generally have quite different histories and installed infrastructure bases from nations that have developed economically earlier. In general, APAC fixed networks are smaller both in absolute terms and in terms of lines per hundred population. It is also likely that these networks have been less well-maintained or damaged for various reasons than similar networks in more developed countries. It is also the case that such networks unless tolerant of tropical climates than they are of the more benign climates in Europe, Australia and North America. This has meant that xDSL solutions have delivered broadband speeds significantly below theoretical levels.[38]

Consideration of these factors suggest that copper-based xDSL broadband solutions will generally be less viable in the APAC context (including the APAC8) and they have been in more developed environments. In fact, for fixed networks deployments, fibre is more tolerant of the climatic conditions typical in APAC countries and is more future proof than legacy networks.

Moreover, the rapid economic growth which is typical of most APAC countries currently means that there will be significant numbers of greenfields deployments where fibre is the logical option. This need for significant customer access network deployment of fibre will be in addition to large required deployments for backhaul and backbone fibre.

Therefore, there are likely to be significant opportunities for economies of scale in fibre deployment in terms of skills development, utilisation of required capital equipment development of supply chains and locally produced inputs. This assumes however that regulatory structures and rules relating to the deployment of fixed network infrastructure-especially if such fibres are to be placed in ducts underground-facilitate such deployment and are not cost-prohibitive.

These arguments suggest that the APAC8 may benefit from a 'leap to fibre' (along with the deployment of LTE-A and future LTE-A Pro/5G networks) and that the optimum mix of broadband technologies may be more oriented to fibre than is the case in more advanced countries where xDSL technologies still play a major role in the customer access network.

In an important sense, the APAC8 are in a better position now than the more advanced nations were at the beginning of the broadband era. The technologies for broadband deployment are better and cheaper now and there is more knowledge about what does and what does not work in a range of contexts.

38. For example, xDSL network in Malaysia often topped out at only 6 Mbps and ADSL networks in Cambodia are only achieving 3 Mbps.

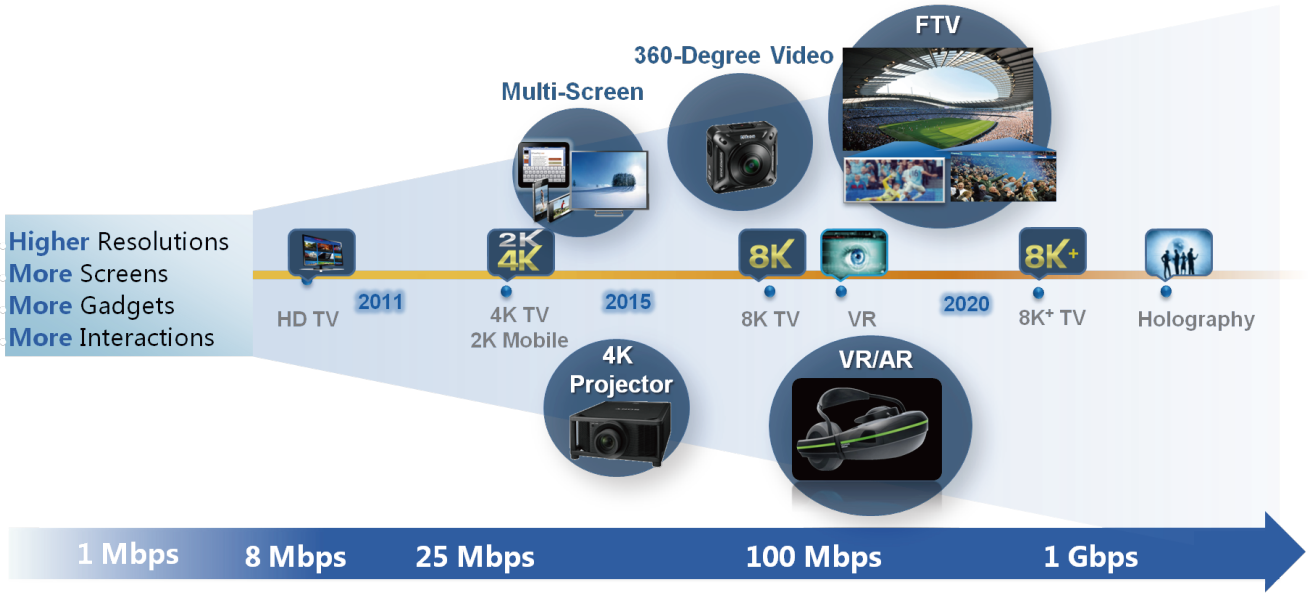
5

Key Drivers: Accelerating Broadband Expansion in Asia-Pacific

5.1 National Broadband Objectives

The benefits of broadband connectivity in ensuring a country's economic progress has arguably never been greater. The possible applications and services are tremendous as highlighted in Exhibit 29 below.

➢ *Exhibit 29: As Bandwidth increases the range of applications explodes and the user experienc e is enhanced*



Source: Huawei, 2016

Globally, the Broadband Commission considers high-speed broadband networks to be the 'central pillar' of the digital economy age. The economic significance of broadband networks has led many Governments to develop strategic National Broadband Plans including national broadband networks to implement national high-speed networks, and 'leapfrog' local industry into the digital economy beyond the promulgation of Broadband Plans (see the discussion in section 3.1).[39] The range of Governments adopting high speed broadband rollout plans is extensive and varied. In Exhibit 30 below we summarise some of better national broadband network plans.

39. Broadband Commission, 2013, 'Planning for Progress: Why National Broadband Plans Matter' www.broadbandcommission.org/documents/reportnbp2013.pdf

➢ *Exhibit 30: Selected National broadband network projects*

Country	ICT policy framework/ entities	Key objectives	Incumbent partnership or new entity?	Technology deployed	Regulatory obligations	Outcomes
Australia	NBN[40]	Connect 93% of pop. to broadband	New entity & public-private partnerships	FTTP/FTTN/ LTE-TDD/Satellite	Wholesale only, open-access	Still in construction and deployment
France	'Plan france Tres Haut Debit'[41]	Connect 50% of pop. By 2017, 100% by 2022	Public-private partnership	Mostly FTTP *(dependant on region and operator)*	Regulated network access sharing	Still in development, though noteworthy model of funding and access sharing
Malaysia	National BB Initiative – ("HSBB")[42]	Connect 75% of pop. By 2015, remainder ongoing	Pubic-private partnership	FTTP but HSBB2 involves some wireless	7 year moratorium on HSBB unbundling Open access services on HSBB	Successful deployment, noteworthy internationally for rollout being low-cost and fast.
New Zealand	Ultra-fast Broadband programme ("UFB")[43]	Connect 75% of pop. to FTTP by 2020	Public-private partnership	FTTP	Wholesale open-access	Halfway through development in 2015, extending coverage goal to 80%
Qatar	QNBN, est. in 2013 by ictQATAR[44]	95% broadband coverage by 2015	New entity	FTTP	Open access	In 2014, 98% of households had internet access
Singapore	Next Gen NBN[45]	Connect 100% pop to high speed broadband	Two new entities – OpCo and NetCo	FTTP	Open access	Achieved in 2013

40. NBN, 'NBN Australia', www.nbnco.com.au/

41. Republique Francaise, 'France: Tres Haut Debit', www.francethd.fr/

42. Malaysia Communication and Multimedia Commission, 'National Broadband Initiative', www.skmm.gov.my/Sectors/Broadband/National-Broadband-Initiative.aspx

43. New Zealand Ministry of Business, Innovation and Employment, 'Fast Broadband', www.mbie.govt.nz/info-services/sectors-industries/technology-communications/fast-broadband

44. ictQATAR, 'QNBN', http://qnbn.qa/

45. IDA, 'Next Gen NBN', https://www.ida.gov.sg/Tech-Scene-News/Infrastructure/Wired/Next-Gen-NBN

From the global study of national broadband exemplars, France and Malaysia emerge as distinctive leaders in the successful rollout of large-scale network infrastructure. The French national broadband plan is noteworthy in particular for its long-term outlook and unique public-private funding model that targets regional connectivity. However, while the French initiative is instructive, the Malaysian example may hold more relevance as an Asia-Pacific country. Analysis also found that while Singapore's national broadband network is similarly successful, the case study is less comparable to other Asia-Pacific markets because it relates to broadband deployment in a city-state. [46]

MALAYSIA'S HSBB PROJECT IS A POSSIBLE EXEMPLAR MODEL

Malaysia's national broadband initiative is commendable as best international practice for its cost-effective, early implementation of infrastructure and networks. Malaysia's high-speed broadband network ("HSBB")[47] is significant for its end-to-end fibre rollout achieved very quickly in comparative terms-one of the fastest project deployment periods globally. Being able to use TM's existing infrastructure accelerated the rollout of broadband services. Malaysia now has one of the highest number of high-speed broadband subscribers in South-East Asia, and is one of the fastest-growing ICT markets in the region. The success of the project is attributable to the effective partnership between the Malaysian Government and the national incumbent operator – Telekom Malaysia. This project is summarised in Exhibit 31 below.

➢ *Exhibit 31: Malaysia's HSBB Project*

On 16 September 2008, the Malaysian Government signed an agreement with Telekom Malaysia Berhad ('TM') to deploy the High-Speed Broadband services project ('HSBB Project') through a public-private partnership with the Government. The HSBB is a core component of Malaysia's National Broadband Initiative ('NBI'). NBI is an initiative made to transform Malaysia into a knowledge society and to leapfrog into a high-income economy by 2020. Through this initiative, the HSBB is designed to make high-speed Internet accessible and affordable, especially to the more economically important areas of the country.

The public-private partnership has been a very successful way of structuring investment for long term infrastructure developments which includes high speed broadband. It has also guaranteed certainty for both TM and other industry stakeholders in planning for the country's high-speed broadband future.

Three broadband zones have been identified under the NBI, i.e. Zone 1-high economic areas such as inner Klang Valley and Iskandar Development Region in Johor (HSBB), Zone 2-urban and semi-urban areas ('BBGP') and Zone 3-rural areas (USP).

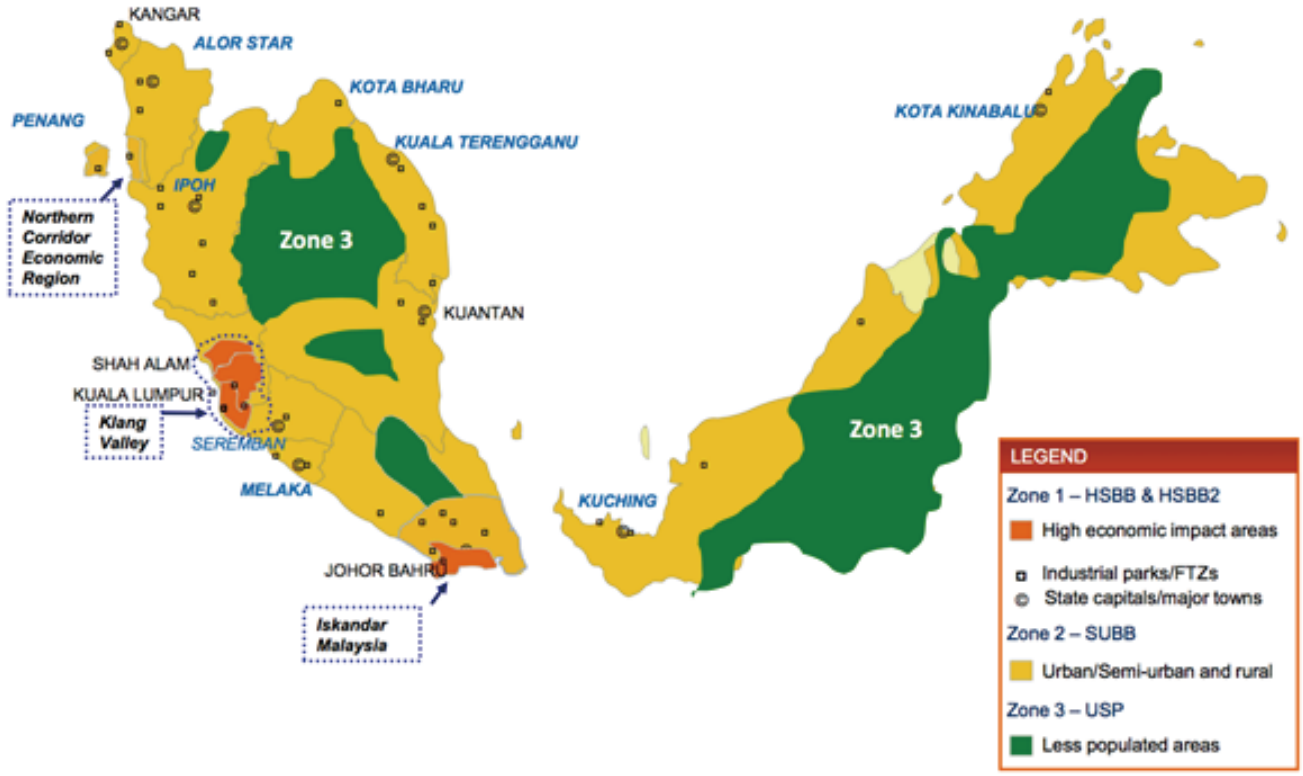
46. The Singaporean Next-Gen Network is the culmination of a series of strategic ICT masterplans that consolidated the city-state's position as an international technological hub. Two corporate entities, an 'OpCo' and a 'NetCo' were appointed to facilitate the rollout of the network although with changes to the infrastructure trust the distinction has been 'watered-down'.

The HSBB network operates by the brand name UniF-unifying broadband i.e. IPTV ('Hypp TV'), broadband access and IP Telephony. Among the key technologies utilized by TM for the provision of HSBB services are Fibre-to-the-Premises ('FTTP'), Metro Ethernet Services, Wavelength Services and an enhanced Submarine Cable Network. Areas within the HSBB zone were granted a seven moratorium on unbundling. As for the Broadband for the General Population ('BBGP'), the operating technology consists of both fixed and wireline broadband with speeds of up to 4Mbps. The BBGP services utilising mainly ADSL technology goes by the brand name Streamyx of which at present has been overtaken by Unifi.

Figure continued:

Since the start of the HSBB project, TM has rolled out significant national ICT infrastructure such that it now has more than 2.37 million broadband customers and has deployed more than 2.22 million HSBB fiber ports. It is now the number 1 broadband provider in Malaysia. Total shareholder returns since the demerger of its mobile arm, which occurred at almost the same time as the signing of the HSBB project is over 400 percent. Profit after tax for the TM remains healthy, due to higher revenue and a strong EBITDA margin reflecting improved customer service.

HSBB and SUBB deployment areas in Malaysia



Source: TM, 23rd CLSA Investor's Forum, Hong Kong, 22-23 September 2016. NB. Areas are indicative only

47. HSBB is marketed by TM under the brand Unifi. See www.tm.com.my/allnewunifi/Pages/index.html

Given the success of its first phase, the Government executed a HSBB2 agreement with TM covering other areas of Malaysia including East Malaysia. Up until September 2016, the HSBB2 project has delivered close to 200,000 ports covering 85 exchange areas while the SUBB (previously known as BBGP) has delivered close to 148,000 ports covering 103 exchange areas. Moving forward, the HSBB2 targets to achieve 390,000 ports by the end of 2017. While the SUBB targets to achieve 420,000 ports by end of 2019.

Through the HSBB project, the Malaysia Government expects to witness a material increase in jobs as this alone would have a significant impact on Malaysia's economic growth. Apart from that, businesses have been able to improve management efficiency through new applications in managed services in accounting, supply chain or customer relationship management. This will subsequently help boost integration with business partners worldwide. From a social perspective, HSBB is designed to spur the development of an increasingly sophisticated IT society with knowledge capital development that will help in bridging the digital divide. This should aid in reducing inequality and creating a skilled workforce which is best able to meet the requirements of Malaysia's 21st century economy.

In summary, the HSBB project has also transformed TM as a company especially through increasing its workforce's skill-set. TM has received multiple awards for its initiatives, such as the Broadband Service. Provider and Service Provider of the Year Awards in 2012 by Frost & Sullivan Malaysia, the 'Most Preferred Brand in ICT' for Broadband by the Brand Laureate Top Ten Masters Awards 2012 and the 'Best Broadband Carrier' at the 15th Annual Telecom Awards.

All country's plans emphasize the importance of high-speed broadband networks to national economic policies. Exemplars' key objectives mostly take the form of supply-side targets, focusing on the provision of infrastructure and the up-take of services amongst the population. Another common feature also endorse open access such as that, public monies/subsidiaes are involved, then such NBN facilities must be open for competitive access.
Importantly, Malaysia and New Zealand both take cross-sectoral approaches that work to encourage wider use of ICT. The approach in exemplars is also to specify areas of coverage and time-based rollout targets. With the exception of Australia, most exemplar NBNs have sought to deploy primarily FTTP technology, on an open-access basis or similar process. However, the improvement in wireless technologies especially LTE in its many forms would suggest a growing role for wireless services in NBNs (including for the last 250 metres access).

WHAT ARE THE BENEFITS OF A POTENTIAL PUBLIC PRIVATE PARTNERSHIP FOR AN NBN?

At its simplest, a Public Private Partnership (PPP) involves government funding the gap between what is commercially viable for an independent infrastructure provider to invest in a project and the total funding the project needs.[48] In addition to direct investment, a partnership between government and an independent entity is in a position to provide other key aspects necessary for a successful deployment of large-scale public infrastructure, such as an NBN. In particular:

- A stable regulatory environment that promotes investment while delivering competition, usage promotion and strategic co-investment – which can take many form including grants, subsidies (including accelerated tax write-offs), soft loans and in kind support: provided by the Government;

- A commitment to deliver fair and reasonable prices[49] and leading quality of service while promoting the development of a vibrant industry with an eco-system of value added service providers* and local content developers: provided by independent entity;

- Commitments to begin build of the enhanced project within a specified timeframe once PPP agreement is formalized in order to achieve the Government's national broadband targets: provided by independent entity.

Globally governments are working with independent entities, including incumbent operators, to facilitate high-speed broadband investments that are commensurate with national economic development objectives. Governments have also supported broadband infrastructure investment as part of their response to the global financial structure (from 2008/9) as a means of stimulating economic recovery and growth.

Arguably, the Government should not be in the business of directly providing broadband infrastructure, a PPP agreement with an independent entity is an appropriate model for ensuring this while still allowing the government to be sure that nationally and strategically important infrastructure is built in the near future. Additionally, a PPP agreement is a good collaborative model for shared risks and investments. The Government will benefit from strategic investment in terms of the economic benefits but should not be the only one to take investment risks, partnering with a private company like helps spread these risks.

A PPP structure helps address the tension inherent in large-scale infrastructure between commercial viability of roll-out and timeliness of availability. By subsidising the cost of rolling out infrastructure at a pace faster than that of independent financial viability the government can reap an efficiency dividend for the national economy as a whole which is likely greater than the cost of the subsidy. While it may not be economic for any single independent entity to bear the costs of widespread roll-out in the short term, the government will receive the benefits which accrue nationwide, and can therefore justify the expenditure needed to support such a rollout.

48. For example, in 2012 out of the R17.6 billion in funding necessary to deploy an NBN in South Africa, Telkom South Africa proposed to South African Treasury invest R10.2 billion, with government contributing the additional R7.4 billion needed for the project to commence.

49. Like in Singapore, with a price cap.

WHAT ARE THE MAJOR ELEMENTS OF AN NBN PPP?

Examples of successful PPP structures used for ICT development include those Malaysia, New Zealand and France respectively. The details of what such a PPP could look like are detailed in Exhibit 32 and Exhibit 33 over.

➢ *Exhibit 32: Suggested form of a Public-Private Partnership (PPP)*

A private entity could work with the Government in a Public-Private Partnership ("PPP") arrangement to deliver the significant national investment that an NBN network requires. The form that such a PPP could take is considered below. Specifically, Exhibit (x) offers potential elements to be included in a PPP to fund and regulate the rollout of a national broad-band network. The elements are categorised into 5 major topics:

1. The objectives of the PPP: broad objectives of the PPP in supporting the government's broadband policy

2. Funding and disbursement: total investment required for NBN network deployment, funding commitments by both partners

3. Private entity commitments: overall and individ-ual broadband coverage, open network access and pricing commitments

4. Government Commitments: including - (a) Regulatory certainty and facilitation of network rollout (b) Reservation of say some allocation of sub-1 GHz as soon as practicable (first priority to spectrum) (c) Policy directive on Deferment of any local loop unbundling (and no application of unbundling to fibre) for a specified time (d) Rapid deployment assistance

5. Transparency, review and possible ongoing opex support: including - (a) Transparency during implementation - reporting of capex and network performance (b) Regular review process during NBN implementation (c) Review process for possible opex support

➢ *Exhibit 33: Suggested elements of a possible Public-Private Partnership (PPP)*

Section	Element	
1. Objectives of the PPP	**1.1 Economic**	Increased NBN and broadband penetration will drive increased economic development and boost GDP
	1.2 Take-up aspiration	Working with industry to aspire to increase broadband penetration towards government targets of X% of the population
	1.3 Coverage and penetration	NBN rollout will focus on agreed priority areas: eg. *X million premises will be provided NBN coverage within X years from signing of agreement. Operators will encourage take up through fair and equitable retail prices*
	1.4 Social benefit	NBN will also be used to enhance education services, and e-Government initiatives
	1.5 Local content	This plan would enable local players to become strong content and application providers
	1.6 Innovation and investment	This plan would promote innovation through a competitive industry landscape with infrastructure enabling multiple content and applications players, while ensuring sufficient and sustainable infrastructure.
	1.7 Roles	The private entity would be responsible for roll-out and operation; the relevant Government department would be responsible for governance; regulator would be responsible for regulation; the Ministry on behalf of Government would be responsible for funding.
2. Funding & disbursement	**2.1 Total**	A total investment of USD X billion would be required over X years to build the NBN as envisaged
	2.2 Private	The private entity will make an investment of USD X billion over and X years period after signing of agreement
	2.3 Public	The Government will provide USD X billion of funding over X years to promote the national interest through development of NBN. One option would be if the total cost elements to build the network, based on the cost verification exercise, are less than USDX billion after X years, Operator and the Government will agree to either (i) return excess funding; or (ii) expand network coverage beyond the target.
3. Private entity Commitments	**3.1 Coverage**	Operator will cover X million premises with NBN *("premises passed/area coverage provided ")* within X years from signing of an agreement. X Specific areas will be covered. Coverage to be adjusted based on any delays in negotiations, or release of funding.

Section	Element	
3. Private entity Commitments	3.2 Access	The private entity will provide fair and equitable access to the NBN, on a wholesale basis, open to all qualified value added SPs.
	3.3 Wholesale	Options include - Wholesale pricing would be set through a commercial negotiation with VASPs, price caps, etc
	3.4 Retail	The private entity would remain committed to ensuring fair and equitable market driven retail prices that (i) encourage penetration and usage; and (ii) fair and equitable providing sufficient returns on capital.
4. Government Commitment	4.1 Regulatory concessions/ certainty	The Government undertakes to provide an X year minimum period of regulatory certainty to the private entity for the following: - Access obligations for NBN wholesale access as described in 3.2 - Wholesale and retail pricing mechanism as described in 3.3 and 3.4.
	4.2 Facilitation of network	The Government will facilitate speedier rollout of NBN (to be detailed) by, for instance - - Facilitating civil works authorization for building facilities (e.g., street cabinets, towers) needed for NBN rollout - Lifting all limitations on network build by municipalities - Acquiring rights of way or access to buildings and/or land where necessary for the rollout of NBN - Supplying the private entity with any relevant data and information, to facilitate timely NBN rollout
5. Transparency, review and ongoing opex support	5.1 Separate accounting	The private entity will work with the Government to develop an accounting record separation framework in order to provide separate accounting of the NBN PPP funding in overall and in geographic terms
	5.2 Network reporting	The private entity will provide a detailed quarterly report that shows transparency of spend and buildout, as well as ongoing network operating metrics, to the Government. Key metrics will include capex and direct cost spending, coverage area, number of homes passed. The reports shall be verified.

Section	Element	
5. Transparency, review and ongoing opex support	5.3 Ongoing review	The partners will meet on an X basis to review progress, agree on any adjustment on overall direction and resolve any matters arising. The scope of the review may include: - Rollout achieved against target - Capex and direct cost spend - Network operating metrics - Any adjustments, experiences learnt, etc. - Pricing
	5.4 Unforeseen circumstances	As part of the review process, the Government and the entity will adjust any target needed due to arising of unforeseen circumstances. A clear process and mechanism will need be defined for this purpose
	5.5 Ongoing opex support	If after a period of deployment, say X years, a particular deployment area is not covering its annual opex costs based on the framework above, then the entity shall be entitled to apply for additional funds from Government. Such funds will be utilized to cover the shortfall in any annual opex and other expenses as agreed.

WHAT ARE THE APPROACHES OF THE APAC8?

In contrast, there are considerable differences in the extent of broadband planning across the nations of the APAC8 (see Exhibit 34).

➢ *Exhibit 34: National broadband/ICT development plans*

COUNTRY	BROADBAND OR ICT PLAN
Bangladesh	2009 Broadband National Policy, 'Digital Bangladesh' - Bangladesh's 'Vision 2021' National Telecommunications Policy (Draft)
Cambodia	2016 Telecommunications and ICT Policy 2020. Broadband Policy planned for 2017
India	2011 National Telecom Policy 2012 and National Optical Fibre Network Plan *IoT 2014 IoT Policy Document; policy framework proposal
Laos	Lao PDR National ICT Development Plan (2016–2025) White Paper (Draft)
Myanmar	Myanmar Telecommunications Master Plan 2015 (final draft)
Sri Lanka	2012 e-Sri Lanka
Thailand	Digital Thailand Plan (previously National Broadband Policy 2010)
Vietnam	2016 Programme for the development of the country's high speed telecoms infrastructure

Source: various

LIKELY OPTIMAL AND RECOMMENDED APPROACH – MULTI-MODE COMPETITION

The likely optimal approach is multi-mode competition. This approach acknowledges the existing situation in most Asia-Pacific countries (including the APAC8), minimises country risk, and starts to address significant deficiencies in high speed broadband infrastructure. It continues to support the wireless mobile industry which has been very successful story and have helped underpin regional and national economic growth.
In this option, both mobile and fixed broadband infrastructure would be encouraged. This would include:

- Facilitate fixed/optical fibre deployment with inter alia, new rules and regulations which facilitate network deployment (including but not limited to a exemplar policy in relation to rights of way, policies to ensure broadband ready buildings and certification all aimed to achieve a low deployment cost) and the establishment of one stop centres to facilitate the granting of any permits, licences etc;
- Under reforms including reviewing ownership structures of incumbent operators including allowing them to more effectively compete including relaxation of any restrictions, removal of subsidies, strengthen management etc and as required licence new competitors;
- Ensure the availability of technology neutral IMT spectrum for wireless broadband services including for 4G/LTE, LTE-A and 5G services. This is even more important in the shorter term as longer lead-time to address the fixed network deployment issues.

Various elements of that likely optimal approach are discussed in sections 5.2 and Section 6 following of this White Paper.

5.2 Suggested Regulatory frameworks to facilitate deployment

Globally, national regulators have taken steps to improve and streamline the site approval process at a local level. For example, in India, local municipal governments must approve tower sites after a company has received permission from the Telecommunications Regulatory Authority of India ('TRAI'). The approval process will generally be subject to time limits to ensure that the local body conducts its assessment in a timely manner.[50]

This is similar to the "shot clock" rules employed by the Federal Communications Commission ('FCC') in the United States. Under these rules, there is a deadline of 90 days for local government bodies to process applications for co-located facilities, and deadline of 150 days for new tower construction. This means that if local governments do not meet the Commission-imposed time limits, the siting proponents have a prima facie argument that the local authority is in violation of the US Communications Act.

More comprehensive framework dealing with network deployment including both for wireless and fixed services have been determined in other Asia-Pacific markets such as Australia. Such frameworks which streamline the ability to deploy 'low-impact facilities' and provide for a national approach to telecommunications infrastructure have a number of features and advantages (see Exhibit 35 below).

➢ *Exhibit 35: Australia's facilitation scheme for network deployment*

In Australia, in order to facilitate the deployment of infrastructure, the Australian Telecommunications Act 1997[51] in Schedule 3 provides that licensed operator carriers can go onto someone's property to inspect the land and install and maintain facilities and infrastructure.[52]

The objective is to allow licensed operators to rollout low-impact facilities infrastructure under one, national process, rather than multiple State, Territory and local government requirements. This reduces the administrative burden on governments and carriers. To allow the NBN Co Limited and other carriers offering NBN equipment services, to more readily deploy fibre in streets, connect premises and locate equipment in multi-unit buildings there rules were amended and strengthened after a consultation process.

The licensed operator is therefore exempt from some state and territory laws, including planning laws, for:

- low-impact facilities;
- temporary facilities for use by a defence organisation;
- facilities for which the Australian Communications and Media Authority (ACMA) has granted a Facility Installation Permit.

If a facility is not one in of these three groups, then licensed operators must comply with the relevant Australian State and Territory laws and planning regulations.

WHAT ARE LOW-IMPACT FACILITIES?

Low-impact facilities include some radiocommunications facilities, underground and above-ground housing, underground and some aerial cables, public payphones, emergency and co-located facilities.
This list of the different type of facilities has been designated by the Minister for Communications in the Telecommunications (Low-Impact Facilities) Determination 1997 (as amended).[53] The strict type, size, colour and location limitations of low-impact facilities means that carriers can roll out networks with as little disruption to the community as possible during installation or operation.
Importantly, facilities cannot be low-impact facilities if they are to be installed in areas of environmental significance or in places listed on a Commonwealth, state of territory heritage register.

WHAT OBLIGATIONS DO LICENSED OPERATORS HAVE?

There are limits on what carriers can do under the Telecommunications Act 1997. These give land owners and occupiers the right to notification (10 days' written notice before they start any work, other than in emergencies), the ability to object and compensation (operators must pay compensation for financial loss or damage they do).

The Telecommunications Code of Practice sets out further obligations on operators. For example, operators, and their contractors, must comply with good engineering practice and consider noise limits, the environment, and obstruction of essential services when installing or maintaining facilities.

Compliance with the Telecommunications Act and the Telecommunications Code of Practice is a licence condition. As the regulator, the ACMA can enforce licence conditions by, for example, issuing directions to carriers, or by initiating court action in serious cases.

Conversely, property owners have certain responsibilities and a duty of care to operators under common law. If an operator is able to demonstrate that a property owner had deliberately or negligently caused damage to a cable, the carrier may be able to seek damages from the property owner in a court of law.

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50. For example, the Municipal Corporation of Gurgaon, under the Haryana Municipal Corporation (Erection of Communication Towers) By-Laws 2009, has the first right of refusal for any proposed tower site within its municipal boundary, however it must, within 15 days from the date of an application for tower installation, offer an alternative location for the site.

51. Prior to the 1997 Act, telecommunications carriers in Australia were able to freely site telecommunications facilities with exemption from state and territory law, and therefore without local council planning approval. The Act now only allows for specified types of facilities, most commonly low impact facilities to be installed under Australian Government legislation. Approval of majority of telecommunications facilities including overhead cables and most radiocommunications towers are now the responsibility of state and territory governments, and usually dealt by the relevant local government authority.

52. In doing this, they also need to meet the requirements of Telecommunications Code of Practice 1997. See www.legislation.gov.au/Details/F2004C01081

53. See www.legislation.gov.au/Series/F2004B00455

There are also other very good examples where relatively easy right of way (ROW) access and infrastructure sharing have saved considerable deployment time and cost. European examples include:

(1) Austria where the Austrian Telecommunications Act (TKG 2003) provides for free ROW access without authorisation on public property (including the street, footpath, public areas, airspace and in relation to private property free ROW under conditions of inter alia existing line expansion or existing line unable to jointly use.[54]

(2) Germany where the German Telecommunications Act (TKG) [55] provides that operators of public telecom networks are entitled to use thoroughfares free of charge and the Infrastructure database requires timely updating as to pipe position, capacity, path information for search and joint construction;

(3) The Netherlands where the Dutch Telecommunications Act provides inter alia that the Municipality must provide operators free access to their infrastructures and must promote sharing and coordinate upcoming civil works to minimize civil disruption. The Act allows easy access for deployment.[56]

In Asia, critical to optical fibre deployment in Vietnam has been Articles 58 to 60 of the Vietnamese Telecommunication Law 2011, [57] where in general, the government plays an active role and as the agent to address and reduce any barriers to broadband development for operators. This is discussed in more detail in Section 9.9.2 of this paper. Other ASEAN markets like Indonesia are also attempting to address such issues and facilitate utility sharing.[58]

ONE STOP CENTRES

Another approach which is the establishment of one stop centre (OSC) model which is used in some markets to facilitate more efficient rollout of telecommunications infrastructure (see, for example, Exhibit 36 below on Greece). The OSC model involves the establishment of a government body that facilitates the licensing process by obtaining co-current permission from the relevant authorities (which may include local planning bodies as well as civil aviation and other authorities) on behalf of the infrastructure provider. Where the infrastructure provider must obtain multiple permits for site planning and installation, this model is especially useful and provides a practical means of dealing with bureaucratic inefficiencies.

54. See Austrian Telecommunications Act 2003 (English translation). Available at www.rtr.at/en/tk/TKG2003#a2 especially Article 5(3).

55. See Telekommunikationsgesetz, TKG, English translation available at http://germanlawarchive.iuscomp.org/?p=692

56. See Wet van 19 oktober 1998, houdende regels inzake de telecommunicatie (Telecommunicatiewet). English translation is available at www.government.nl/binaries/government/documents/policy-notes/2012/06/07/dutch-telecommunications-act/telecommunications-act.pdf, See especially Article 5.2 and 5.3

57. Số: 25/2011/NĐ-CP, Quy định chi tiết và hướng dẫn thi hành một số điều của Luật Viễn thong. English translation available at http://moj.gov.vn/vbpq/en/lists/vn%20bn%20php%20lut/view_detail.aspx?itemid=10472

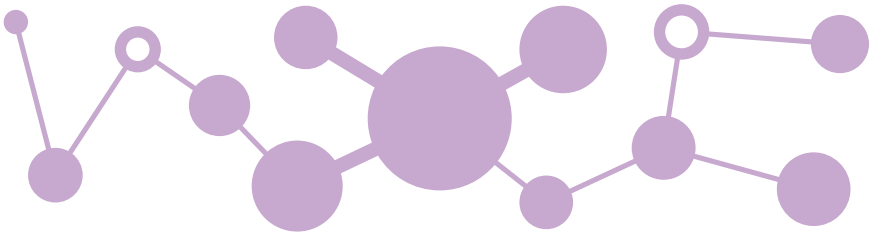
58. See Indonesian FTTH Association, Broadband Development Policy and Regulation White Paper (draft), 25 October 2016.

➢ *Exhibit 36: Greece's one-stop centre for BTS planning and permission*

Requirements and conditions that operators face in order to be granted a permit for base station deployment vary across Europe. Procedures can be defined at different government levels, even though generally the local authority (municipality) is the main point of referral for the process. In addition, general requirements relating to regional or national levels of legislation usually have to be met.

As the GSMA notes, it takes on average one year for an applicant to receive all permits necessary to deploy single base station antennas in Europe. As a general observation, most delays are caused by bureaucratic and time-consuming administrative processes and a lack of co-operation with operators. In Greece, the EETT (Hellenic Telecommunications and Post Commission) assumes the role of a one-stop licensing body, whereby applications are filed through the Electronic Submission of Applications System ('ESAS') and subsequently forwarded to the various competent authorities and agencies for co-current issuance of the relative authorizations or approvals. The final approval is then issued by the EETT. The competent authorities should respond back to the EETT through the EAFS within four months.

Greece introduced the Law 4053/2012 on licensing antenna constructions to improve the approval process. Under the new provisions, the EETT facilitates approval across a number of agencies, including the Civil Aviation Authority and the Greek Atomic Energy Commission, and ensures compliance with the Standard Environmental Conditions and applicable city planning provisions. [60] Authorities involved are obligated to update the EETT through the ESAS platform on whet the application is approved or rejected. If all authorities approve, then the EETT issues the final approval. However, if one authority rejects the application, then the operator or provider must renew the application process through the EETT.



59. *www.gsma.com/publicpolicy/wp-content/uploads/2012/07/BSL-Report-2013-Update_121813.pdf*
60. *www.eett.gr/opencms/export/sites/default/EETT_EN/Publications/Newsletter/2012/32.pdf*

DIG ONCE APPROACHES

On June 14, 2012, the US President Barak Obama signed an Executive Order to facilitate the deployment of broadband technology on Federal lands, buildings, rights of way, federally-assisted highways and tribal lands. The goal is to reduce barriers to the expansion of broadband services in underserved communities. One of the directives was to review "dig once" requirements in existing programs and identify a flexible set of best practices that can accommodate changes in broadband technology and minimize excavations. Dig Once requirements, as defined by the US Presidential Executive Order, refer to "requirements designed to reduce the number and scale of repeated excavations for the installation and maintenance of broadband facilities in rights of way." Although this definition provides a basis for understanding the concept of dig once, there are various interpretations of what may constitute a dig once policy and/or policies and practices to facilitate broadband deployment. [61] More broadly, the objective of Dig Once in the US and beyond is to have all major infrastructure programs install an underground fibre link when building or renovating roads, railways, pipelines, utility infrastructure, and energy distribution channels. [62] The policy strongly suggests laying fibre rather than empty conduit to prevent waste. The argument in the US is that the empty conduit often fills with dirt or is otherwise destroyed during utility and roadway construction projects.

Dig once would seem to have a number of advantages including:

(i) Cost Savings—Limiting the number of times transportation and utility channels must be opened up is approximately 10 times cheaper than adding broadband infrastructure after the channel are built. When fibre installation is coordinated with a road or utility project, there is a 20 percent cost savings. The cost savings applies primarily to urban environments where the only option is to install fibre underground;

(ii) Increased Access to and Reliability of Broadband Networks;

(iii) Public Benefits—Dig Once policies can increase public safety systems and decrease government telecommunications costs. Additionally, decreased road construction will reduce traffic congestion as well as increase infrastructure life-spans, which are often diminished the more times the infrastructure is under construction;

(iv) Economic Benefits—Increased access to broadband will benefit existing businesses and will boost local economic activity;

(v) Decrease Time Needed to Deploy Fibre—When conduit is already in place at the time of fibre installation, the time and cost needed to deploy the fibre will be minimal if the conduit remains in good condition and is usable. Benefits diminish when the conduit becomes damaged and when there is poor conduit location tracking.

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61. See www.fhwa.dot.gov/policy/otps/workplan.cfm

62. The view was to use modern digging technology—avoid trenching when adding fibre to heavily populated areas by using either horizontal directional drilling or micro-trenching

6

Recommended detailed policy interventions

6.1 Sharing Essential Infrastructure

While the ITU's recommended regulatory approach to infrastructure sharing is well known and summarised below (see Exhibit 33 below) to facilitate faster and fixed broadband services there is a consider whether such an approach to infrastructure sharing continues to be appropriate given experience over the past decade or whether such rules should be extended in any way. There are already strong commercial reasons for mobile operators to share infrastructure and mandating ought be unnecessary in a competitive market. There should however, be no limitations on the forms of infrastructure sharing which should be permitted in a market. Regulators generally approve of mobile network infrastructure sharing in principle, they tend to be reactive about such deals and typically approvals are on a case-by-case basis. It is important to note that sharing of network infrastructure among mobile operators has become common internationally. In 2013, the ITU reported that: [63]

- Nearly 130 countries have permitted infrastructure sharing for mobile operators;
- Infrastructure sharing of some form mandated in some 93 countries;
- 90 countries have mandated co-location/site-sharing.

The ITU's regulatory approach to infrastructure sharing is discussed over (see Exhibit 37).
More broadly markets have moved to permit active infrastructure sharing and in markets like Europe it has been actively embraced with 22 sharing[64] deals by 2014 and even more until mid-2016. It has also prompted the establishment of specialist towerco companies in a range of markets like China, India, Indonesia, and Malaysia which are focused on infrastructure sharing.[65] Such moves are recognised by the World Bank which has stated that "In high technology markets, shorter technology life cycles, the commoditization of network equipment, and less capital expenditure needed to adopt new technologies shifts the incentives of operators toward sharing passive and active infrastructure." (World Bank emphasis).[66]

63. ITU, ICT Regulatory Tracker Rev2014 (released June 2015). Available at www.itu.int/en/ITU-D/Regulatory-Market/tracker/Pages/default.aspx

64. Active network sharing refers to sharing of active electronic infrastructure and radio spectrum. Shared equipment includes: antennas, feeder cables, radio access networks (RANs), base transceiver stations (BTSs)/Node Bs, BSC/RNC, backhaul (transmission) and microwave radio equipment.

65. Examples include Indus Towers (india), Profesional Telekomunikasi Indonesia (Protelindo) (Indonesia) and edotco (Malaysia but pan-ASEAN).

66. World Bank, Jose Marino Garcia and Tim Kelly, The Economics and Policy Implications of Infrastructure Sharing and Mutualisation in Africa, World Development Report 2016. Page 11

➢ *Exhibit 37: ITU's regulatory approach to the promotion of infrastructure sharing*

The International Telecommunications Union's ('ITU') focus is on how governments and regulatory authorities can encourage infrastructure sharing to facilitate network rollout.[67] This includes allowing or mandating the sharing of infrastructure by mobile operators, as well as the promotion of independent tower companies, which may provide the whole or a substantial proportion of network infrastructure. In some cases, the entry of independent tower companies will require amendments to the existing licensing framework. Regulatory measures include:

- **Optional sharing**: In many cases operators will voluntarily opt to share infrastructure in order to reduce costs. Self-regulatory bodies such as operator associations may encourage sharing through the establishment of uniform conditions for site sharing, as well as communicating with government authorities. The government may provide guidance on the types of sharing allowed, and may encourage sharing by allowing access to state-owned facilities, as well as providing financial incentives for sharing such as tax concessions.

- **Mandatory sharing**: Operators are required to share sites or facilities on request. This should be implemented with clear policy objectives in mind, for example to achieve certain geographic or population coverage targets or addressing competition issues. The authority needs to develop criteria for determining those facilities subject to sharing, the setting of tariffs and other conditions, access to technical site information and conditions for the negotiation of sharing agreements between operators (e.g. time limits for sharing agreements).

- **Dispute resolution mechanisms**: The government may provide independent dispute resolution bodies to arbitrate on issues relating to access negotiations or agreements. The body must be independent of any interested parties.

- **Licensing conditions and local authorities**: In most countries the installation of masts and towers is dealt with by local authorities, which require permits for the construction of mobile infrastructure. It may be possible for central authorities to develop rules or guidelines to be followed by local authorities to ensure the efficient rollout of infrastructure and to minimise disputes between operators/tower providers and local authorities.

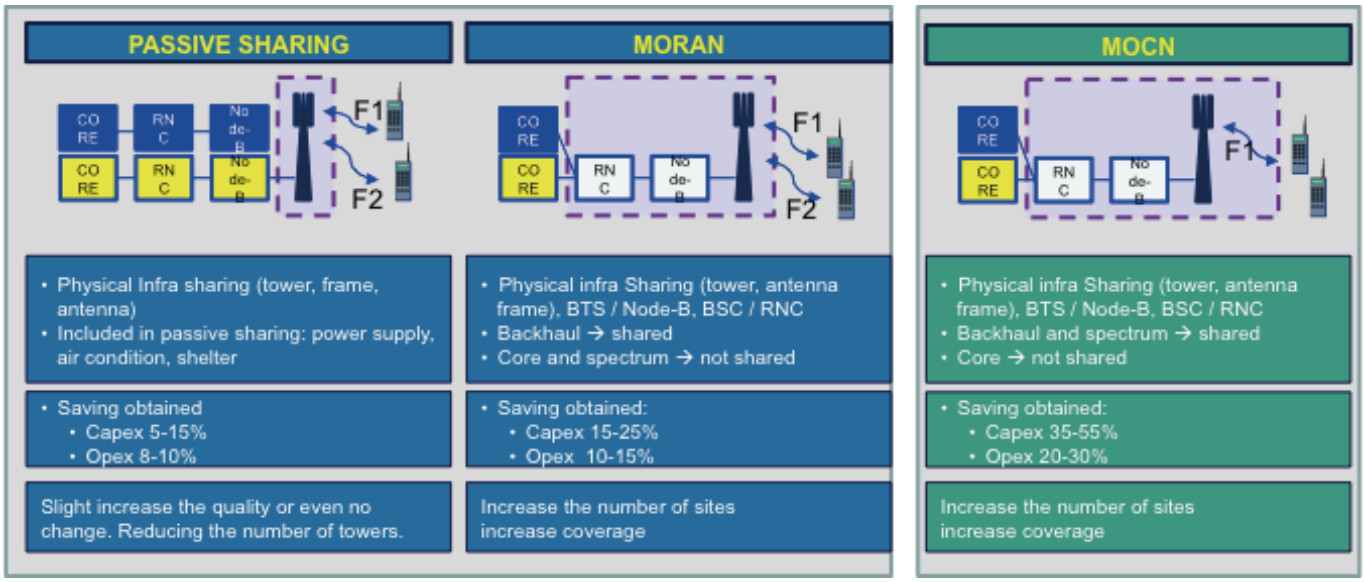
Site sharing agreements between operators may be unilateral, bilateral or multilateral. They may concern an individual site or provide a framework for multiple sites or all sites in a geographic region. Site sharing agreements do not generally restrict competition as operators retain independent control of their respective networks and services. Governments should ensure such agreements do not include exclusivity clauses, and leases should allow other operators to place equipment on the site without requiring further consent from the real estate owner.

The ITU also highlighted ways in which governments can address legal issues relating to tower ownership, and particularly the need to avoid ownership by accession by owners of land containing tower structures.

More specifically there are a number of reasons as articulated in Exhibit 38 and Exhibit 39 over for the infrastructure sharing of mobile network to extend beyond passive sharing to the use of Multi-Operator Radio Access Networks (MORANs), also known as Radio Access Network sharing, and Multi-Operator Core Networks (MOCNs).

67. *Refer to www.itu.int/ITU-D/treg/Events/Seminars/GSR/GSR08/discussion_papers/Camila_session4.pdf*

➢ *Exhibit 38: Moving to Active mobile infrastructure sharing*



➢ *Exhibit 39: Infrastructure sharing and roaming support a wide range of Government policies and regulatory objectives*

	Benefit areas	Implications and impact
1	National Economic Benefits	• Drives improvements on economic indicators (GDP growth, FDI, etc.) • Stimulates the development of "Digital Industries", small-and-medium enterprises (SMEs) and industries' growth • Promotes license fees , non-tax revenue and government's tax revenues • Supports and accelerates the national Broadband Plan
2	Consumer Benefits	• Provides more affordable tariffs • Allows to reach a wider coverage, sooner • Gives consumer a choice of service providers to meet their needs • Provides access to latest 4G technology and highest speed to more consumers
3	Telco Industry Efficiency	• Promotes greater efficiency by generating 20-50% savings vs standalone rollout • Enables operators to meet their service obligations more rapidly • Increases total addressable market and revenue opportunity • Allows to use more efficiently scarce mobile spectrum resources
4	Social Benefits	• Is proven to drive improvements on a range of well-being indicators such as education, HDI, wellness index, etc. • Helps to minimize regional imbalances • Gives greater access to Government e-services, Supports the deployment of "branchless" banking
5	Environmental Benefits	• Reduces the number of towers and improves aesthetic visual impact • Reduces site power consumption and thus CO_2 emissions • Allows e-services to faster substitute multiple physical services and processes, leading to improved energy efficiency across society

Source: Industry sources with modifications by author

Beyond mobile network infrastructure, similar arguments apply in relation to fixed network infrastructure especially where that infrastructure includes new constructed greenfields deployments and/or where costs of new ducts, manholes, etc. are shared. Obviously the payback period for such infrastructure is much longer than mobile infrastructure and the agreed (or mandated costs) need to reflect the costs of rollout including a contribution to the weighted average cost of capital (WACC).

6.2 Necessary Assignment of Government Assets

Regulatory policies that actively promote infrastructure sharing and re-use could also help significantly to lower deployment costs. Co-operation between governments and municipalities can equally lead to significant cost savings, for example through and coordination of civil engineering works. Supporting co-investment strategies with utilities can help to lower costs and share risks as has been done by than 200 Nordic municipal governments which already deployed fibre optic cables for leasing or self-operation. The cost of competition analysis shows that considerable cost can be avoided through duct access versus competitive new build network deployment. However, whilst competition under duct access avoids the cost of multiple duct networks

Telecoms operators might team up with power companies who may wish (or may be obliged to) make use of smart meters and require the appropriate ICT infrastructure to support their smart grids. Examples highlighted by the FTTH Council and others include:

(i) Sewage system projects: Examples include (a) Austrian municipalities in rolling out a regional fibre network. The co-operative aims to take advantage of planned works on the sewage system in the area to install ducts, which would result in significant cost savings in the roll-out of fibre and (b) In Oman, Haya Water Company deploys fibre optic network along its sewage ducts and wholesale it to operators;

(ii) Electricity system projects: Examples include (a) Italy and Germany where regional operator has teamed up with power companies and the local councils to roll out fibre in the district of Cochem-Zell[68] and (b) Poland Orange, [69] Vodafone and ESB in Ireland, and Altibox in Norway. [70] In Croatia, 30-year contracts were signed between public-owned transmission company and stated-owned road, motorway, railway, oil, gas and electricity companies to fully utilize their conduits and surplus fibre capacity

68. dotecon, Regulatory policy and the roll-out of fibre-to-the-home networks A report for the FTTH Council Europe July 2012, page 36

69. It is understood that Orange saves 14 percent ODN investment and 12 months of lead-time by fully sharing pipe, infrastructure, labour and deployment cost with Electricity Company.

70. Norway Altibox, saves 30 percent of deployment cost by cooperating with 42 regional electricity companies. Its business strategy that allows network construction only up to 60 percent of potential subscribers sign up, largely enhances service uptake and return on investment.

6.3 Orchestrated Infrastructure Construction

In particular, multi-user infrastructure corridor (see Exhibit 40 below) have proven globally to have considerable merit. For example, Canada co-locates compatible infrastructure within major road reserves and calls them transportation/utility corridors. Singapore-with less land and more concentrated urban-uses the roadway as the corridor. Australian cities have also adopted such approaches.

➢ *Exhibit 40: Multi-user infrastructure corridors*

AVOIDING DAMAGES TO UNDERGROUND CABLES AND FACILITIES

Once constructed it is important to ensure that there is no damage to duct and/or fibre infrastructure from later construction (one recent example, is damage done to the Telecom Cambodia's new 10km fibre route from Phnom Penh Airport to the City). Best practice would also be to create a 'dial before you dig' organisation. Depending on the market these types of organisations are supported by electricity, gas, communications and water companies-as well as many other private enterprises.

Country examples include Australia, Singapore, United Kingdom and, North America (the United States and Canada).[71] In Australia the access code is 1100 and in the US it is 811 (see Exhibit 41).

It is therefore recommended that countries in the APAC8 especially larger market like Cambodia, India, Thailand, Vietnam, etc create such organisations as part of the push to deploy fibre cable and infrastructure underground.

➢ *Exhibit 41: Example of dial before you dig advertising*

71. *See: www.1100.com.au/, www.beforeudig.com.sg/ and www.clickbeforeyoudig.com/ respectively*

6.4 Policies, standards and specifications for fibre

Setting policies, standards, and specifications that inter alia mandate the deployment of fibre to the home and promote competition help drive broadband deployment. For example, in China, Ministry of Housing mandates all developers must deploy FTTH facilities in new constructed and refurbished houses, buildings and communities. While in Europe, regulators have already mandated the new constructed and remodelled buildings must equip with high-speed-ready in-building infrastructure. Portugal, for instance, mandates that new buildings and remodelled old buildings must equip at least 2 fibres per home to be shared by operators to avoid monopolisation of in-building infrastructure. Through these construction specifications, Portugal places the sixth place in NGA coverage in Europe, with 91 percent high-speed broadband penetration, leading the UK, Germany and Spain.

6.5 Improved International Connectivity

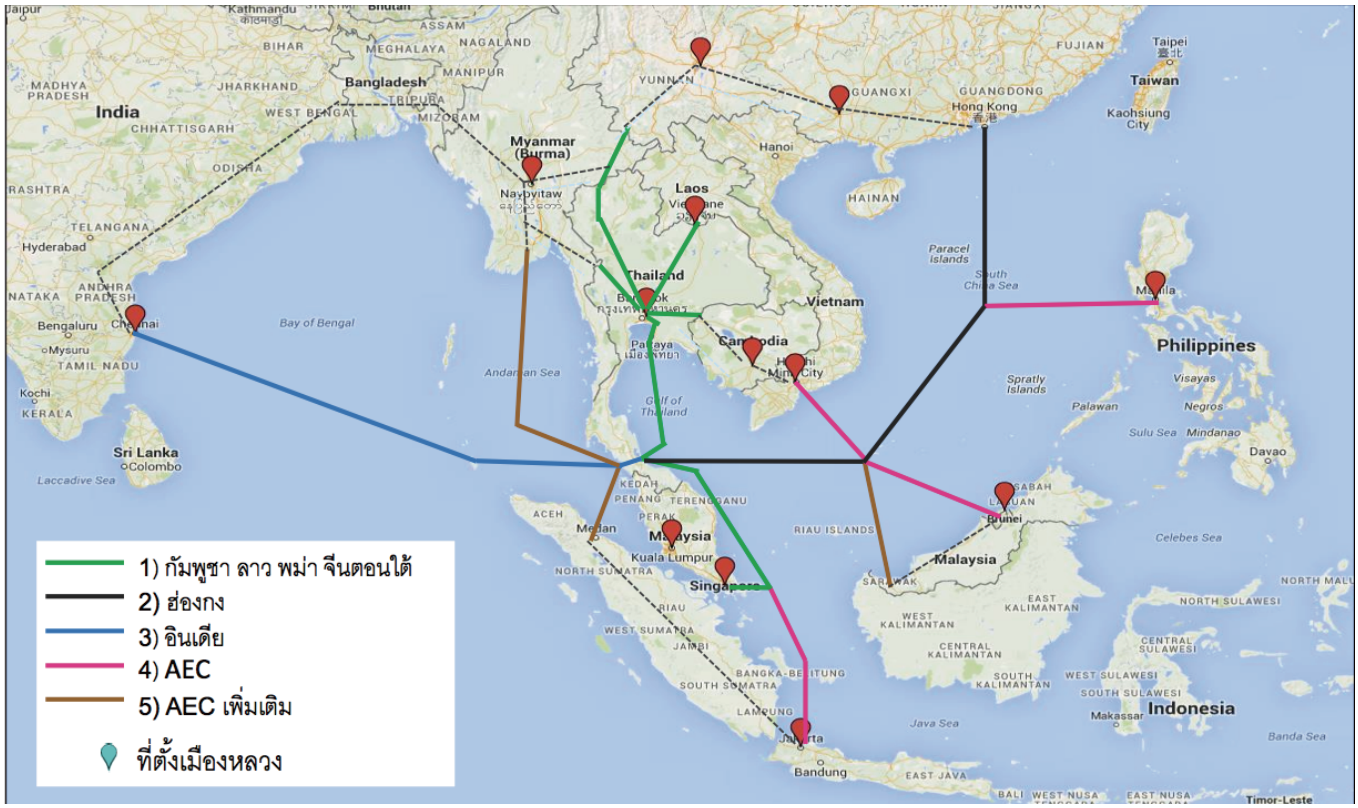
Consistent with the analysis of the broadband ecosystem, at its core, there is a necessity for increased investment in submarine cable submarine and terrestrial cable connectivity. Recent studies from Deloitte[72] and Analysys Mason highlight unleashing international connectivity can fuel growth and bridge the digital divide. Likewise there are strong arguments, for major operators to secure access rights to the submarine cable landing stations and similar connection points like Asian regional peers like Malaysia and Singapore. In both markets the respective regulators have mandated access to such facilities [73] although given the current security situation and the importance of broadband services and ecommerce providing virtual co-location or “meet me fibre” in order to gain access to such facilities is a more than acceptable alternative.
It should be noted that the establishment of additional submarine capacity and landing stations is already the subject of submissions and presentations in Thailand, in order for Bangkok can become the ASEAN Hub (see Exhibit 42). The Kingdom of Cambodia, another of the APAC8 has taken major steps taken to address international capacity with licensing of four new submarine cable providers in that market.

72. See Deloitte, The future of Telecoms in Africa: The blueprint for the brave, 2014, page 13

For example, in Malaysia: Commission Determination on the Access List, Determination No.2 of 2015, 24

73. August 2015, Article 19 and in Singapore: Code of Practice for Competition in the provision of Telecommunication Services 2012, articles 5.3 and 7.2

➢ *Exhibit 42: Proposed expansion of Thailand's submarine and terrestrial cable connectivity*



Source: TCT, ASEAN HUB, 2015

Globally it is well-understood that there are significant national security and other risks in relation to submarine cables and landing stations which need to be addressed. [74] In this context given the growing importance of international connectivity Governments should assess whether new legislation needs promulgated to upgrade protection for submarine cables and associated infrastructure. [75]

74. See The Protection of Undersea Cables: A Global Security Threat by Commander Michael Matis United States Navy, March 2012. Available online.

75. See www.acma.gov.au/Industry/Telco/Infrastructure/Submarine-cabling-and-protection-zones/submarine-telecommunications-cables-submarine-cable-zones-i-acma and Australian Telecommunications Legislation Amendment (Submarine Cable Protection) Act 2014. Available at www.legislation.gov.au/Details/C2014A00033. It should be noted that Australia's regime has been praised by both the International Cable Protection Committee and APEC as a global best practice regulatory example for the protection of submarine cables.

6.6 Suggested rules for greenfield fibre deployments

Firstly, it should be noted that the deployment of fixed network infrastructure can be characterised into two types, namely 'greenfields' and 'brownfields". These terms are used to describe the rollout areas which network infrastructure is being built into. Greenfields refers to new estates or commercial/housing developments where fibre network and associated infrastructure can be built alongside other utilities at the same time that the area is developed or the building is being constructed. Brownfields refers to established areas where there is already ducts and/or network infrastructure is being deployed.

It is an important distinction as the techniques required to deploy fixed infrastructure differ markedly from a new build rather than having to retrofit or similar the infrastructure. In a number of markets rules have been set from Rwanda where it is mandatory for every new housing estate built in Kigali to cater to broadband access to South Korea where the building certification Program (BCP) introduced in 1999 attempts to connect new apartment building to 4 optical fibre cables. If building is compliant it is given an award/certificate. [76] In Australia, the NBNCO set rules for new developments [77] and there have been regulatory rules in place for them since 2010 (although changes were made in March 2015). [78]

While in Portugal new buildings are mandatorily equipped with at least 2 fibres per home to be shared by operators, with the in-house wiring belonging to building owner. In the case of old buildings sharing of new or upgraded infrastructure within the building is mandated to avoid monopolisation of in-building infrastructure by first operator. The first operator to reach an old building has to install at least 2 fibres per home to be shared by other operators, with the second operator paying 50 percent of the costs incurred in the installation of shared infrastructure and the third operator will pay 33 percent.

In most cases the new property purchaser (through the property developer) pays for or makes a contribution to the cost of fibre connectivity. The strategy of many global incumbent network operators is in many cases to deploy fibre infrastructure in new buildings, while incrementally upgrading their existing infrastructures. If this is done there is only a need to deal with legacy infrastructure/networks which will decrease over time. This suggested approach is depicted in Exhibit 43 below.

Care does need to be taken though to ensure that stranded assets are not created in terms of service availability (dial tone, priority assistance, emergency service calls and customer service guarantees) and network availability (backhaul connection to the new estate etc.). Such risks can be managed with good planning and will naturally reduce over time.

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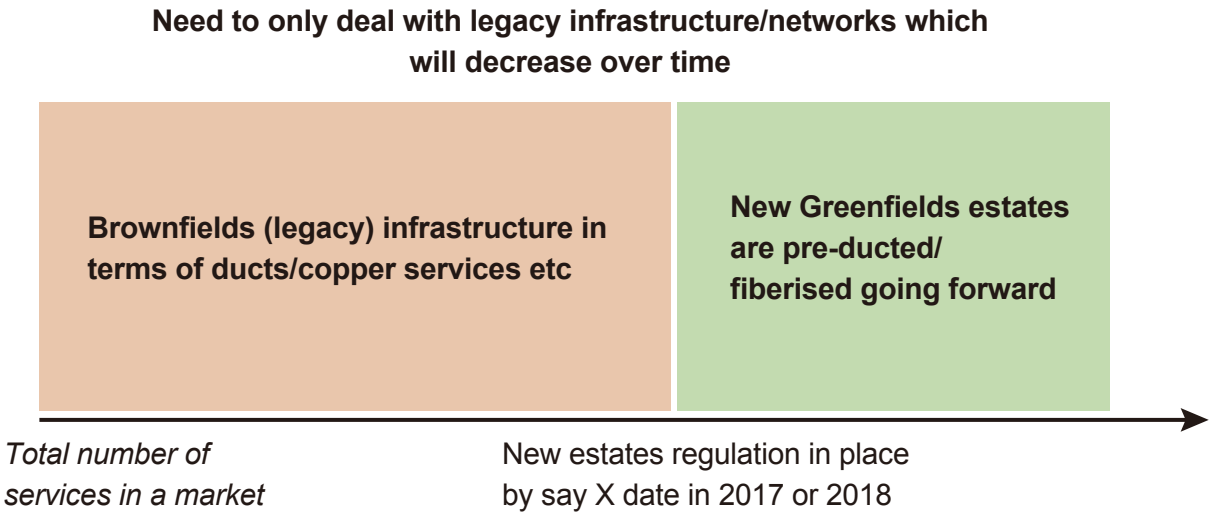
76. Mohamed El Bashir, Qatar, Communications Regulatory Authority, Open Access, Policies, Opportunities and Challenges, Telecom Laws and Regulations Forum, 13 – 15 April 2015. Note Introduced in 1999, the BCP is de facto for in-building wiring in South Korea.

77. Nbnco, New Developments: Deployment of the nbn Conduit & Pit Network, 21 October 2015. Available at www.nbnco.com.au/content/dam/nbnco/documents/installing-pit-and-conduit-infrastructure.pdf

78. www.communications.gov.au/policy/policy-listing/telecommunications-new-developments

➢ *Exhibit 43: Suggested approach to greenfields fibre deployments*



Source: Author

6.7 Policy for Transition to Broadband Networks

In a number of developed countries (And the EU) there has been considerable debate about the policy issues associated with the transition to broadband networks. New fibre access networks are expected eventually to replace existing copper infrastructure. The migration from new fibre and IP technology to another means that there will be a transition period where both are in use, and competing for (incremental) investment as well as users. Interconnection and access regime and long held regulatory approaches to computing incremental costs similarly need to be reviewed as VoIP/-VoLTE calls become an ever shrinking proportion of traffic on all networks and traffic is interconnected on a peering basis.

Because there is a high degree of regulation applying to the fixed legacy network operators in many developed countries, there is a debate as to the whether the approach used for setting charges for access to the legacy copper network will also affect the incentives for fibre investment. Such analysis highlights that the interaction between fibre and copper access charges is complex, with a number of effects working in opposite directions. This has there being little consensus on whether lower or higher access prices for copper (relative to fibre) would stimulate fibre investment, as both technologies not only compete for investment but also for end-users.

In the Asia-Pacific context (at least for our APAC8) such issues are more theoretical as the market has moved to optical fibre and there is not the investment in legacy networks as there is in developed country markets. [79]

79. There are some exceptions with India and Vietnam having significant fixed networks but generally the teledensity in such markets is lower and it has been dropping rapidly.

6.8 Spectrum Policy enabling Broadband Deployment

OVERALL IMT SPECTRUM DEMAND AND ALLOCATIONS

While this White Paper has focused more on fixed network and fibre deployment also critical to ensuring faster broadband services in Asia-Pacific and the APAC8 is the spectrum policy, particularly in relation to IMT spectrum.

International organisations including ITU and the GSMA have modelled the amount of spectrum that national economies will need by 2020. Estimates suggest that current national spectrum allocations for IMT which are, in general, between 400 MHz and 600 MHz nationally, should be increased substantially by 2020. [80]

Such issues as well as being topical given the growth in wireless broadband, were also motivated by World Radiocommunications Conference (WRC-15) which took place in November 2015. In the ITU Report prepared in advance of WRC-15, countries expected to have lower levels of mobile communications demand are advised to consider increasing their level of spectrum in use for IMT from a level of around 400 MHz to 1300 MHz in total by 2020. Countries with higher levels of mobile communications demand and which may have current spectrum in use of over 600 MHz are advised to consider increasing their present national allocations of spectrum for IMT to around 1900 MHz. This high ITU estimate of the spectrum required has been the subject of considerable industry and regulator criticism.[81]

In contrast, the ITU in its Guidelines for the Preparation of National Wireless Broadband Masterplans for Asia Pacific Region, October 2012, recommended that the minimum spectrum allocated and in use for cellular mobile services should be at least 760 MHz by 2020 and preferably 840 MHz [82]. This is shown in Exhibit 44 over.

(i) While countries can certainly seek to set stretch IMT targets of 1,000 MHz or more, as a minimum the Asia-Pacific countries – especially the APAC8 should Undertake the refarming of 2G bands for LTE and LTE-A services (and plan for the switch off of 2G networks like Singapore and other developed countries) similar to approach in Indonesia and Malaysia as well as APAC8 countries including Sri Lanka, Thailand, and Cambodia. To do so various regulatory restrictions which do not permit technology neutral spectrum use should be eased so that operators are able to use the most efficient and affordable technologies;

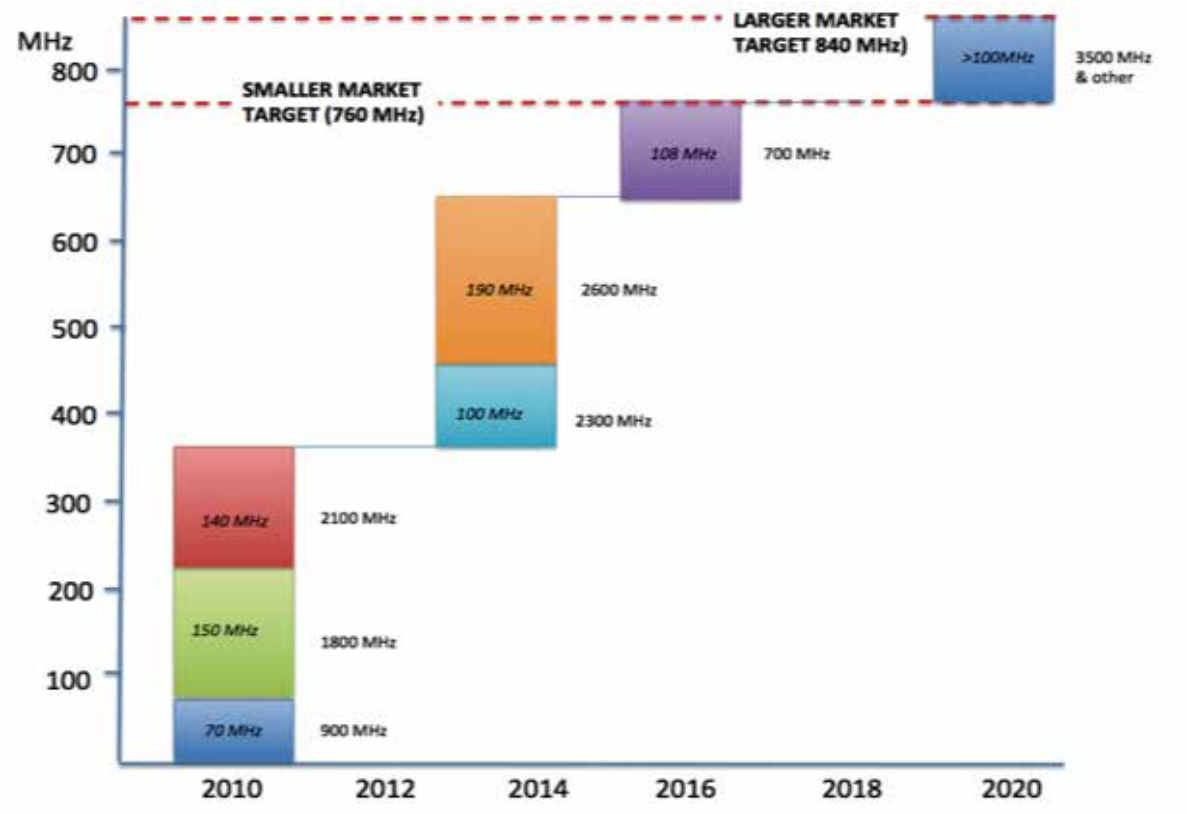
(ii) Allocate and have in use at least 760 MHz but preferably 840 MHz of IMT spectrum by 2020. Going forward with the availability of the L-band spectrum following the decisions taken at WRC-15, Governments and regulators should plan for additional IMT spectrum allocations. In order to do so it is recommended that respective country spectrum managers develop an IMT spectrum roadmap. A summary of the contents of an IMT Spectrum Roadmap are summarised in Exhibit 45.

80. See for example, ITU-R, M.2290-0 (01/2014), Future spectrum requirements estimate for terrestrial IMT, Geneva, January 2014.

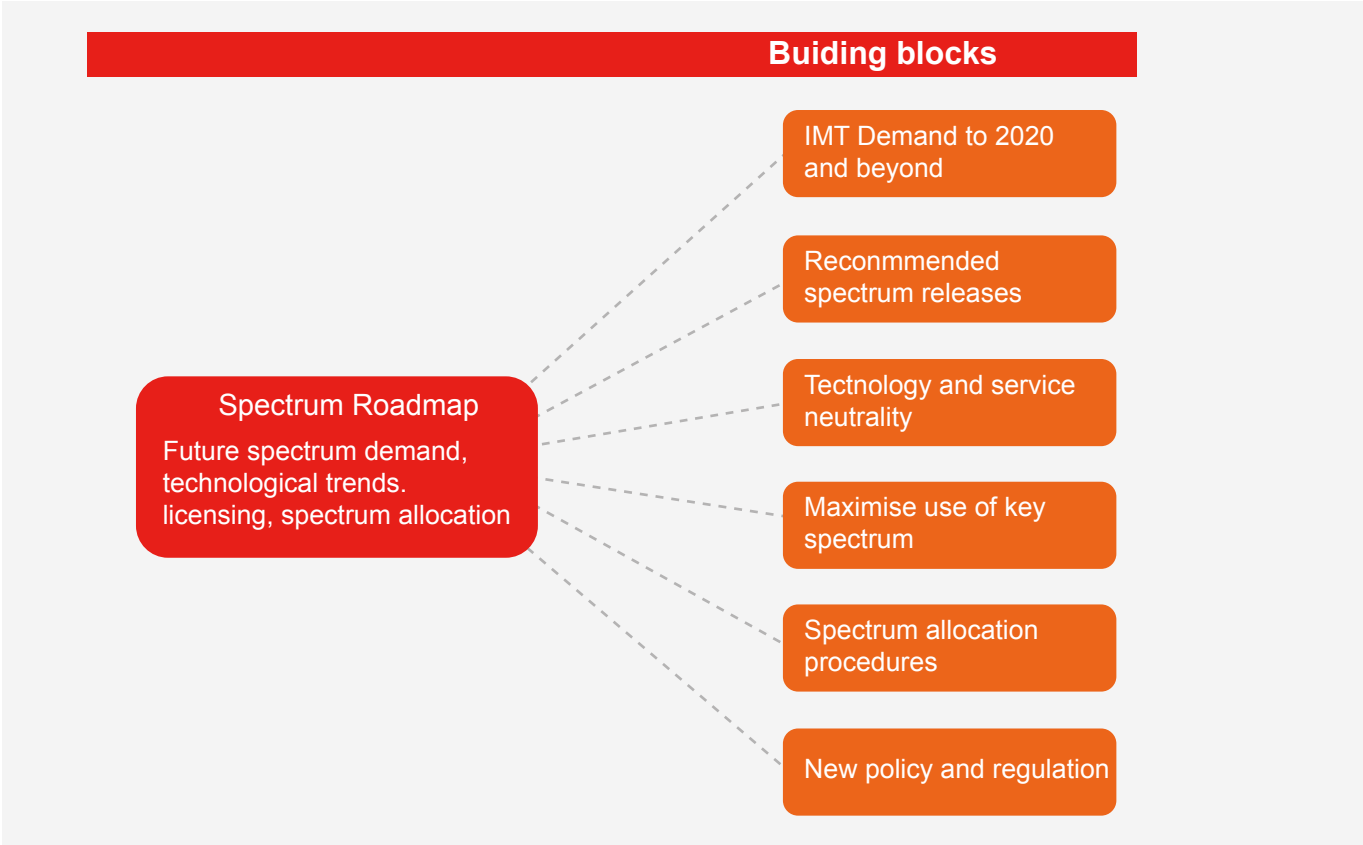
81. See for example, http://stakeholders.ofcom.org.uk/consultations/cfi-mobile-bb/summary

82. Available at www.itu.int/ITU-D/tech/broadband_networks/WirelessBDMasterPlans_ASP/Masterplan%20guidelines%20EV%20BAT1.pdf. See page 45.

➢ *Exhibit 44: Country suggested IMT allocation targets for wireless spectrum until 2020*



➢ *Exhibit 45: Suggested approach to the contents of an IMT Spectrum roadmap*



Source: WPC, 2014

USE OF HYBRID NETWORKS FOR LAST MILE ACCESS

It is important to highlight that frequency spectrum such as 1.5 GHz (when available and harmonised), 2.6 GHz and higher frequency bands such as 3.5 GHz such is very well suited for last mile services (from a fibre access point) and future 5G services. Consultations and discussions have commenced in a number of regional markets [83] and globally with Qualcomm also releasing a paper on 5G shared spectrum. [84]

In Myanmar the successful bidder for last month's 2.6 GHz spectrum auction have indicated that they will be using the spectrum for last mile broadband services in Yangon, Mandalay and other urban areas.

The use of these hybrid networks which may use LTE and other 4G/5G technologies would greatly increase if there was increased fixed broadband connectivity available in a market.

6.9 Cost implications of proposed policy interventions

It is worth emphasising at this point that many of the policy interventions discussed in Section 6 will have potentially significant direct or indirect impacts on the costs of deploying fixed broadband infrastructure and therefore the affordability of broadband services downstream. In particular, those policy interventions associated with sharing of essential infrastructure, orchestrating infrastructure construction and the efficient assignment of government assets, will all contribute to reduced deployment costs.

It should also be noted that the implementation of such policies would represent an extremely positive signal to a range of potential domestic and overseas infrastructure investors. As such, some of these issues are likely to be 'threshold issues' for potential investors and once overcome, it is likely that substantial volumes of investment for broadband infrastructure would become available. These policies not only represent in a material way a proactive broadband footing on the part of national governments, but would also signal to investors are likely rapid future growth in broadband uptake and a move towards maturity in the domestic broadband market.

83. In Australia – see http://acma.gov.au/theACMA/future-use-of-the-15-ghz-and-36-ghz-band . ACMA has indicated that it may be possible to start re-farming the spectrum as soon as the fourth quarter of 2017. Other discussions are taking place in Thailand and Vietnam.

84. Refer to http://gsacom.com/paper/5g-shared-spectrum-new-spectrum-sharing-paradigms/

7

Key Drivers: Stimulating Demand for Services and Applications

Previous sections of this paper have focused predominantly on economic factors and policy that influence the rollout of broadband infrastructure. In this Section, we focus on the factors that drive the demand for broadband access and services.

As we have noted above, significantly more people have access to broadband than have adopted broadband at this time. Why are adoption levels not higher where broadband access is available? Reporting from the Asia Pacific regional Internet Governance Forum (Taipei, 2016), Said Zazai, identifies a list of 13 factors that impede internet adoption and hence provides a useful summary. The factors identified were:

1. Government realization and support for broad band connectivity
2. Basic Infrastructure
3. Basic Literacy
4. Localization
5. Local Content
6. Digital Skills
7. The need for speed
8. Affordable prices
9. E-payment
10. Cyber-security
11. Social and organizational cultures
12. Legal framework
13. Regulatory framework. [85]

Drawing from this list and other sources this paper identifies the following key demand factors:

- The price of broadband services and devices;
- Language, localisation, digital literacy and local content and apps;
- Government services and data;
- 'Soft infrastructure': law, regulation, e-payments and security.

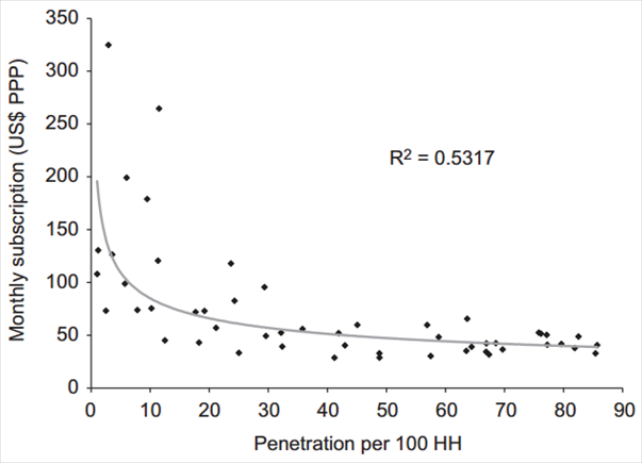
7.1 The price of broadband services

The ITU has defined affordability of broadband services as being less than 5 percent of average monthly income. As discussed above there has been significant progress towards the goal of increased broadband affordability but in many countries broadband prices are still prohibitively high.

Research indicates the demand for broadband is relative sensitive to price – broadband demand "is relatively elastic to price in LAC but not in the OECD" with estimates "that an average price reduction of 10% would result in an increase of almost 22% in the penetration rate in LAC" . [86] Exhibit 46 illustrates the relationship between broadband penetration and price.[87]

85. *www.circleid.com/posts/20160824_internet_access_a_chokepoint_for_development/ accessed 24/10/2016*
86. *Price elasticity of demand for broadband: Evidence from Latin America and the Caribbean Herna´n Galperin, Christian A. Ruzzier, Universidad de San Andre´s in Telecommunications Policy 37 (2013) 429–438*
87. *Broadband Commission, State of Broadband 2016.*

Exhibit 46: Correlation between average prices (in US$ PPP) and broadband penetration (connections per 100 households) in LAC and OECD, Q2 2010.



Source: Price elasticity of demand for broadband: Evidence from Latin America and the Caribbean Herna

This type of finding supports the emphasis on affordability of services as a driver of broadband demand but, in addition, the price of devices used to connect to the Internet is also important:

> *Affordability describes both the price of services, as well as the cost of devices, relative to income. The good news is that new technologies and market forces have encouraged the launching of innovative business partnerships between key players in the ICT ecosystem, helping make broadband connectivity more affordable, accessible and valuable for unconnected people.*

As the smartphone becomes increasingly the predominant device for connecting to the Internet especially in developing economies, it is reasonable to expect that the cost of devices will be a low barrier to Internet adoption in the future. Lower technology and production costs will mean that smartphones will soon be affordable almost anywhere in the world.
Given the falling price of devices, it is likely that recurrent broadband charges will be the greatest price barrier to increased adoption. In areas where cost of provision is very high, such as remote regions with low population densities, governments will likely need to put in place subsidisation arrangements in some form to enable providers to price low enough to attract new users.

7.2 Language, localisation, digital literacy and local content and apps

It is not surprising that most of the last communities that come online are ones that are remote, have small populations and relatively poor. Even within the countries with large populations that still have relatively low broadband penetration rates such as India, Myanmar and Vietnam, there are regions common often remote, where there are significant populations that are culturally and ethnically distinct where quite different languages are spoken.

In some communities, literacy itself will be a barrier and overcoming this will need to be part of a longer-term education strategy by national governments as will the development of digital literacy skills, although it is arguable that, among young people who can get access, there is significant capacity for them to self learn through experience and interaction with peers. Nonetheless, digital literacy should be a part of primary and secondary school circular

Another language related problem is that various operating systems for smart devices may not support local language characters and developing such local language support may require national governments to develop partnerships with the vendor's of major operating systems.

These language related problems will require medium to long-term solutions but in the shorter term there is a need to develop local content and applications that are relevant to users within their specific local or national context.

The ITU, Guidelines for the preparation of national wireless broadband masterplans for the Asia Pacific region (October 2012) provides the following checklist of questions and issues (See Exhibit 47)

Exhibit 47: Checklist of applications and content related questions and issues

Initial questions/issues on the applications and content market

How large is the content creation industry in the country? Are there estimates available of value of the industry or the number of firms engaged in content creation?

Are courses available at education institutions which aid or encourage content creation and provide the skills necessary for this? Has there been significant investment in this area?

Is the ICT sector the recipient of any investment from the perspective of labour training and creation? And are there appropriate competency and skill measures and standards/certificate in the country?

Does the government subsidise local content production? Or is the local content industry viable itself?

Are there regulatory measures which stimulate content production? For example, dome content quotas.

What content is available in local languages (i.e. beyond English etc.)?

Does the government have a direct presence in online services? What is the government's score in the e-government evolution? [88]

Does the government encourage development in the key content areas of mobile network services, online games, online advertising and e-commerce?

7.2.1Assist the development of an entrepreneurial start-up culture

The US economy has benefited enormously from the entrepreneurial start-up culture centred in Silicon Valley. Similarly, China has developed a completely new industry driven by the opportunities in the online and app economy. It should not be assumed that global companies will dominate all niches across all national jurisdictions. Within regions, within nations and even within subnational jurisdictions, there are specific local opportunities for online and app development. Governments can support this sector by initiating or collaborating in the development of start-up incubators that are designed to bring entrepreneurs and application developers together and provide them with access to mentors, marketing channels and capital.

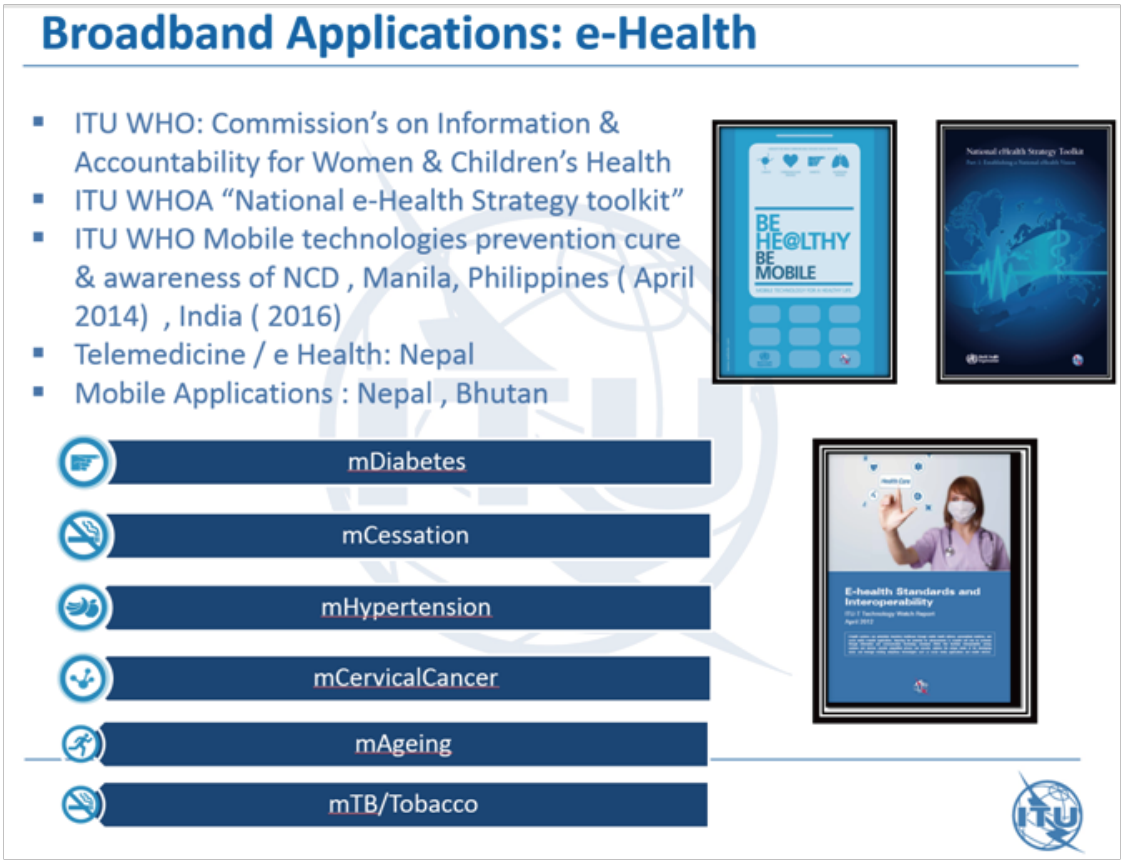
88. E-government Web measure index measures the level of sophistication of a government's online presence based on four stages of e-government evolution: emerging presence, enhanced presence, transactional presence, and connected presence. A value of 0 indicates the lowest presence, a value of 1 the highest. Data listed for 2009 are for 2010. United Nations Department of Economic and Social Affairs and United Nations Public Administration Network.

7.3 Government services and data

By moving early into developing sophisticated web presences that provide relevant and useful information and services to end consumers, governments can influence the thinking of the broader community about the usefulness of connectivity in general thereby encouraging the take-up of broadband. Such initiatives should include the development of apps for handheld devices and such projects can provide a springboard for private development companies to acquire the skills and track record necessary to win projects in the private sector.

By encouraging broadband adoption and more wide-spread use of local apps, governments are assisting in the creation of critical mass in the online and app market space. This increases the likelihood that private companies will begin using web-based and app based approaches to engaging with their markets.

Exhibit 48: Government produced e-Health applications, Nepal, Bhutan



Source: ITU presentation, Sameer Sharma, ITU Regional Office, Bangkok, 6 October 2016, Phnom Penh, Cambodia

Governments should also recognise that they collect and manage valuable datasets which can be used in a number of ways by private citizens or companies. There is now considerable experience, for example, in the UK and the USA, on how such datasets can be shared safely while protecting privacy and such practices can encourage new forms of commercial activity and provide a range of quasi-government services more effectively to citizens.

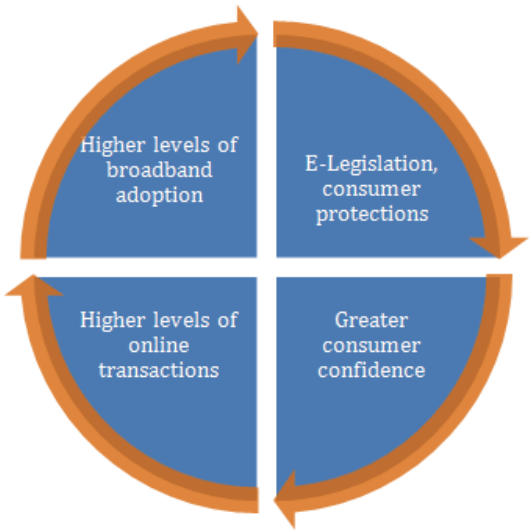
7.4 'Soft infrastructure': law, regulation, e-payments, privacyand security

Governments have a critical role to play in setting up the soft infrastructure of law and regulation such that growth of the online economy is encouraged rather than impeded. There are many aspects to this including

- Creation of the necessary legislation to enable online trading and contracting including e-payments
- Set national standards for privacy and security in relation to personal information
- Optimise taxation laws to encourage entrepreneurial activity including provisions to enable "sweat equity' participation and non-punitive capital gains tax
- Create or extend consumer protections for online transaction in order to encourage use by consumers.

These policy and regulatory changes by governments will encourage consumers to increasingly transact online and this will, in turn, create more opportunities for local entrepreneurs. Developing the online and app ecosystem in this way will make broadband increasingly attractive to consumers, leading to higher levels of broadband adoption over time.

Exhibit 49: Government produced e-Health applications, Nepal, Bhutan



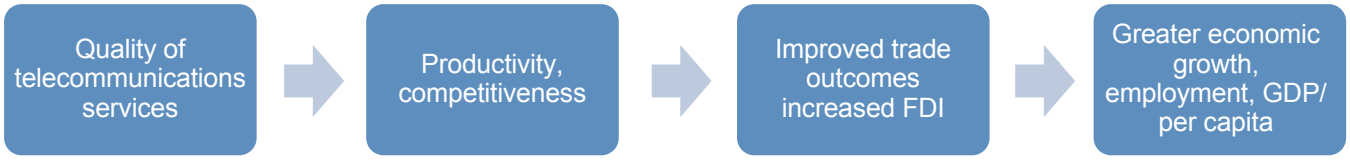
Source: Author

8

Conclusion and Recommendations

This White Paper strongly endorses the position that Information and communications technology (ICT) has had a profound impact on economies and societies throughout the world. Rapid advancements in telecommunications technology, computing, storage and audio-visual systems have allowed countries to leverage existing areas of comparative advantage as well as to establish new industries, develop new skills, and produce new products for consumers. This is succinctly summarised in Exhibit 50.

Exhibit 50: Communications driving economic development



Source: Author

Aside from its economic contribution, ICT has had an enabling impact on society, creating better access to information and learning resources, access to government, health and financial services, and better-connected communities. Investment in ICT is seen by governments as being essential to improving people's lives, as well as improving growth and productivity. Mobile device penetration and access to the Internet and other ICT services are considered key metrics in the measurement of economic and social development. Coming later to broadband deployment – especially optical fibre rollout - provides an excellent opportunity for many Asia-Pacific countries (especially the APAC8) to leapfrog ahead and deploy fibre solutions which should provide a degree of technology future proofing especially if done properly in terms of ducts and other infrastructure.

8.1 Recommendations

In this context, this White Paper considers that for many Asia-Pacific markets and especially the APAC8 which have been the subject of special study in this paper, an 8 point plan is needed, namely:

➢ RECOMMENDATION 1

Wireless broadband while excellent and getting better, cheaper and faster is, by itself, insufficient for a modern nation and to underpin a digital economy.

➢ RECOMMENDATION 2

High speed broadband services, namely delivered through optical fibre are necessary as a minimum for (i) enterprises and Government and (ii) are required for backhaul transmission to support the growing traffic volumes (including especially video content) being delivered over wireless networks now and into the future.

➢ RECOMMENDATION 3

The optimal approach to delivering national broadband services is multi-mode competition. Under this approach the wireless mobile industry which has been very successful in underpining regional and national economic growth would be strongly supported by Government policy while concurrently steps would be taken to accelerate fixed broadband infrastructure.

➢ RECOMMENDATION 4

Significant effort now needs to be directed by Asia-Pacific Governments and regional institutions like ASEAN and the SAARC to draft regulatory and legal frameworks based on global and regional exemplars to facilitate efficient and optimal fixed broadband deployment which, in part, will support 5G services. This includes inter alia enhanced rights of way (ROW) access, a new telecommunications code for low impact facilities, establish one-stop centres, and 'dig once' policies. Such measures will materially reduce the costs of optical fibre deployment and hence shorten the investment payback periods.

➢ RECOMMENDATION 5

Recommended detailed policy interventions are also needed in Asia-Pacific (including the APAC8 markets) including policies and rules to share essential infrastructure between operators, actively promote infrastructure sharing and re-use of Government assets based on global exemplars, co-ordinate infrastructure construction and formulate standards and rules for fibre deployment, development of greenfields estates and substantially improve international connectivity.

➢ RECOMMENDATION 6

It is critical to strengthen and reform incumbent operators (who for the main part continue to remain Government owned especially in the APAC8) in order to secure viable and properly scaled optical fibre deployments. This includes allowing them to more effectively compete by inter alia the relaxation of any restrictions, removal of subsidies, strengthen management etc. In the APAC8, Vietnam, and Thailand (in progress) have already taken steps to make their incumbent operator globally competitive, domestically strong and financially viable[89]

Should those incumbent operators not be able to perform this role then new licensees should be provided with an opportunity to make the requisite investments. Consideration should also be given, if sufficient funds exist, for national broadband network project given the success of such projects globally and regionally.

➢ RECOMMENDATION 7

Ensure the availability of technology neutral IMT spectrum for wireless broadband services including for 4G/LTE, LTE-A and 5G services at reasonable prices. It continues to support the wireless mobile industry which has been very successful story and have helped underpin regional and national economic growth. This is even more important in the shorter term as longer lead time to address the fixed network deployment issues means that wireless networks will continue to do the 'heavy lifting' for some time to come.

➢ RECOMMENDATION 8

Formulate programs and policies which will stimulate the development of domestic content and app relevant for Asia-Pacific markets including in local languages.

89. In the other members of the APAC8, there remains much to do even thought we note a number of steps have been taken to reform and improve their incumbent operators is taking place eg (i) the sale of a majority stake in ETL by the Lao PDR Government, (ii) the issuance of a large network contract by BTCL in Bangladesh and (iii) new shareholders for MPT and YTP in Myanmar.

8.2 Path to prosperity

If the above eight steps are done then it will underpin world class multi-mode broadband competition which will lay the foundation for increased economic growth, social inclusion, and a greater integration of Asia-Pacific markets and its citizens. It would also facilitate the successful transition of the APAC8 into a globally connected world and promote their participation in the global app economy. Such an approach minimises country risk, and starts to address significant deficiencies in the availability of high- speed broadband infrastructure found in many APAC8 markets.

A summary of this White Paper's recommended broadband policy objectives and regulatory settings for facilitating faster and fixed broadband services in contained in Exhibit 51. They importantly address broadband policy for economic development as well as broadband policy for social equity.

Exhibit 51:Recommended Broadband policy objectives and regulatory settingsbroadband policy for economic development as well as broadband policy for social equity.

Exhibit 51: Recommended Broadband policy objectives and regulatory settings

POLICY FOCUS	BROADBAND POLICY FOR ECONOMIC DEVELOPMENT	BROADBAND POLICY FOR SOCIAL EQUITY
Objective	• Accelerate productivity, global competitiveness • Facilitate sustainable economic growth • Create high skill high income employment	• Improve social equity, access to connectivity • Improve access to government services: healthcare, education • Improve gender equality outcomes and social inclusiveness
Emphasis in broadband policy	• High speed broadband access in high value economic zones • Improve international links • Improve backhaul and backbone capacity • Sharing public/private infrastructure	• Ubiquitous access to basic wireless broadband at affordable prices • Fibre to village connecting administration offices, school, and clinics should be considered • Provide service coverage to unserved/ underserved areas
Appropriate regulatory settings	• Incentivise investment by ensuring adequate returns on high speed broadband investment, necessary infrastructure capex • Facilitate easier fixed network deployment and fibre ready buildings • Make additional IMT spectrum available at fair & reasonable cost • Promote regulatory certainty	• Access to the sub-1 GHz spectrum (eg 700 MHz) at fair & reasonable cost • Subsidies/USO for high per user cost rollout areas • Possible Government focus on fixed network infrastructure/ reforms to facilitate efficient deployment

Source: Author

9

Appendix A: The APAC8 countries

9.1 Overview

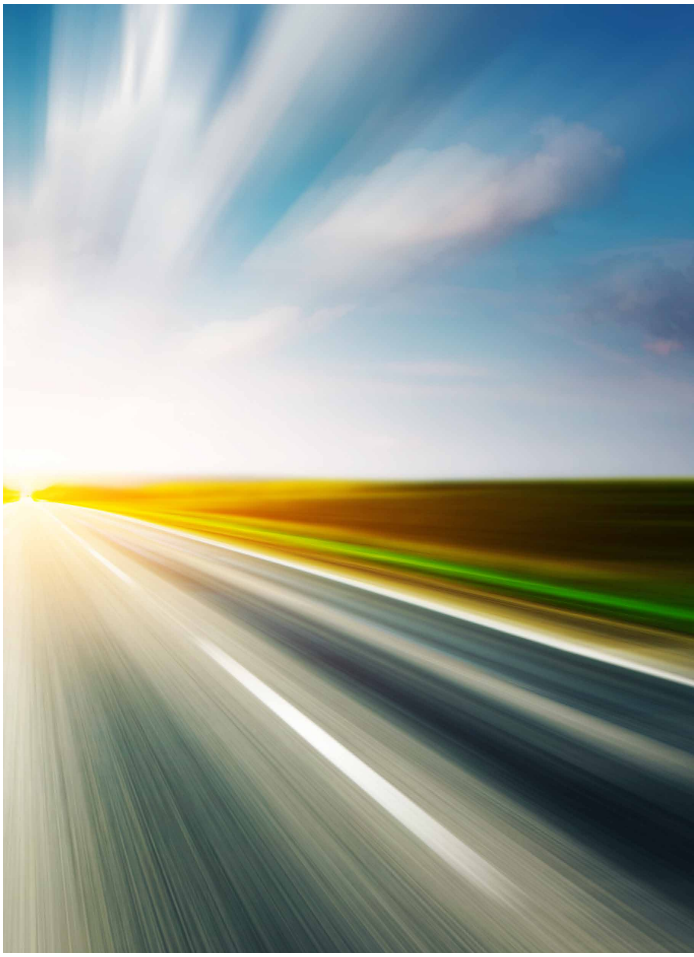
In this Appendix a summary of the key broadband policy issues facing the APAC8 countries are detailed, in the following order.

(i) People's Republic of Bangladesh;
(ii) Kingdom of Cambodia;
(iii) Republic of India;
(iv) Lao People's Democratic Republic (Lao PDR);
(v) Republic of the Union of Myanmar;
(vi) Democratic Socialist Republic of Sri Lanka;
(vii) Kingdom of Thailand; and
(viii) Socialist Republic of Vietnam.

9.2 Broadband in the People's Republic of Bangladesh

9.2.1 Key summary points

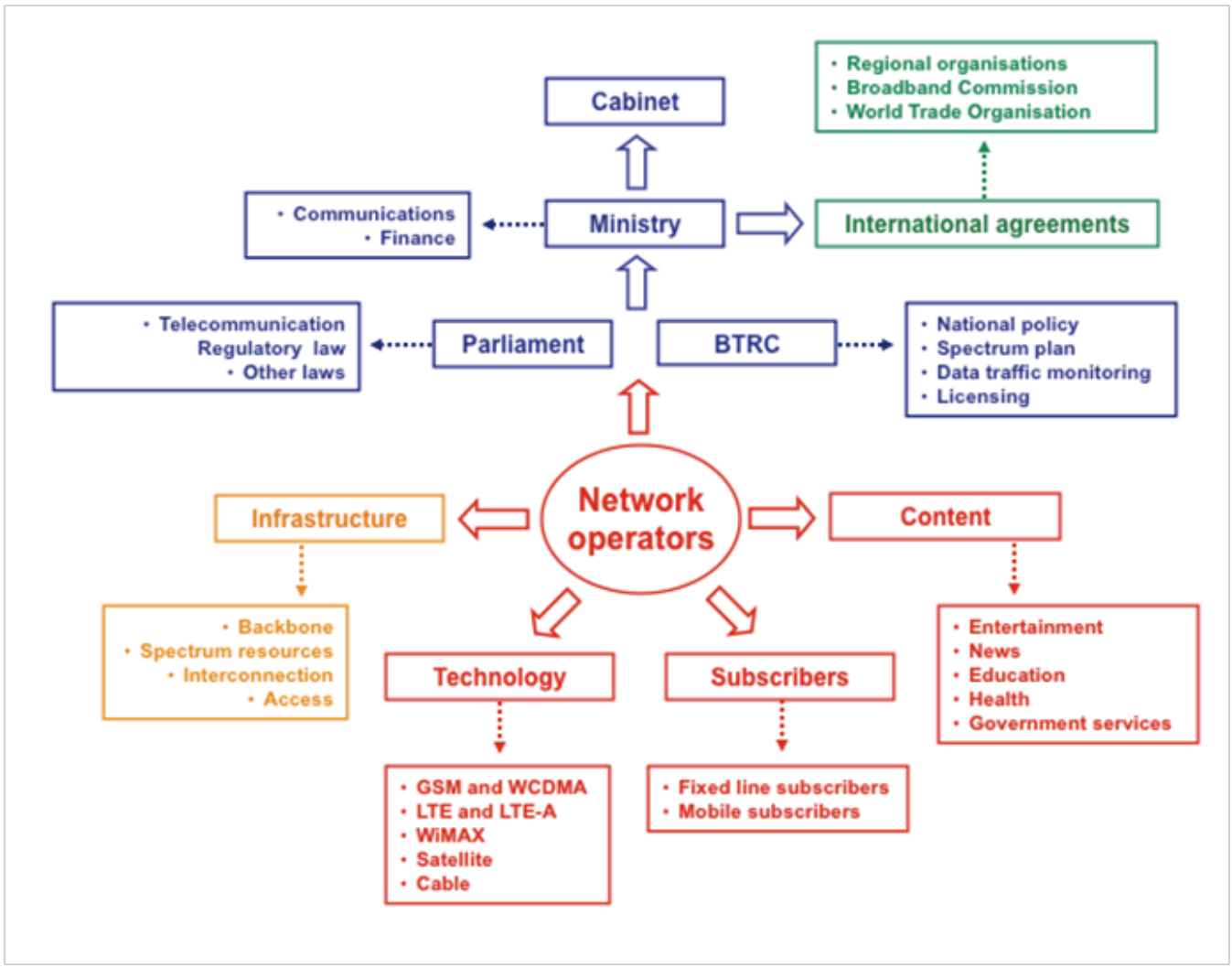
There remains are significant challenges in Bangladesh's telecommunications sector including the need to (i) significantly improve fixed line broadband services including undertaking reforms to/securing additional capital for BTCL (ii) allocating further IMT spectrum on fair and reasonable prices under a technology neutral spectrum management regime in order to provide efficient and affordable wireless broadband services and (iii) facilitating fixed broadband deployment to underpin the objectives of Digital Bangladesh



9.2.2 Legislative and Policy Background

Since the promulgation of the Bangladesh National Telecommunications Policy in 1998, the institutional and legal arrangements have changed markedly with the passage of the Bangladesh Telecommunication Regulatory Act (as amended) and the establishment of the Bangladesh Telecommunication Regulatory Commission ("BTRC"). The sector's overall institutional arrangements are now similar to many other global markets as shown in Exhibit 52 below.

Exhibit 52: Bangladesh's institutional arrangements



Since 2009, the key policy vision driving the sector has been the Digital Bangladesh manifesto (see Exhibit 53) which the Government adopted at the time of the 2009 elections as one of its key policy platforms.

Exhibit 53: Bangladesh's institutional arrangements

Digital Bangladesh is a vision set out by the Government of Bangladesh in its 2009 election manifesto. Its goal is for Bangladesh to be a fully digitised nation utilising 3G technologies by 2021.

The aim of Digital Bangladesh is to improve the living standards of all the people of Bangladesh by allowing easier access to resources, increasing efficiency and by implementing best practises in Bangladesh's ICT industry. It is hoped that this program will lead to increases in the levels of health, education and employment as well as a corresponding decrease in poverty.

Four key end goals, known as 'pillars', have been identified as necessary for the success of Digital Bangladesh. These are: development of human resources for the 21st century, connecting citizens, bringing services to citizens' doorsteps and making the private sector more competitive and productive through the effective use of ICT technologies.

One of the major aims of the policy is to ensure that Bangladesh can become self-reliant in the ICT sector and will be able to maintain and expand investment in this field internally, rather than being dependent on international aid .[90]

It is envisaged that Digital Bangladesh will have significant socio-economic benefits for Bangladesh. There is a focus within Digital Bangladesh to improve developmental sectors of Bangladesh's economy such as Agriculture, Health, Land Management, the Environment, Disaster Management and to improve the investment climate of Bangladesh.[91] It is also hoped that greater development via ICT technologies will lead to increases in transparency both in government and in the private sector.
Digital Bangladesh is a key part of the government's strategy to modernise Bangladesh and transform it into a middle-income country. If implemented successfully it will significantly aid in doing this and in improving the lives of Bangladesh's citizens. By beginning with the education and health sectors it is hoped to have an immediate impact on the wellbeing of Bangladeshi citizens.

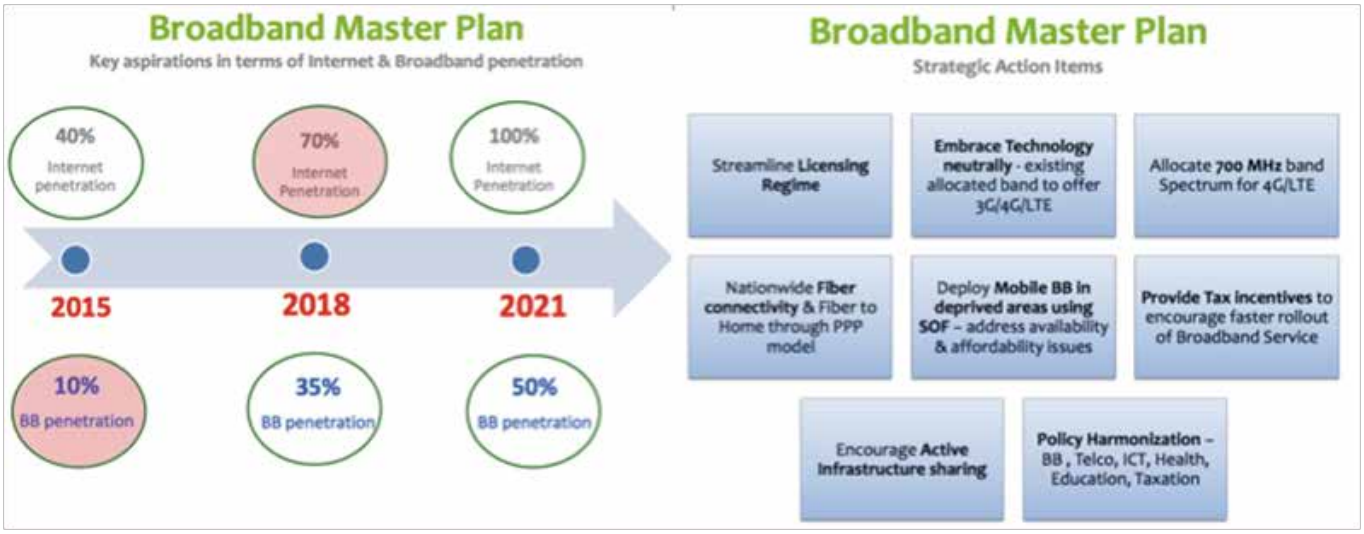
Looking specifically at the 2009 Broadband Policy [92] the fundamental policy objectives which it contained were:

- To ensure the availability of affordable, highly advanced and secure broadband services to the Bangladeshi consumers;
- To create an enabling environment for the development of access network and interconnection of networks in order to spread broadband services throughout the country;
- To ensure equal consideration of technology neutral/ service neutral broadband technologies depending on suitability and technological feasibility;
- To encourage private sector development and public private partnership for the growth of broadband service industry;
- To encourage investment and efforts in localised content development with special emphasis on Bangla content, value added services and broadband related equipment and accessories.
- To achieve broadband penetration of 30 percent by 2015.

Against these targets considerable progress has been made on all of the objectives including the Internet/broadband penetration with 54 million Internet subscribers at the end of 2015. As more than 96% of the internet subscribers are accessing internet using mobile technologies there is a need for future substantial investments in both wireless networks and in high speed fixed infrastructure as proposed in the Government's future Broadband Master Plan (see Exhibit 54 below).

90. *www.thedailystar.net/newDesign/news-details.php?nid=79698*
91. *www.digitalbangladesh.gov.bd/documents/Digital%20Bangladesh%20Strategy_BDF_final%20draft_AS_edit.pdf*
92. *See www.btrc.gov.bd/sites/default/files/national_broadband_policy_2009_0.pdf*

Exhibit 54: Future Government broadband plans



Source: Digital Bangladesh: Future plans for broadband roll-out in Bangladesh. Honourable Zunaid Ahmed Palak MP, Minister, Ministry of Posts and Telecommunications, Commonwealth Broadband Forum, November 2014

The market share of Bangladesh's subscribers and revenues is detailed in Exhibit 55 and Exhibit 56 below.

Exhibit 55: Bangladesh's Mobile Market – Subscribers (2015)

Operator	Number of Subscribers (millions)	Market Share (%)
Grameenphone	55.50	42.2
Robi Axiata (inc Airtel)	38.1	29
Bangalink	32.62	24.8
Teletalk	4.06	3.0
Others	1.24	1.0
Total	**131.52**	**100**

Source: Industry Sources

Exhibit 56: Bangladesh's Telecommunications Market - Revenues

Operator	Revenues (BDT billions)	Market Share (%)
Grameenphone	102.6	48.5
Robi Axiata	66.5	30.9
Bangalink	43.7	20.6
Teletalk	n.a	n.a
Total	**212.8**	**100**

Source: Industry Sources- Revenues

Market shares post merger only tell part of the story however. The market leader Grameenphone has already reacted to increased sector competition arising from the recently approved merger of Robi Axiata and Airtel by making new investments to deploy 3G/4G infrastructure and improving its quality of service (see Exhibit 57 below). The merger seems a potential gamechanger in the market as it provides a competitor with sufficient scale to effectively compete with the market leader.

Exhibit 57: New Investments by Grameenphone

In January 2016, Grameenphone announced it will upgrade all base stations to 3G by June 2016. This will involve upgrading all of its nearly 10,000 base stations to 3G by that date with approximately 1,700 new sites added in Q1, 2016 and 3,400 3G sites were added in 2015. The company invested BDT 19.3 billion during 2015 to further rollout of 3G sites, 2G coverage, capacity enhancement for catering higher volume of data and voice as well as enhancement of IT infrastructure for better product and service offerings.

The investment announced in early 2016 will result in nearly 90 per cent of its subscriber base of 58 million customer having access to 3G services. Currently over 15 per cent of its customers are 3G subscribers, and Grameenphone's target is to have 26 per cent on 3G by the end of 2016.

In addition, as noted by Telenor Group CEO Sigve Brekke, Grameenphone is on a transformation journey from a voice communications company to a digital service provider. He indicated that "As part of this transformation, we have not only seen significant network investments but also the introduction of new digital content and rich e-services to education, agriculture and health".

Source: Media reports including http://bdnews24.com/ Bangladesh's Telecommunications Market - Revenues

Fixed broadband services, however, continue to struggle in Bangladesh with Bangladesh Telecommunications Company Limited (BTCL)[93] and the fixed broadband providers such as Banglalion Communications and Qubee seeing falls in their customer base (the latter two companies as transitioned from WiMAX to LTE based technologies). In the case of BTCL plans was to seek a foreign strategic investor and to sell the shares to the public in the 2009/10 time period did not eventuate. No progress has therefore been made to transform BTCL and improve its balance sheet and technical skills.

Therefore in order to attempt to address some of the deficiencies in BTCL in late August 2016, it was announced that Bangladesh's Cabinet Committee on Economic Affairs has awarded a Chinese joint venture – formed by ZTE Holding Company Ltd and ZTE Corporation – the contract for a BDT20.48 billion (~USD256 million) upgrade project for BTCL fixed network.[94] The network overhaul is aimed at providing a wider, modernised and low-cost range of IP telephony, high speed internet and converged services such as video calling and videoconferencing over BTCL's PSTN access lines, which would enable it to compete better against mobile alternatives. Under the programme, three main platforms will be established in Dhaka, Chittagong and Khulna, from which new telecom services will be made available in all divisions, districts and upazilas (sub-districts). [95]

Two other isssues of importance should also be highlighted, namely spectrum allocations and licensing. Firstly, in respect of spectrum issues, In Bangladesh, the prevailing legislative and regulatory guidelines applying to frequency spectrum are mainly set out in the Telecommunications Act 2001 as amended; and the Bangladesh Telecommunications Regulatory Commission (Licensing Procedure) Regulations 2004, BTRC Regulation No. 1 of 2004, the National Telecommunications Policy 1998 and the Bangladesh National Frequency Allocation Plan 2005.

- Chapter VIII of the Act regulates radio communications and spectrum management. In particular, Section 55 provides for licensing of radio apparatus and allocation of radio frequency.

- Regulation 8 of the Licensing Regulations provides for licensing of cellular mobile phone, which shall be subject to the availability of frequency spectrum.

- The NTP provides for spectrum management via inter alia paragraphs 3.17 on regulatory framework and 4.2.4 on spectrum management and monitoring.

- The NFAP reflects the national policy on the use of the radio spectrum and identifies the distribution of spectrum.

93. The company was founded as the Bangladesh Telegraph & Telephone Board (BTTB) following Bangladesh's independence in 1971. On July 1, 2008 the BTTB became a public limited company and was renamed as BTCL.

94. Of the total cost, the Chinese government will provide BDT18.52 billion, representing 90% of the total project cost under the

95. This follows the withdrawal of USD25 million aid from Japan International Cooperation Agency (JICA) on 13 August 2015 after a review which found attempted corruption, inefficiency and there had been a failure to establish a nationwide telecom backbone network which was the subject of the aid project in the past ten years. See http://bangladeshinside.com/insight-en/japan-with-draws-us25m-aid-from-btcl-project-for-attempted-corruption-6254contract awarded on 24 August 2016.

Bangladesh has in the recent past implemented both market-based assignment (through the auctioning 3G licences in 2013), and administrative assignment (through the assignment of BWA licences and additional 1800 MHz spectrum in 2008).
While some 650 MHz of FDD/TDD spectrum has been reserved for IMT use only approximately 440 MHz of this spectrum (i.e. 67 percent) has actually been allocated. Core IMT spectrum in the 1800 and 2100 MHz bands remains unused today unlike the majority of other global and regional markets. The allocation of 700 MHz spectrum in accordance with the APT700 bandplan would be particularly welcomed by industry (and consumers). Not allocating this spectrum means that it is not available by licensed operators to provide additional capacity, higher quality of service and to support economic growth. Furthermore, reserve spectrum prices are set high in global terms and there are artificial restrictions on the use of allocated spectrum that do not permit its use of 4G/LTE or 5G services without the payment of a fee. Moving to more market based spectrum mechanisms and to a technology neutral spectrum regime is strongly supported. Such approaches are consistent with global exemplars. Secondly, in respect of licensing in Bangladesh there are a number of restrictions which may have a adverse impact on broadband provisioning including restrictions on which licensee is able to provide fibre backbone and backhaul transmission and the potential restrictions on the number of towercos.

9.2.3 Broadband penetration in Bangladesh

In terms of broadband penetration according to the ITU's 2015 Global ICT Development index Bangladesh's 2015 fixed (wired)-broadband subscriptions was a low 1.19 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 6.41. The same index found that Bangladesh's international internet bandwidth per Internet user (Bit/s) was 5,925.

9.3 Broadband in the Kingdom of Cambodia

9.3.1 Key summary points

With the passage of new legislation, new institutional arrangements being operationalized, new pending subsidiary legislation and policy announcements, the Cambodian broadband market and regulation is in a state of transition. Proposals for a new broadband policy to be issued by the Ministry of Posts and Telecommunications ('MPTC') in early 2017, which is being developed with assistance from the ITU, should provide a strong impetus to address the over reliance on mobile/wireless broadband services, strengthen Telecom Cambodia the incumbent and drive higher speed (fixed) broadband services in the Kingdom of Cambodia. A new USO Fund may also help to address any gaps in the country's broadband services.

9.3.2 Legislative and Policy Background

In late 2015, after a decade of attempts, consultant reports and assistance from international agencies, the Government passed new legislation regulating the sector, namely the new Law on Telecommunications (promulgated by the Royal Kram NS/RKM/1215/017 dated 17 December 2015). It is comprehensive legislation although in the civil law tradition.
The Law which supersedes earlier regulation (including inter alia the Royal Kram (or Decree) dated 1 March 2012 on the establishment of the Telecommunications Regulator of Cambodia (TRC)) materially adjusts the institutional structure of the sector, including the various responsibilities of the Ministry of Posts and Telecommunications ('MPTC') and the TRC.

Subsequent to the passage of the new law, the Government issued the key policy document underpinning current approaches to infrastructure deployment and development in Cambodia. It is known as the Telecommunications, Information and Communication Technology Development Policy for 2015 to 2020, entitled "Toward ICT Connectedness and Readiness" ('TICT Policy'). The objective of the ICT policy is for Cambodia, by 2020 "to be transformed to be the society with full of ICT connectedness and readiness for the interest of the people and moving forward of Cambodia to the new development stage, especially to ensure the prosperity competition of Cambodia in the future economic intelligence".

To achieve their vision and mission, the Royal Government of Cambodia has decided to focus on three main objectives: [97]

1) Strengthening and expanding the connection of the telecommunications and ICT infrastructure;

2) Promoting human resource development

3) Developing the ICT industry to increase and promote the use of ICT.

The first is the most relevant to infrastructure deployment and development. The key objective under the objective Strengthening and expanding the connection of the telecommunications and ICT infrastructure is to expanding the coverage of broadband internet over urban and rural areas as well as increasing the rate of internet phone and television usage as detailed in Exhibit 58 below.

Exhibit 58: Indication of the development of infrastructure and the telecommunication utilization:

	Target Rate 2020
Coverage of broadband internet in urban areas	100%
Coverage of broadband internet in rural areas	70%
Rate of mobile phone service usage	100%
Rate of internet service usage	80%
Rate of broadband internet service usage	70%
Rate of households with internet access	30%
Rate of households using computers	30%
Rate of connection to internet of things	10%

Source: MPTC, 2016

97. It should be noted that many of these elements are consistent with the ASEAN ICT Masterplan objectives. It is a broad, overarching policy-framework that is intended to guide ASEAN Member State ICT development and includes objectives in relation to infrastructure development, human resource development etc. See www.aseansec.org/documents/ASEAN%20ICT%20Masterplan%202015.pdf

In terms of ICT Infrastructure, the focus of the Royal Government of Cambodia, in the ICT Policy,[98] is on inter alia:

- Promoting investment in connection through submarine fibre-optic cable and satellite systems;

- Promoting comprehensive development of broadband internet infrastructure nationwide to provide ease of use and affordability (accessibility, affordability and availability), especially at state high schools, industrial zones, tourist sites and areas with economic potential through preparation of the policy to encourage investment in these infrastructures and implementation of a universal service obligation program;

- Encouraging the best possible use of backbone infrastructure and common infrastructure;

- Promoting cooperation between ministries–institutions in preparing an outline of physical infrastructure and the collective network of the telecommunications sector, aligning it with the communications infrastructure plan, power supply, public lighting, clean water supply, solid and liquid waste discharge and other infrastructure plans;

- Establishing and expanding the network of connection between internet service providers, both within the country and at the international gateway, especially the internet connection network between Cambodia and ASEAN (Internet Exchange Point);

- Improving national infrastructure by examining, organizing and maintaining the existing networks as well as by mobilizing resources to expand additional networks;

Another section of the ICT policy highlights current challenges for TICT infrastructure in Cambodia including inter alia:[99]

- Traffic flow of telecommunications and internet services with the international depends almost totally on the infrastructures of neighbouring countries since Cambodia lacks a submarine fiber-optic cable network and satellite system of its own.

- Partly concentrated development on the backbone infrastructure of the fiber-optic cable network and supporting infrastructures making this development fail to provide universal coverage.

- The management of application of scarce telecommunications resources such as radio frequency spectrum and telecommunications prefix is not yet highly effective, which may allow the use of these resources for expansion of TICT infrastructure coverage.

- The stability of the backbone infrastructure of the fiber-optic cable network is limited.

- Infrastructures supporting other sectors such as national information infrastructure have not yet been comprehensively expanded.

Further the ICT Policy stated that “promoting the preparation of classification of telecommunications operators by distinguishing the infrastructure and network infrastructure operators from the telecommunications service operators in order to promote and attract investment, create new services and increase competitiveness. [100]

The Royal Government of Cambodia has delegated MPTC to monitor, review and evaluate of the implementation of this policy. The MPTC therefore leads and oversees Telecommunication and ICT sectors and is the coordination institution in implementing all T-ICT related policies.

98. See Section 1B of the TICT Policy.

99. See Section 2.1B of the TICT Policy.

100. See Section 6.2B, bullet point 7 of the TICT Policy.

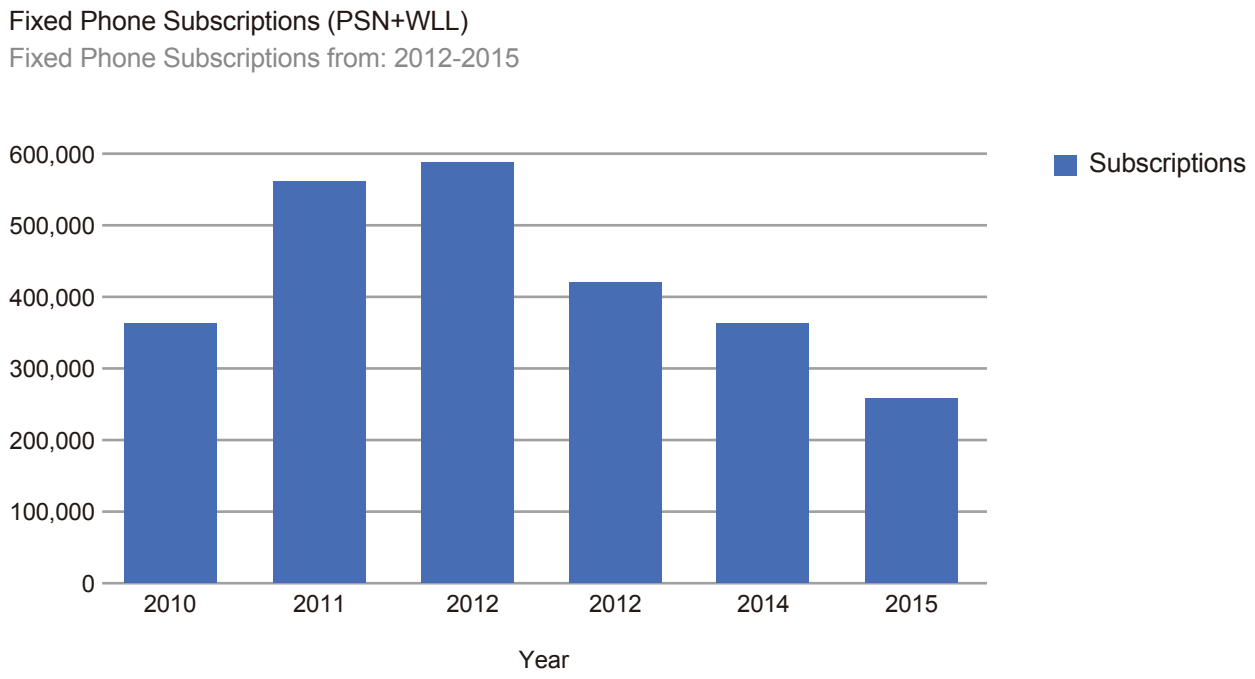
In addition, to above there are initiatives which impact broadband infrastructure and development. These initiatives which are detailed in a series of letters to sector stakeholders since 2011, are concerned with the beautification of cable infrastructure in Phnom Penh and remove cable aerials which are laying across main roads in the Kingdom of Cambodia. The integration with other utilities and public works is consistent with the Law on Telecommunications, especially Articles 25 and 34. It should also be noted that that electro-magnetic field ('EMF') issues related to tower deployment is becoming an issue in Cambodia.

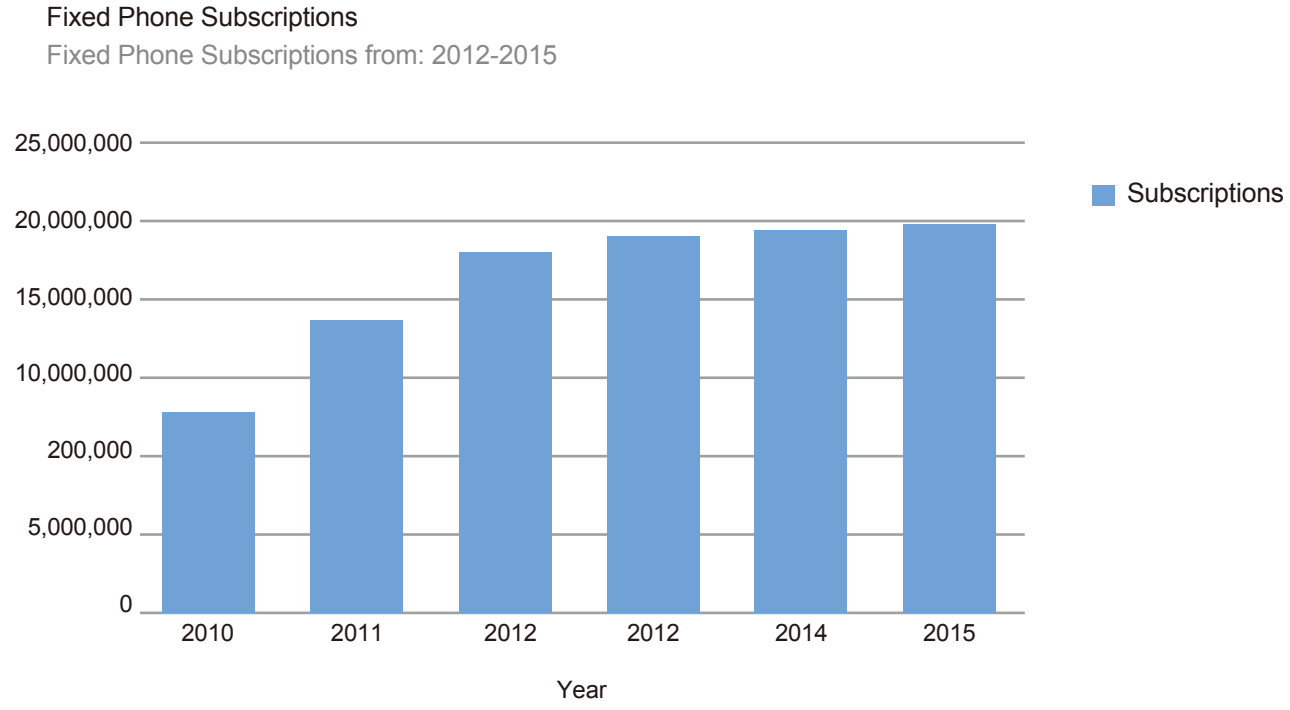
It should be noted that other frameworks (e.g. on infrastructure sharing, rules applying to greenfield estates, spectrum roadmap including the release of additional spectrum including inter alia 700 MHz spectrum) which would facilitate both fixed and wireless broadband is a work in progress. However, significant positive steps have been taken with the issuing of new submarine cable licences which would underpin that aspect of the broadband eco-system in the Kingdom of Cambodia.

9.3.3 Broadband penetration in the Kingdom of Cambodia

In terms of broadband penetration according to the ITU's 2015 Global ICT Development index Cambodia's 2015 fixed (wired)-broadband subscriptions was 0.21 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 13.96. The same index found that Cambodia's international internet bandwidth per Internet user (Bit/s) was 9,374. It should also be noted that there are moves to increase Cambodia's fixed broadband subscriptions with Telecom Cambodia during undertaking a pilot FTTH deployment of 9,000 connections of which 5,000 are in Phnom Penh and the remainder in other parts of the country. Such a pilot will assist in Telecom Cambodia understanding the costs and other implementation issues associated with any large scale fibre deployments. Other operators are also deployment additional broadband telecommunications infrastructure.
The ITU figures are consistent with the TRC's statistics for fixed and mobile phone subscriptions depicted in Exhibit 59 below. Coverage for wireless mobile services is currently understood to be over 98 percent population coverage.

Exhibit 59: Cambodia Fixed and mobile subscriptions





Source: TRC, October 2016

The future challenge for Cambodia is to ensure high Speed Broadband in high value economic zones including Phnom Penh, Siem Reap etc. in order to compete effectively with inter alia Bangkok and HCMC for foreign direct investment, and to create a modern Cambodia while at the same time ensuring ubiquitous access to basic wireless broadband at affordable prices. To do so will require the provision of service coverage to areas that are currently unserved or underserved.

If the latter is done well, such ubiquitous services will Improve social equity and access to connectivity services while increasing rural incomes and underpin the country's nation building.

9.4 Broadband in the Republic of India

9.4.1 Key summary points

There remains are significant challenges in Indian telecommunications sector relating to the delivery of world class broadband services including the need to (i) facilitate greater investment in fixed broadband services including lowering the costs of doing (ii) restructure and improve the financial and other performance of the PSUs in MTNL and BSNL including improving their capital structure and competitiveness (iii) increase the overall IMT spectrum allocations to wireless broadband services including allowing the spectrum holdings and block sizes of spectrum to fully take account of 4G/LTE, LTE-A and further 5G technologies (iv) address a range of issue associated with the move to IP services and VoLTE and (v) update the current legislative structure to address the challenge of the Digital economy.

9.4.2 Legislative and Policy Background

From an institutional perspective in India, the Telecom Commission is an inter-ministerial high level government body. The Commission consists of a Chairman, four full time members, who are ex-officio, Secretary to the Government of India in the Department of Telecommunications and four part time members who are the Secretaries to the Government of India of the concerned Departments. The essential functions of the Telecom Commission are:

- Policy formulation, licensing and coordination matters relating to telegraphs, telephones, wireless, data, facsimile services and other similar forms of communications;

- International cooperation in matters connected with telecommunications;

- Promotion of standardization, research and development in telecommunications;

- Promotion of private investment in telecommunications;

- Preparing the DoT budget and supervising its operations.

The Indian telecommunications sector is regulated by a mosaic of legislation; some of which are from the colonial period. These laws collectively set out the general legal framework for telecommunications in India. They include: [101]

(i) The Indian Telegraph Act 1885

This Act is one of the oldest legislations still in effect in India and is an Act to amend the law relating to telegraph[102] in India. Some of the key features of this Act are:

- It empowers the Government of India to take control of the existing telegraph lines and lay down the necessary infrastructure for further expansion of telecommunications in India.

- It authorizes the Government of India to grant telecom licenses on such conditions and in consideration of such payments as it thinks fit, to any person to establish, maintain, work a telegraph within any part of India.

- It authorizes the Government of India to take possession of licensed telegraphs and to order interception of messages on the occurrence of any public emergency or in the interest of public safety.

- Any dispute concerning a telegraphic appliance/ apparatus/ line between the telegraph authority and a licensee (for whose benefit the line, appliance or apparatus is, or has been provided) shall be determined by arbitration by an arbitrator appointed by the Central Government.

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101. See Lexpore research Partners, Telecom Regulatory Framework and Legislation in India, 2013 and Word Bank, Telecommunications - Laws, Regulations and License. Available at https://ppp.worldbank.org/public-private-partnership/sector/telecom/laws-regulations

102. "telegraph" means any appliance, instrument, material or apparatus used or capable of use for transmission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, visual or other electro- magnetic emissions, Radio waves or Hertzian waves, galvanic, electric or magnetic means. - Preamble to the Act.

The power granted to the Government to grant licenses to private bodies to provide telecommunication services in India on conditions it deems fit ought be noted. This power is in fact a proviso of the exclusive privilege granted by the Indian Telegraph Act 1885 to provide telecommunications services in India.

(ii) The Indian Wireless Telegraphy Act, 1933

This Act was enacted to regulate the possession of wireless telegraphy apparatus. According to this Act, the possession of wireless telegraphy apparatus by any person can only be allowed in accordance with a license issued by the telecom authority. Further, the Act also levies penalties if any wireless telegraphy apparatus is held without a valid license.

In accordance with the legislation above the Central Government has the exclusive privilege of establishing, maintaining and working telegraph and wireless telegraphy equipment and is the authority to grant licenses for such activities. The Central Government acts through the Department of Telecommunications (DoT). Some of the important functions of the DoT are:

- Licensing and regulation
- International cooperation in matters connected with telecommunications (such as ITU) etc;
- Promotion of private investment in the Indian telecommunications sector;
- Promotion of standardization, research and development in telecommunications.

(iii) The Telecom Regulatory Authority of India Act 1997

The Telecom Regulatory Authority of India Act 1997 enabled the establishment of the TRAI.

TRAI acts as an independent regulator of the Indian telecommunications industry. One of the main objectives of TRAI is to provide a fair and transparent policy environment which promotes a level playing field and facilitates fair competition amongst various telecom players. TRAI's powers are recommendatory, mandatory, regulatory and judicial.

The important recommendatory powers of TRAI are as follows1:

- Recommendations regarding the need and timing for introduction of new service providers.
- Recommendations pertaining to the grant of telecom licenses including their terms and conditions.
- Recommend revocation of license for non-compliance of terms and conditions of license.

TRAI is the sole authority empowered to take binding decisions on fixation of tariffs for provision of telecommunication services.

It is important to note interplay between the policy making powers of Department of Telecommunications and the recommendatory powers of TRAI. While the DoT is the sole authority for licensing of all telecommunications services in India, it is mandatory for the DoT to consider the TRAI's recommendations with regard to matters over which TRAI has recommendatory powers (summarised above) but it has not always done so.[103] The DoT also has the discretion to either accept or reject the recommendations of TRAI. Since its establishment the TRAI has over the years made a number of recommendations but the DoT has accepted many recommendations either wholly or partially or has rejected such recommendations.

Later the TRAI Act was amended by the Telecom Regulatory Authority of India (Amendment) Act 2000 to bring in better clarity and distinction between the regulatory and recommendatory functions of TRAI. Importantly, the amendments of 2000 completely differentiating the judicial functions of TRAI by setting up of the Telecom Disputes Settlement and Appellate Tribunal ("TDSAT"). The jurisdiction of civil courts has been expressly barred in cases where the TDSAT has jurisdiction.

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103. See CUTS International, Regulatory Management and Reform in India, Background Paper for OECD, page 18. Available at www.oecd.org/gov/regulatory-policy/44925979.pdf

first-net-profit-by-2018-rs-prasad/story-ZFwM9OHn5ZuSFLOpW3a3gK.html

The TDSAT has been vested with exclusive powers to adjudicate any dispute between (i) the licensor (DoT) and a licensee; (ii) service providers; and (iii) and service providers and groups of customers. Any appeal from the decision of the TDSAT can be filed only with the Supreme Court of India which is the apex court of the country.

PUBLIC SECTOR UNDERTAKINGS (PSU)

It is important to note two other state players in the Indian telecommunications sectors, namely the public sector undertakings (PSUs):

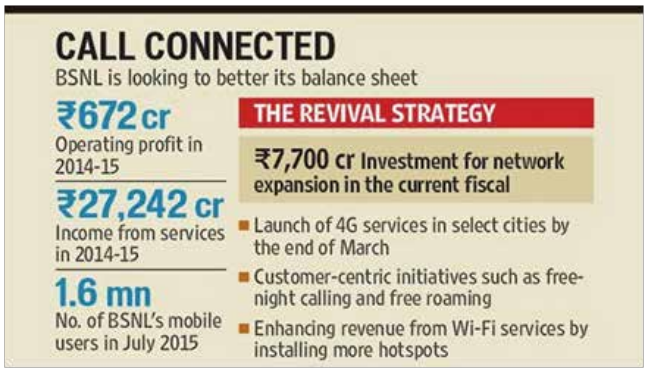
Mahanagar Telephone Nigam Limited was created by the Government of India in 1986 to oversee the telephone services of Delhi and Mumbai (the Bombay). The company held a monopoly in both cities until 1992, when the telecommunications sector was opened to competition. It is expected to be operationally profitable in 2016-17 and completely profitable in 2017-18. Total operational revenue for MTNL to March 2016, was Rs 835.79 crore a decrease of 4.3 percent for the quarter. The state-run telecom firm has been running in losses since 2009-10.[104] It is reported that over 70 percent of MTNL's revenues are taken up by salaries and pensions.[105]

The company is looking at BSNL to provide equipment for its mobile services in Delhi and Mumbai circles as managed service provider on revenue share basis. MTNL is also looking to expand its basic or fixed services network in partnership with private players on revenue share basis. TRAI's network test report issued in June 2016, unfortunately showed MTNL's quality of service falling in all parameters. The Government holds majority of 57.03 per cent shares in MTNL, while the rest 42.97 per cent is held by public holdings, including domestic financial institutions (DFIs) such as insurance companies, banks, individuals and others.

Bharat Sanchar Nigam Limited (BSNL). It was incorporated on 15 September 2000 and took over the business of providing of telecom services and network management from the Central Government Departments of Telecom Services (DTS) and Telecom Operations (DTO), with effect from 1 October 2000 on a going concern basis. It is the largest provider of fixed telephony and broadband services. Its 2016 revenues were the equivalent of USD4.9 billion. However, in recent years the company's revenues and market share have plummeted into heavy losses due to intense competition in the Indian telecommunications sector.[106]

With new management there is a view that it is back on track for recovery (see Exhibit 60) with Rs 672-crore operating profit in 2014-15, and is likely to report the first net profit in the last nine years within 2018, according to the Indian Communications minister Ravi Shankar Prasad. The company's income from services grew 4.16% to 27,242 crore in 2014-15, the highest in the last five years.[107]

Exhibit 60: Key elements of BSNL's Revival Strategy



Source Hindustan Times, 2015

104. See http://economictimes.indiatimes.com/articleshow/52541819.cms

105. Seehttp://indianexpress.com/article/business/companies/salaries-and-pension-take-up-70-per-cent-of-mtnls-revenue-2955771/

106. See http://economictimes.indiatimes.com/articleshow/52541819.cms

107. See www.hindustantimes.com/business/after-9-years-bsnl-to-make-first-net-profit-by-2018-rs-prasad/story-ZFwM9OHn5ZuSFLOpW3a3gK.html

To address these issues it has been reported that the Government's think-tank Niti Aayog may consider state-owned Bharat Sanchar Nigam Ltd (BSNL) and Mahanagar Telephone Nigam Ltd (MTNL) for strategic disinvestment. The current government, has on several occasions, blamed the previous regime for the financial decline of the two telecom service providers.[108] In case of BSNL and MTNL, the companies were not present in the first list of 74 PSUs, despite being loss making, that could be considered by the Aayog for strategic disinvestment. If a strategic divestment of the two telecom companies is made, government would sell a majority stake in these firms. Niti Aayog has been given the responsibility to identify Central Public Sector Enterprises (CPSEs) where government should exit from management control, to extent they should exit and what should be the mode of divestment.[109]
In September it is understood that MTNL submitted a report on its asset and liability to the Prime Minister's Office (PMO) and suggested that the Government can either go for 100 per cent stake sale or opt for a strategic disinvestment and offload majority share. The PMO had recently asked the MTNL to submit its asset and liability reports and the revival plan, if any. [110]

NATIONAL TELECOMMUNICATIONS POLICIES

From a policy perspective the Indian National Telecommunications 1994 spelt out five basic objectives of which two objectives of availability of telephone on demand and universal service (connecting all villages) were targeted to be realized by 1997.

In regard to quality of service, matching "world standard" and providing "widest possible range of services" "at reasonable prices" were stated aims.[111]
The 1994 policy was designed with the approach that services should continue to be provided largely by a strong incumbent that faced little competition. The powers of licensing and spectrum management were retained by the Government on that basis.[112]
The opening up of the Internet sector set the background to National Telecommunications Policy 1999, which is a major attempt addressing deficiencies in the earlier 1994 policy. Its articulation of policy objectives was itself a marked improvement. Provision of 'Universal Service' (including unconnected and rural areas, re-targeted for year 2002) was to balanced by provision of sophisticated telecommunications services capable of meeting needs of the country's growing economy. This latter objective was further amplified to include 'Internet' access to all district head quarters (DHQs) by 2000 and providing high speed data and multimedia capabilities to all towns of population of 200,000 and above by 2002. In addition to a targeted average teledensity of 7 by year 2005 (and 15 per cent by 2010), targets for rural 'teledensity' were set to increase from its then current level of 0.4 per cent to 4 per cent during the same period.
Since that time there has been significant policy announcements[113] including a new 2012 National Telecommunications Policy.[114] It seeks to simplify licensing rules by prescribing a single license for the entire country and the separation of licenses from bandwidth. It also provides for MNP and for technology neutral spectrum use. In relation to broadband and rural telephony it provides that:

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108. See www.financialexpress.com/economy/disinvestment-narendra-modi-govt-may-sell-stake-3-psus/322551/

109. It is understood that the Niti Aayog will make recommendations on strategic sales to a core group of secretaries, headed by the cabinet secretary. The group of secretaries will make final suggestions to the Cabinet Committee on Economic Affairs on the mode and quantum of strategic disinvestment.

110. See www.dailypioneer.com/todays-newspaper/sale-only-option-for-terminally-ill-mtnl.html

111. Harsha Vardhana Singh, Anita Soni, and Rajat Kathuria, Telecom Policy Reform in India, 2000. Available at http://siteresources.worldbank.org/INTRANETTRADE/Resources/Singh.pdf

112. See http://economictimes.indiatimes.com/articleshow/52541819.cms

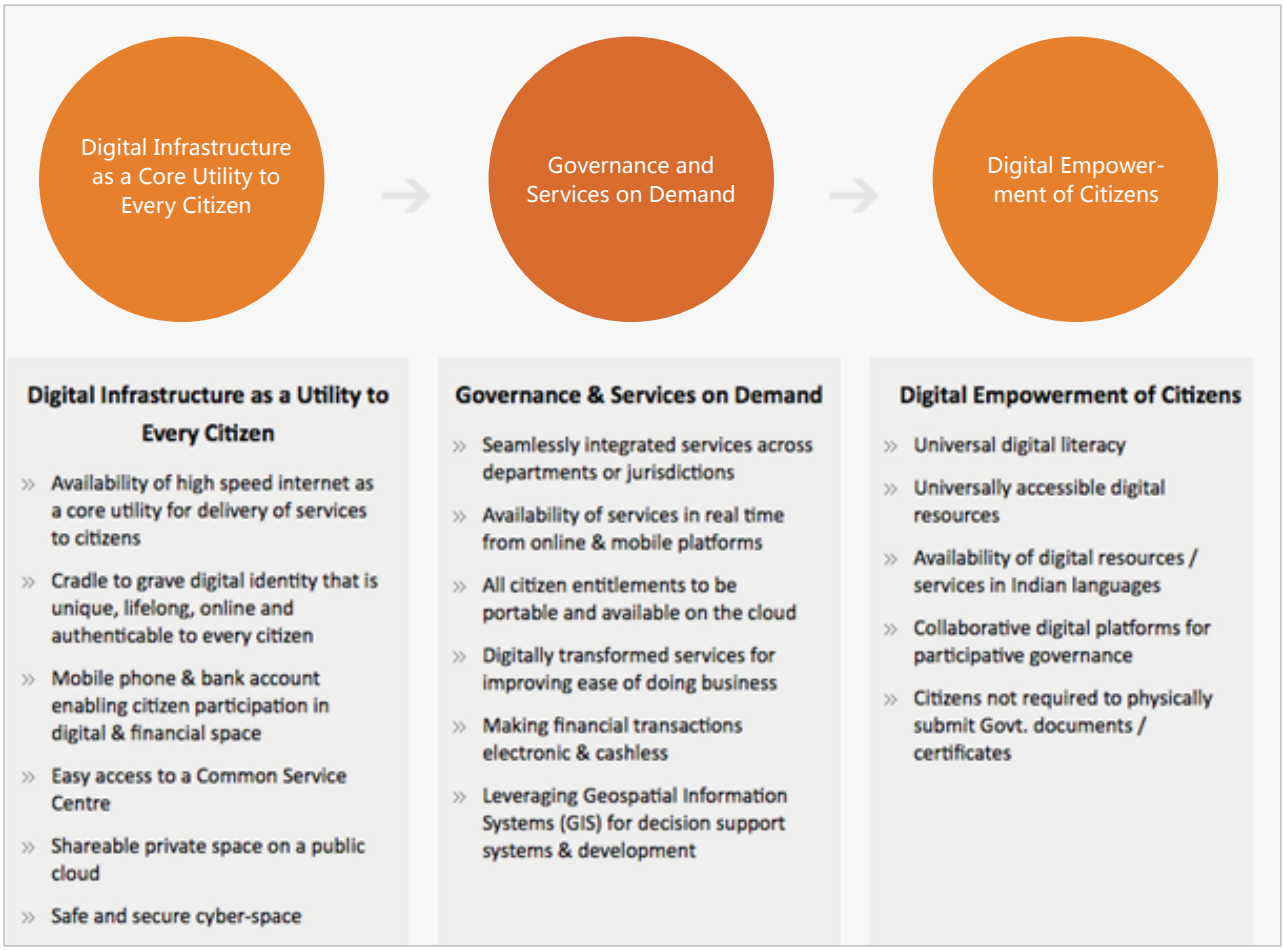
113. Others include FDI Policy in the Telecom Sector 2014.

114. See www.trai.gov.in/WriteReadData/userfiles/file/NTP%202012.pdf

- Increase rural teledensity from the current level of around 39 to 70 by the year 2017 and 100 by the year 2020;
- To recognise telecom, including broadband connectivity as a basic necessity like education and health and work towards 'Right to Broadband';
- Provide affordable and reliable broadband-on-demand by the year 2015 and to achieve 175 million broadband connections by the year 2017 and 600 million by the year 2020 at minimum 2 Mbps download speed and making available higher speeds of at least 100 Mbps on demand.[115]
- Provide high speed and high quality broadband access to all village panchayats through a combination of technologies by the year 2014 and progressively to all villages and habitations by 2020.

It is also important to highlight Digital India.[116] The Digital India program is a flagship program of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy. It is an umbrella program – covering many departments and is centred on three key areas, namely digital infrastructure as a utility to every citizen, governance and services on demand and digital empowerment of citizens.

Exhibit 61: Key elements of Digital India



Source Digital India, 2016

115. Interestingly the failure to provide the broadband speeds contained in the Policy has resulted in a unique Public Interest to come up before Chhattisgarh High court, challenging the unusual delay in revising the existing broadband speed to 2 Mbps and the Central Government 's failure to implement the policy. The next date of hearing has been fixed for 5 December 2016. See http://timesofindia.indiatimes.com/city/raipur/Broad-band-speed-revision-DoT-TRAI-get-HC-notice/articleshow/54207740.cms

116. See www.digitalindia.gov.in/

In relation to broadband connectivity this covers three sub components, namely Broadband for All - Rural, Broadband for All - Urban and National Information Infrastructure (NII). The key objectives are:

(i) Broadband for All – Rural. 250,000 village Panchayats would be covered under the National Optical Fibre Network (NOFN) by December 2016. Department of Telecommunications (DoT) is the nodal Department for this project;

(ii) Broadband for All – Urban. Virtual Network Operators would be leveraged for service delivery and communication infrastructure in new urban developments and buildings would be mandated.

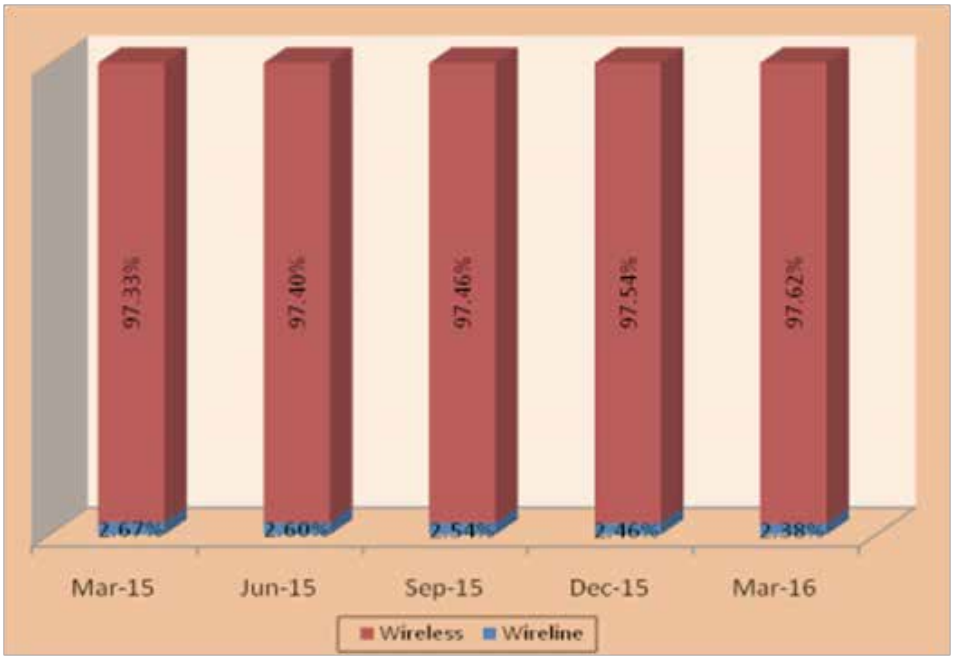
(iii) National Information Infrastructure (NII). NII would integrate the network and cloud infrastructure in the country to provide high speed connectivity and cloud platform to various government departments up to the panchayat level. These infrastructure components include networks such as State Wide Area Network (SWAN), National Knowledge Network (NKN), National Optical Fibre Network (NOFN), Government User Network (GUN) and the MeghRaj Cloud. The Ministry of Electronics and Information Technology[117] is the nodal Department for this project.

The second program to highlight is the universal access to mobile connectivity. This initiative focuses on network penetration and filling the gaps in connectivity in the country. There were around 55,619 villages in the country that did not have mobile coverage. As part of the comprehensive development plan for North East, providing mobile coverage to uncovered villages has been initiated. Mobile coverage to remaining uncovered villages would be provided in a phased manner. The Department of Telecommunications will be the nodal department and project cost will be around INR 16,000 Cr during 2014-18.

MARKET PERFORMANCE

Throughtout this period India underwent a mobile revolution with a huge explosion in cellular mobile serices mainly driven by the private sector.
The TRAI has indicated that the number of telephone subscribers in India increased from 1,036.41 million at the end of December 2015 to 1,058.86 million at the end of March 2016, registering a growth of 2.2% over the previous quarter. This reflects year-on-year (Y-O-Y) growth of 6.3% over the same quarter of last year. The overall teledensity in India increased to 83.4 at the end of March 2016 from 81.8 at the end of the previous quarter (see Exhibit 62).

Exhibit 62: Total number of Indian subscribers by technology



Source: TRAI, 5 August 2016

117. *See http://meity.gov.in/*

Total number of Internet subscribers has increased from 331.7 million at the end of December 2015 to 342.7 million at the end of March 2016, registering a quarterly growth rate of 3.31%. Out of 342.65 million, Wired Internet subscribers were 20.44 million and Wireless Internet subscribers are 322.21 million (see Exhibit 69).

The Internet subscriber base of 342.7 million at the end of March 2016 is comprised of Broadband Internet subscriber base of 149.8 million and Narrowband Internet subscriber base of 192.9 million. The broadband Internet subscriber base grew by 9.7% from 136.5 million at the end of December 2015 to 149.8 million at the end of March 2016.

Exhibit 63: Internet/Broadband Subscribers in India

Internet/Broadband Subscribers	Total
Total Internet Subscribers	342.7 million
% change over previous quarter	3.3%
Narrowband subscribers	192.9 Million
Broadband subscribers	149.8 Million
Wired Internet Subscribers	20.4 Million
Wireless Internet Subscribers	322.2 Million
Urban Internet Subscribers	230.7 Million
Rural Internet Subscribers	111.9 Million
Total Internet Subscribers per 100 population	26.98
Urban Internet Subscribers per 100 population	58.28
Rural Internet Subscribers per 100 population	12.80

Source: TRAI, Indian Telecom Services Performance Indicators, January - March 2016, 5 August 2016

Central to addressing connectivity has been the availability of spectrum to provide cellular mobile services. While beyond the scope of this paper (and indeed ought to be a paper on its own) India has successfully auctioned spectrum for a number of IMT bands. This has created a number of large Indian cellular operators including Bharti AirTel, Idea Cellular and Vodafone. The recently concluded largest ever spectrum auction in October 2016 has again redrawn the mobile spectrum map of India. The latest spectrum auction has paved way for the entry of a new 3G operator in at least 6 circles, also there has been enough capacity created for a new 4G entrant in all 22 Indian circles. A complete run down on the results and spectrum holdings is available online. [118]

Exhibit 64: Indian Subscribers QE March 2016 (not pre launch of Jio)

Service provider	Subscriber base (millions)	Market Share Percentage
Bharti	254.90	24%
Vodafone	198.04	19%
Idea Cellular	175.07	17%
Reliance	103.58	10%
BSNL	101.11	10%
Aircel	87.09	8%
Tata	61.82	6%
Telenor	52.45	5%
Sistema	7.75	1%
MTNL	7.06	1%
Videcon	6.56	1%
Quadrant	3.42	0%
TOTAL	**1,058.86**	100%

Source: TRAI, 5 August 2016

118. Refer to https://telecomtalk.info/india-spectrum-data-sheet/134245/

LAUNCH OF RELIANCE JIO

In September 2016, Reliance commercially launched the Jio 4G LTE network (without 2G/3G based services) and is the only 100 percent VoLTE operator in India with coverage across all 22 telecom circles. Jio owns spectrum in 800 MHz and 1,800 MHz bands in 10 and 6 circles, respectively, of the total 22 circles in the country, and also owns pan-India licensed 2.3 GHz spectrum. The spectrum is valid till 2035.

Within the first month of commercial operations, Jio announced that it had acquired 16 million subscribers. It is understood that is the fastest ramp-up by any mobile network operator anywhere in the world. There are currently a number of interconnection issues between Jio and its major competitors Bharti Airtel, Vodfone and Idea Cellular concerning asymmetric traffic patterns and cost based interconnect charges for mobile call termination.[119]

FIXED NETWORKS

India's fixed broadband market remains underdeveloped in India, mainly due to the dominance of the mobile platform and an unwillingness by operators to invest in fixed broadband infrastructure. Between 2011 and 2015, fixed broadband penetration increased only marginally. During 2015/16 the market grew by nearly 10% reaching. Moderate growth is predicted for the next five years to 2021. In November 2015 Bharti Airtel allocated an investment of INR600 billion (USD9 billion) for the upgrade of its pan-Indian network over the next three years under 'Project Leap'.[120] In March 2016 Vodafone signed an agreement to acquire cable broadband provider YOU Broadband.

ESTABLISHMENT OF WORLD CLASS TOWERCOS

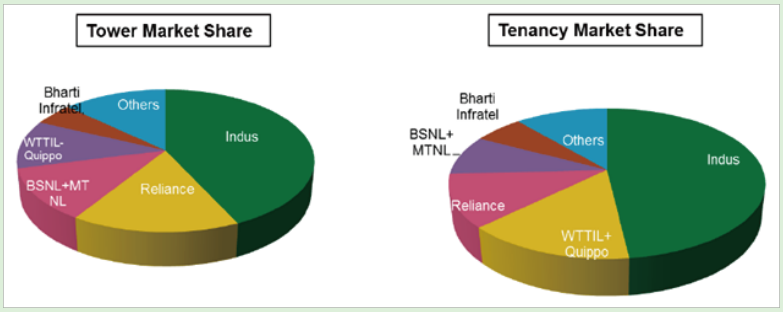
Currently with the growth in mobile communications, India has built world class towercos as highlighted in Exhibit 65.

Exhibit 65: Towercos in India

Indus Towers is the world's largest tower company and the largest provider of mobile towers in India, with a portfolio of more than 110,000 towers. Indus was first proposed in November 2007 as a joint venture between Bharti Infratel Ventures (42 per cent), Vodafone Infrastructure (42 per cent) and Idea Cellular Infrastructure (16 per cent) in order to reduce the costs of managing the towers and to avoid duplication of infrastructure. The merger became effective on 11 June 2013 after final approval from the Delhi High Court. [121]

As shown below, Indus is the clear industry leader both in terms of the number of towers and tower tenancy. However, there is significant competition from Reliance (>50,000 towers), Viom Networks (formerly Quippo WTTIL) (>41,000 towers), and the state-owned operators BSNL and MTNL.

Market share among tower providers in India



Source: Indus Towers, 2013

119. *Refer to article concerning Idea Cellular's release of POIs available at www.livemint.com/Industry/bSfWJaGGyIxgAqf5-No38XN/Idea-agrees-to-provide-interconnection-points-to-Reliance-Ji.html*

120. *See www.airtel.in/about-bharti/media-centre/bharti-airtel-news/mobile/airtel+announces+open+network+initiative+under+project+leap*

121. *http://articles.economictimes.indiatimes.com/2013-06-12/news/39925712_1_merger-delhi-hc-vodafone*

9.4.3 Broadband penetration in Indiasummary points

In terms of broadband penetration according to the ITU's 2015 Global ICT Development index India's 2015 fixed (wired)-broadband subscriptions was a low 1.24 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 5.52[122]. The same index found that India's international internet bandwidth per Internet user (Bit/s) was 5,677.

9.5 Broadband in the Lao People's Democratic Republic

9.5.1 Key summary points

There remains are significant challenges in Lao PDR telecommunications sector including the need to (i) optimise the institutional arrangements in accordance with its WTO commitments including the establishment of the new sector regulator (ii) strengthen the major operators who each have the Lao PDR Government as a shareholder including encouraging new sector, (iii) finalise and promulgate a range of subsidiary legislation pending since the passage of the Law on Telecommunications 2011, (iv) consult on and issue a national broadband policy so that there is clarity for all sector stakeholders on the objectives and plan and (v) release further sub-1 GHz spectrum for IMT services (eg 700 MHz) and allow all IMT bands to be technology neutral.

9.5.2 Legislative and Policy Background

The Government of Lao PDR, represented by the Ministry of Posts and Telecommunications ('MPT') as part of its broader reforms and re-entry into the world economy, has been focused on instituting new sector legislation and an effective regulatory framework that meets the country's plans for sector development and expansion. This has included in particular the introduction of the Law on Telecommunications, enacted by the National Assembly in December 2011. A new decree on radio frequency management has also been promulgated but new licences have yet to be issued to operators under the new Law on Telecommunications 2011.

In early 2013, the accession of Lao PDR to the WTO was finalised. As a consequence, Laos committed to implement its post-WTO accession agenda. Of critical importance for Lao PDR's telecommunications sector, the country's commitment to implementing the WTO Reference Paper on telecommunications among other things called for a review of the telecommunications regulation and the establishment of independent telecom regulator.

As a least developed country ('LDC'), Lao PDR was only required to be put this in place two years after its accession (ie by February 2015). However, as of October 2016 this had not been achieved even though a major project involving the Lao PDR Ministry of Industry and Commerce along with the Ministry of Posts and Telecommunications was completed in 2014/15. Decisions, it is understood, which will involve changes to the country's sector institutional arrangements and corporate governance of the major operators will soon be undertaken.

122. *www.itu.int/net4/ITU-D/idi/2015/#idi2015countrycard-tab&IND*

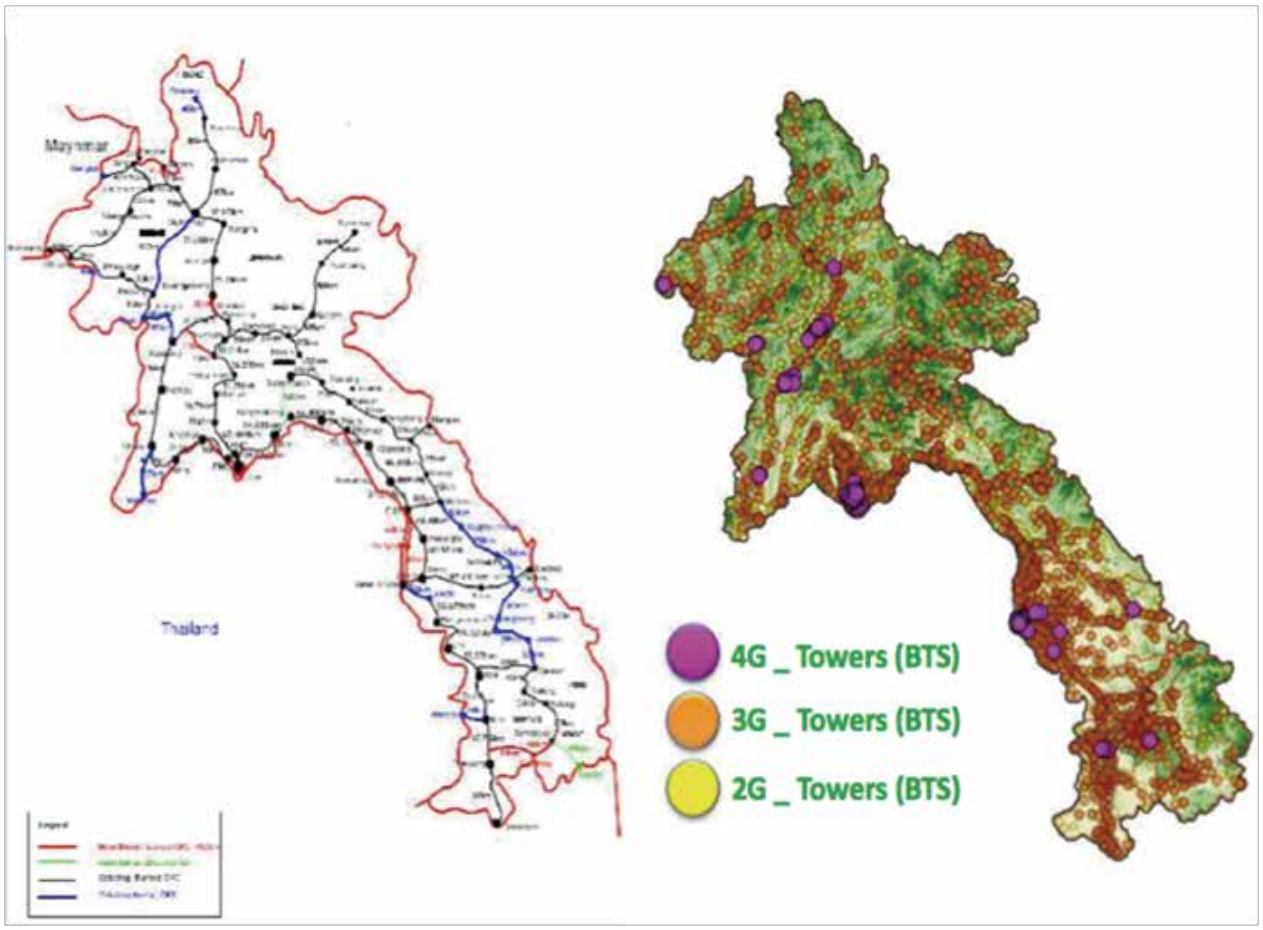
On 1 September 2016, Comba Telecom has announced that special purpose investment holding company Jiafu Holdings, and an associated company in which it holds 49% interest, has signed a joint venture (JV) agreement with the Government of Lao PDR, enabling Jiafu Holdings to acquire a 51% interest in state-run ETL for a consideration of USD91.8 million. Comba Telecom will make the capital contribution of approximately USD50.0 million to fund Jiafu Holdings for the acquisition. Upon completion of the agreement, ETL will be 51%/49%-owned by Jiafu Holdings and the Lao PDR Government, respectively. While the decision does not seem to involve a capital injection, perhaps this will come at a later date as the country continues to need significant investments in telecommunications infrastructure. The decision of the Lao PDR Government follows earlier attempts to merge ETL with LaoTel and/or undertake for the Government to undertake a listing of its telecommunications assets.Until October 2001, LTC had a monopoly on the provision of all forms of telecommunications services. The telecommunications market in Lao PDR consists of four major fixed and mobile operators – Unitel, LaoTel, ETL and Beeline Lao. The Lao PDR Government has a stake in each of the four major operators. There are also smaller providers such as Planet Online, which supplies wireless Internet services. LANIC is international Internet gateway provider affiliated with the MPT. A summary of Lao PDR's operators is provided in Exhibit 66 below.

Exhibit 66: Summary of operators in Lao PDR

Operator/ISP	Technology/service	Ownership
ETL	• PSTN • 2.5G, 3G & 4G/LTE • ISP (leased lines, ADSL (up to 2 Mbps and FTTH up to 5 MBps)	51% Jiafu Holdings (China) 49% Lao Government
LANIC (Lao National Internet Centre)	• International Internet Gateway	Affiliate of MPT
Lao Telecom	• PSTN • 2.5G, 3G launched July 2008 and 4G (launched December 2012) • ISP (ADSL up to 2 Mbps)	51% Lao Government 49% Shin Corporation (Thailand), reverts to Lao Government in 2021
Planet Online	• Broadband wireless Internet (700 MHz ISP)	100% private
Unitel	• PSTN • 2.5G, 3G and 4G/LTE • ISP (FTTH & ADSL)	51% Lao Government 49% VietTel (Viet Nam)
Beeline Lao	• 2.5G, 3G & 4G/LTE • FTTH (up to 100 Mbps)	22% Lao Government 78% Vimpelcom

Source: Industry sources and news reports, October 2016

The national fibre backbone of the country is extensive (with some 62,714 kms of fibre) and extensive cellular mobile coverage as shown in Exhibit 67 below. [123] As a landlocked country, Lao PDR suffers from an inability to directly access submarine cable systems but in recent years this has been assisted with competing terresterial connectivity to Thailand, China and Vietnam.



Source: MPT, 2015

123. *See Chanthone Chanthavong, MPT, ICT statistics and Its Infrastructure in Laos 2014. Available at www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2016/Mar-ICTStats/Presentations/Paper_for%20country%20report%20Lao%20PDR.pdf*

9.5.3 Broadband penetration in Lao PDR

In terms of broadband penetration according to the ITU's 2015 Global ICT Development Index, Lao PDR's 2015 fixed (wired)-broadband subscriptions was a very low 0.16 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 4.58. The same index found that Lao PDR's international internet bandwidth per Internet user (Bit/s) was 2,828.

LTE services using the 1800 MHz band are mainly deployed in Lao PDR's major urban areas and fibre services (which are limited) are concentrated in Vientiane. In the case of fixed internet services according to data supplied by the MPT, there were over 36,000 services (a 35 percent increase of 2014 figures) and over 1.4 million wireless broadband subscriptions at the end of 2015. See Exhibit 68 below.

Exhibit 68: Broadband access technology by type

Broadband connections	Sub-total	Total 2015
Fixed (wired)-broadband subscriptions		36,408
Cable Modem Internet Subscriptions	*4,988*	
DSL Internet subscriptions	*14,550*	
Fibre-to-the-home/building Internet subscriptions	*8,768*	
Other fixed (wired)-broadband subscriptions	*8,102*	
Wireless-broadband subscriptions		1,457,061

Source: MPT, 2016.

Broadband services in Laos continue to lag. This remains a major concern in terms of the overall social and economic development of the country. However, the positive news is that since 2012 there has been a boom in mobile broadband internet services including the launch of 4G/LTE services by the major operators. All of the major operators are also offering fibre connection although the key focus is in Vientiane. The expansion of Internet and especially broadband into the provinces and the rural areas is high on the Lao PDR's Government's list of development priorities.

Lao PDR does not currently have a broadband plan even though a draft broadband plan was developed with the assistance of the ITU in 2013. There is also Laos PDR National ICT Development Plan (2016–2025) White Paper which is also in draft form. Focusing on broadband and the improvement of the regulatory regime in 2017 is likely to attract the necessary additional foreign investment into the sector.

9.6 Broadband in the Republic of the Union of Myanmar

9.6.1 Key Summary Points

Myanmar is undergoing a period of profound political and economic reform since Myanmar's military turned power over to an elected government in 2010. This has drawn intense interest from multinationals seeking fresh markets and customers in this resource-rich, populous nation conveniently situated between India and China and sharing borders with around 40 per cent of the world's population.

Telecommunications is viewed as one of the foundational pillars for Myanmar to modernize. Consequently, the sector is undergoing major reform. Such changes include the introduction of new telecommunications laws, reform of the institutional structure, the introduction of new mobile service providers and the promulgation of a telecommunications master plan.

Myanmar's inadequate telecoms development poses big challenges, but it also provides a unique opportunity for the country to take advantage of lessons learned from other markets, and leapfrog past their development path. This will be necessary to ensure rollouts are fast, future-proofed, and implemented with maximum cost savings.

9.6.2 Legislative and Policy Background

With the support of many international organisations including the World Bank, the International Telecommunication Union, the Asian Development Bank and USAID, plans for the reform of Myanmar's telecommunications sector were made. A key initial priority was legislative reform which paved the way for further structural, institutional and regulatory reforms.

In October 2013, the Telecommunications Law came into effect. The law provides a broad-based framework governing the conduct of telecommunications related activities in Myanmar and has the following objectives:

(a) To support the modernization and development of the nation with telecommunications technology;

(b) To enable Telecommunications Services that will be able to provide high quality and worthy services to the users by allowing fair and transparent competitions from domestic and abroad in the telecommunications sector which is developing;

(c) To give more opportunities to the general public to use Telecommunications Service by expanding the Telecommunications Network in the entire country along with the telecommunications technology which is developing;

(d) To protect the Telecommunications Service providers and users in accord with law;

(e) To supervise Telecommunications Service, Network Facilities and Telecommunications Equipment which require license for national peace and tranquillity and for public security.

The Telecommunications Law provides for the issuing of licences for the provision of network facilities, network services and application services. In addition, the law contains enabling provisions for detailed regulations to be made regarding a range of matters including, licensing rules, interconnection and access, spectrum, numbering and competition.

The approval of the Telecommunications Law was followed by the issuance of telecommunications service licenses to compete with the State-owned monopoly Myanmar Posts and Telecommunications (MPT). Licenses to build and operate a nationwide wireless network for 15 years were issued to Ooredoo (formerly Qatar Telecom) and Norway's Telenor in 2013 and each became operational in 2014. Ooredoo and Telenor both have spectrum in the 900MHz and 2100MHz bands.

Key reforms are being made to Myanmar's institutional structure. Historically, the Ministry of Communication and Information Technology (MCIT) has acted as Myanmar's telecommunications sector policy making body, sector regulator through its Posts and Telecommunications Department (PTD) and has been the primary provider of telecommunications services through its ownership of MPT. Plans are in place to more formally separate the policy functions of the MCIT and regulatory functions of the PTD. However, with limited skilled resources this process is proving to be challenging.

Plans are also in place for MPT to become independent of MCIT and to improve its operational performance. Significant progress has been made in this area with Japan's KDDI together with Sumitomo Group signing an agreement with MPT in July 2014 to jointly operate a mobile phone service in Myanmar for the next 10 years. In addition, KDDI and Sumitomo are reported to have committed to invest over USD 2 billion to accelerate the development of MPT and Myanmar's telecommunications industry.

Myanmar has made significant progress in the process of reform to its telecommunications sector in the absence of a formal national telecommunications policy. However, a comprehensive final draft of Telecommunications Master Plan (TMP) was promulgated for industry consultation by the MCIT in July 2015. While the TMP has not yet been officially adopted, it sets out ambitious plans and strategies for the on-going reform and the sustained growth and development of Myanmar's telecommunications sector. The final draft TMP sets out the MCIT's vision to:

> *Connect the people of Myanmar nationally and globally, using mobile, fixed and satellite technologies to connect over 90% of the population within 2020 to the internet with 50% having access to high-speed internet services of at least 7.2 Mbps*

> *Empower Myanmar's economy with ICT and Innovation, to create social impact in health, education and other sectors by overcoming these constraints in serving all of Myanmar through physical facilities and specialist skills, and to power broader industry and economic growth*

> *Enable the journey to digital Government with infrastructure and mobile applications, supporting the Government's initiatives by creating the information architecture, and providing implementation support.*

The final draft TMP sets out a broad vision of Myanmar to become a mobile-first, digitally connected nation, realised through three enabling objectives:

1. Create a Myanmar national broadband infrastructure asset – through initiatives to Connect Myanmar to broadband services, to encourage Affordability and Quality, and to safeguard security

2. Deliver communications content and services for the Myanmar people – to foster a mobile- first orientation in the delivery of many goods and services in the economy, to encourage truly local innovation, to understand and protect consumer rights and drive customer value

3. Create an enabling institutional framework – envisioning a dynamic Ministry setting policy, an empowered and independent Regulator, accountable and autonomous service providers, and most important of all, enriched and satisfied customers who benefit from a wide choice of high quality, competitive and affordable services.

These measures are intended to create an appealing, predictable and stable investment environment for the telecommunications industry in Myanmar. The final draft TMP sets out the action plan for how to achieve this, the framework that will support it, and the measures the MCIT will put in place to ensure the reforms are implemented and sustained.

On the basis that Myanmar has inadequate legacy network infrastructure, the final draft TMP positions services which are provided over mobile networks as the first connection choice for users. Mobile is considered to be the most important technology to connect customers for both basic voice services and for high-speed broadband through 3G and 4G services. Fixed technologies, especially fibre networks and international gateways, are considered critical to providing a high-speed infrastructure from which operators can connect globally and connect citizens and businesses. In addition, satellite services will be leveraged in closing remote coverage gaps where neither mobile nor fixed terrestrial technologies can easily reach.

The final draft TMP recognises the challenges for all operators to expand their backhaul transmission capabilities so that they may keep up with the growth in customers and the expanding usage of voice and data services. This has led to the creation of the National Fibre Policy (NFP15) which sits within the final draft TMP. As such, the NFP15 has not been officially adopted.

NFP15 focuses specifically on transmission challenges. NFP15 refers to three elements of the transmission network:

- Unused fibre-optic cable, referred to as Dark Fibre
- Ducts and Trenches used for housing installed fibre cables, referred to as Duct
- Fibre-optic cable that is already in use, referred to as Lit Fibre.

The policy is articulated across these elements and provides for a liberalized market in transmission (subject to regulatory approvals for route applications) for sharing and building dark fibre and duct, and for building lit fibre. The policy provides no obligations today for sharing lit fibre, or for fibre used for access into premises.

NFP15 will be supported by an enabling regulatory framework to mandate reasonable access and pricing. This framework will consist of Access Rules and Price Regulation, the establishment of a National Telecommunications Infrastructure Committee and the publication of Standard Operating Procedures (SOP) for Fibre Approvals and Deployment. The MCIT will put in place further institutional measures to provide additional support at an inter-ministerial level. The MCIT will ensure that other utilities' (energy, road, railways and gas pipeline providers) fibre assets and rights of way can be leveraged for the development of a robust nationwide fibre network.

Under the NFP15 a National Telecommunications Infrastructure Committee (NTIC) will be convened. The purpose of the NTIC will be to foster stronger coordination between licensees who own, lease or operate telecommunications infrastructure assets or provide infrastructure-based services, as well as other stakeholders. The objective of such coordination will be to facilitate the planning, approval and deployment of fibre networks, coordination on the build out and sharing of tower assets and other elements of Myanmar's telecommunications infrastructure in the future (such as international links and public wi-fi networks).

In October 2016, the PTD undertook a successful spectrum auction for 40 MHz of 2600-MHz spectrum reserved for mobile broadband services. Multiple ISPs and other companies – including Yatanarpon Teleport and Myanmar Telecommunication Network lodged expressions of interest regarding the auction. In total, 22 companies applied. The 40 MHz of 2600-MHz spectrum is divided into two 20 MHz lots, and this will itself be divided into three separate regions. The spectrum auction raised USD244.26 million as shown in Exhibit 69 below. It is understood that the PTD has issued a spectrum roadmap concerning future releases of IMT spectrum.

Exhibit 69: 2600 MHz Spectrum Auction Results

2600 MHz လိုင်းနှုန်းစဉ်လေလံ အောင်မြင်သူများစာရင်း

Region	Lot Number	Bidder Name	Price USD (Million)
Region 1 (Nay Pyi Taw, Magwe, Bago, Mon, Tanintharyi)	Lot 1.1	Fortune International Ltd	6.09
	Lot 1.2	Global Technology Co.,Ltd	7.03
Region 2 (Yangon, Ayeyawaddy, Rakhine)	Lot 2.1	Amara Communications Co.,Ltd	95.81
	Lot 2.2	Yatanarpon Teleport Public Co., Ltd	83.44
Region 3(Mandalay, Sagaing, Chin, Shan, Kachin, Kayah)	Lot 3.1	Yatanarpon Teleport Public Co., Ltd	27.24
	Lot 3.2	Amara Communications Co.,Ltd	24.55

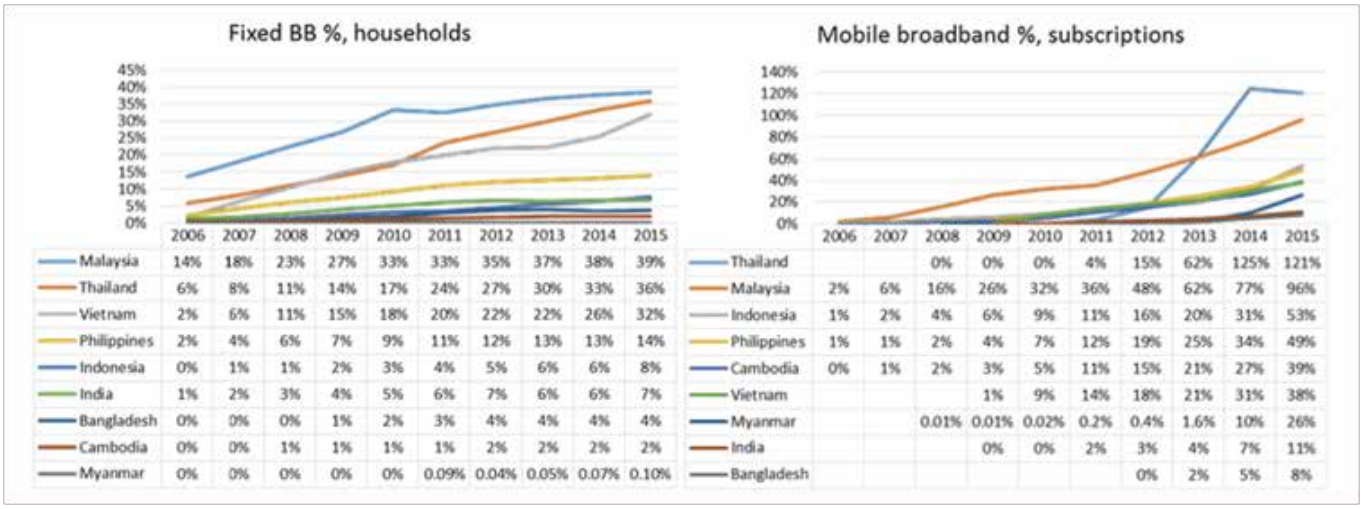
In other developments, Viettel, is expected to make US$2 billion investment in Myanmar's telecom sector within 5 years, with plans to launch its service business as the fourth national mobile operator in 2017 Viettel will hold a 49 per cent share of the joint venture company while 23 per cent will go to a local consortium. The government-owned Star High Public Co Ltd will hold the remaining 28 per cent stake. A joint venture agreement has already been signed between Viettel and local partners to kick off operations in early 2017, according to a director of the Myanmar Technologies and Investment Corporation. The company is likely to offer telecommunications services through mobile towers owned by the Myanmar Economic Cooperation. [124]

124. See https://consult-myanmar.com/2016/10/21/vietnamese-telecom-viettel-to-invest-2bn-in-myanmar-over-five-years/ and http://viettelglobal.vn/press-release-viettel-enters-myanmar-with-an-aim-to-connect-95-of-the-countrys-population.html

9.6.3 Broadband penetration in Myanmar

Exhibit 70 below shows the performance of countries compared to their regional peers in the areas of fixed and mobile broadband. Myanmar's mobile broadband penetration of 26 per cent outperforms India and Bangladesh while Myanmar's fixed broadband penetration is at the bottom of the table.

Exhibit 70: Fixed and mobile broadband penetration, South and Southeast Asia, 2015 (selected countries)



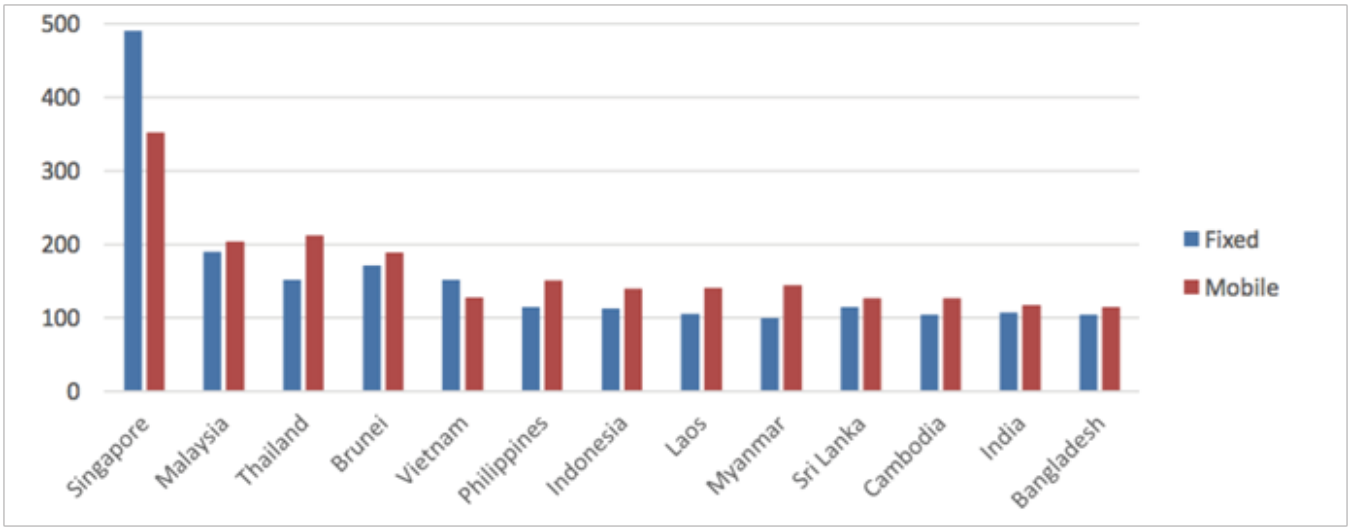
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Malaysia	14%	18%	23%	27%	33%	33%	35%	37%	38%	39%
Thailand	6%	8%	11%	14%	17%	24%	27%	30%	33%	36%
Vietnam	2%	6%	11%	15%	18%	20%	22%	22%	26%	32%
Philippines	2%	4%	6%	7%	9%	11%	12%	13%	13%	14%
Indonesia	0%	1%	1%	2%	3%	4%	5%	6%	6%	8%
India	1%	2%	3%	4%	5%	6%	7%	6%	6%	7%
Bangladesh	0%	0%	0%	1%	2%	3%	4%	4%	4%	4%
Cambodia	0%	0%	1%	1%	1%	1%	2%	2%	2%	2%
Myanmar	0%	0%	0%	0%	0%	0.09%	0.04%	0.05%	0.07%	0.10%

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Thailand			0%	0%	0%	4%	15%	62%	125%	121%
Malaysia	2%	6%	16%	26%	32%	36%	48%	62%	77%	96%
Indonesia	1%	2%	4%	6%	9%	11%	16%	20%	31%	53%
Philippines	1%	1%	2%	4%	7%	12%	19%	25%	34%	49%
Cambodia	0%	1%	2%	3%	5%	11%	15%	21%	27%	39%
Vietnam				1%	9%	14%	18%	21%	31%	38%
Myanmar			0.01%	0.01%	0.02%	0.2%	0.4%	1.6%	10%	26%
India				0%	0%	2%	3%	4%	7%	11%
Bangladesh							0%	2%	5%	8%

Source: Ovum

Exhibit 71 below shows Ovum's Broadband Development Index (BDI) rankings for both fixed and mobile in South and Southeast Asia. The BDI provides both a global and regional picture of telecoms consumer connectivity. The Index ranks the levels of connectivity in each country based on the speed of technology migration to super-fast broadband. The Index ranks countries on global and regional levels to allow a rounded view of the success of a country's migration to next-generation broadband technologies.

Exhibit 71: Broadband Development Index, South and Southeast Asia

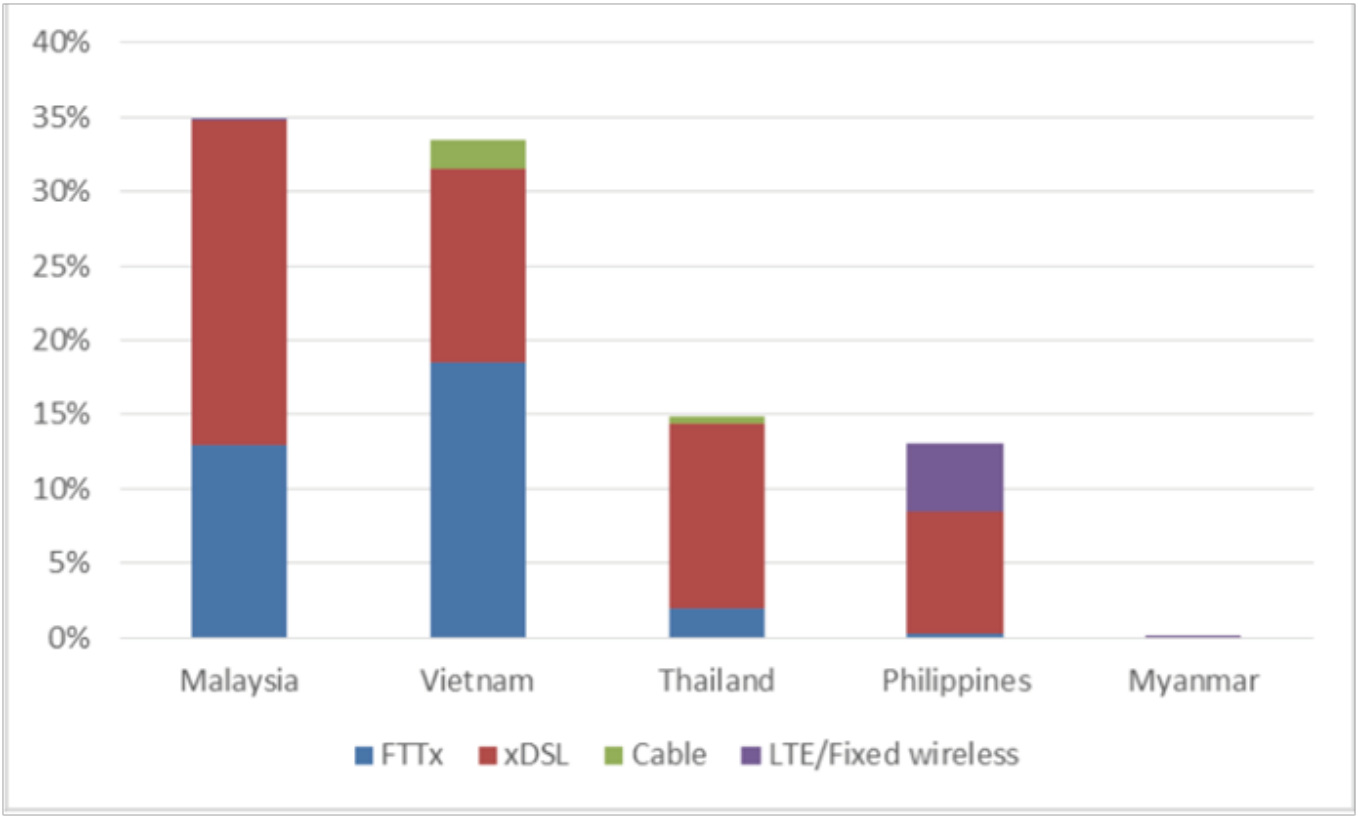


Source: Ovum's Global Broadband Development Index

Myanmar's mobile ranking is actually ahead of South Asian peers like India and Sri Lanka, and is on par with Indonesia and Vietnam, as it enjoys comparatively higher share of mobile broadband connections. However, Myanmar's much weaker fixed broadband market tempers results, pulling its overall ranking into the lower half of the BDI.

Exhibit 72, below, contrasts Myanmar with its leading regional peers in terms of broadband penetration. DSL makes up the bulk of connections across most markets, as operators leverage legacy copper early on to provision services. Clearly, Myanmar is starting from a very low base.

Exhibit 72: Share of broadband subscriptions by technology, selected SE Asian Countries, 1Q16



Source: Ovum

There are huge hurdles ahead across all sectors in Myanmar, but getting the ICT component right is perhaps the most urgent as it is critical in driving transformation and plays one of the biggest roles in enabling social and economic development. Myanmar recognizes this, and much progress has been made – most notably the issuance of telecoms licenses and introduction of foreign competition – resulting in massive investment and service rollouts. By the end of 1Q16, Myanmar's mobile penetration rate was an astonishing 68%, with more than 80% of the population covered by a mobile network. Penetration is expected to hit 90% by 2019, in-line with government connectivity targets.

Yet challenges remain, especially with the government and many other sectors looking to pivot towards transformation through digitization of processes and services. In order to realize the vision of a digitally connected nation, a robust ecosystem needs to evolve, nurtured by both a mobile and fixed national infrastructure asset. The latter poses particular challenges with regard to household penetration, average access speeds, affordability, and over the longer term the ability to sustain high utilization; building blocks need to be set now to ensure the right balance between providing for the consumption oriented mass market, and the services driven layer needed to support it.

With regard to international internet connectivity Myanmar is currently served by submarine cable SEA-ME-WE 3 and terrestrial links to both Thailand and China. In addition to international capacity which has been sourced by both Ooredoo and Telenor, there are several initiatives underway to markedly boost Myanmar's international fibre capacity. These include:

- The Myanmar-Malaysia-Thailand-International Connection (MYTHIC) cable which will provide an extra 300 Gigabits a second of bandwidth
- The submarine cable SEA-ME-WE 5 that MPT is reported to be sourcing and which is expected to be operational in 2017
- The new AAE-1 undersea cable that China Unicom is reported to have been working with MPT.

9.7 Broadband in the Democratic Socialist Republic of Sri Lanka

9.7.1 Key Summary Points

Over the past few years, Sri Lanka's social and economic well-being has rebounded from the difficult state that it was in following the end of the civil war in 2009. The generally improving market environment has seen Sri Lanka's telecom sector well positioned for continuing growth and development. This also fits well with the government's wider agenda for national development.

Sri Lanka has benefited from a competitive and progressive telecommunications sector which has generated very high mobile service penetration rates. However, in the face of a range of challenges including the absence of a clearly articulated national broadband policy, the potentially high penetration of broadband services in Sri Lanka is yet to be realised.

9.7.2 Legislative and Policy Background

Sri Lanka was one of the early Asian jurisdictions to implement telecommunications sector reform. In 1991, the state owned monopoly provider of telecommunications services, i.e., the Department of Telecommunications, was converted into a state owned corporation, i.e., Sri Lanka Telecom. At the same time, the Office of the Director General of Telecommunications (ODGT) was established as the sector regulatory body with the enactment of the Sri Lanka Telecommunications Act No. 25 of 1991.

A further round of reforms occurred in 1996. In particular, the ODGT became the present Telecommunications Regulatory Commission of Sri Lanka (TRCSL) under the Sri Lanka Telecommunications (Amendment) Act No 27 of 1996. As the national regulatory agency for telecommunications, the TRCSL promotes sustained development in the telecommunication industry by shaping the regulatory process, protecting public interest and being responsive to challenges in an increasingly competitive market.

The objectives of the TRCSL are:

- To ensure the provision of a reliable and efficient, national and international telecommunication services in Sri Lanka
- To protect and promote the interests of consumers, purchasers and other users and the public interest with respect to charges for and the quality and variety of telecommunication services provided and apparatus supplied
- To maintain and promote effective competition between persons engaged in commercial activities
- To promote rapid and sustained development of domestic and international telecommunication facilities
- To promote research into and development and use of new techniques in telecommunications and related fields

Also in 1996, Sri Lanka Telecom was converted to a fully state-owned company, i.e., Sri Lanka Telecom Ltd (SLTL). SLTL's monopoly over fixed-line telephone service ended at the same time with the issue of licences to two Wireless Local Loop (WLL) operators. While the TRCSL is responsible for sector regulation, Sri Lanka's policy responsibility rests with the Ministry of Telecommunication and Digital Infrastructure (MTDI). The MTDI is responsible for formulating and implementing national policy on telecommunication and digital infrastructure and other subjects which come under its purview.

In addition to TRCSL, the government established the Information and Communication Technology Agency (ICTA) was created by an Act of Parliament in 2003 as the ultimate body in charge of the implementation of ICT policy. The ICTA is responsible for implementing all ICT projects initiated by government. For example, the ICTA is responsible for implementation of the e-Sri Lanka initiative which uses ICT to develop the economy, reduce poverty and improve the quality of life of all Sri Lanka's people. This vision will be realized through a strategy based on the following six programs:

- ICT Policy, Leadership, and Institutional Development;
- Information Infrastructure;
- Re-engineering Government;
- ICT Human Resource Development;
- ICT Investment and Private Sector Development;
- E-Society.

The ICTA has activated projects such as the Government Information Centre (GIC), the Lanka Government Network (LGN), the Lanka Gate, the Lanka Government Cloud (LGC) and the e-Population Register. These ICT enabled development programs have created the need for broadband services. ☒

Despite various attempts to have one in place, Sri Lanka does not have a clearly articulated formal national broadband policy. Such a policy would assist in focussing industry efforts to realise Sri Lanka's broadband potential.

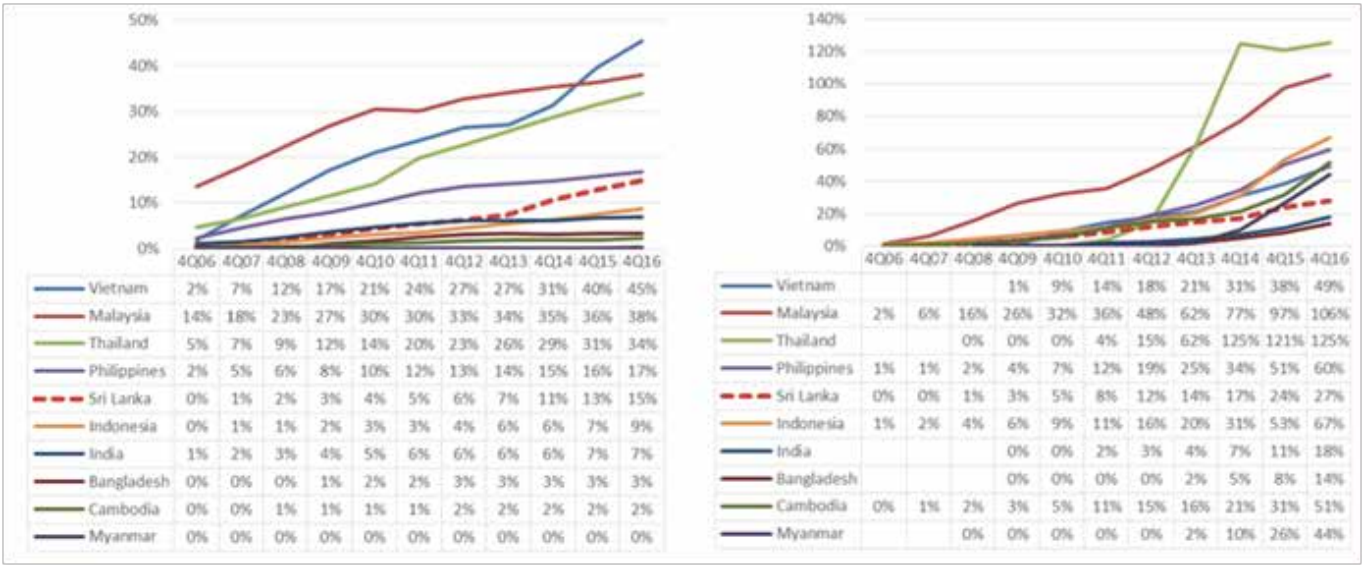
9.7.3 Broadband penetration in Sri Lanka

n terms of broadband penetration according to the ITU's 2015 Global ICT Development index Sri Lanka's 2015 fixed (wired)-broadband subscriptions was 2.65 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 13.01. The same index found that Sri Lanka's international internet bandwidth per Internet user (Bit/s) was 12,651.

Exhibit 73 below shows the performance of countries compared to their regional peers in the areas of fixed and mobile broadband. Sri Lanka sits in the middle for both fixed and mobile broadband penetration. Sri Lanka's penetration rates are particularly low compared with those of market leaders Vietnam, Malaysia, and Thailand. This is despite Sri Lanka's mobile service penetration exceeding the 100% penetration milestone in early 2014. In 2013, mobile operators Dialog and then Mobitel launched Fourth Generation (4G) LTE services in a move that effectively lifted the countries standing as a telecom market in the region.

The development of the internet remains of particular concern for Sri Lanka. In a country whose population is increasingly undeniably internet savvy and the government rhetoric positively supporting the nation going online, the estimated user penetration remained relatively low. One material issue seems to be access to transmission capacity and submarine cable landing stations which have been called a monopoly. It has been argued that alternatives within the domestic wholesale and retail market are necessary to provide telecommunication services at affordable prices. [125]

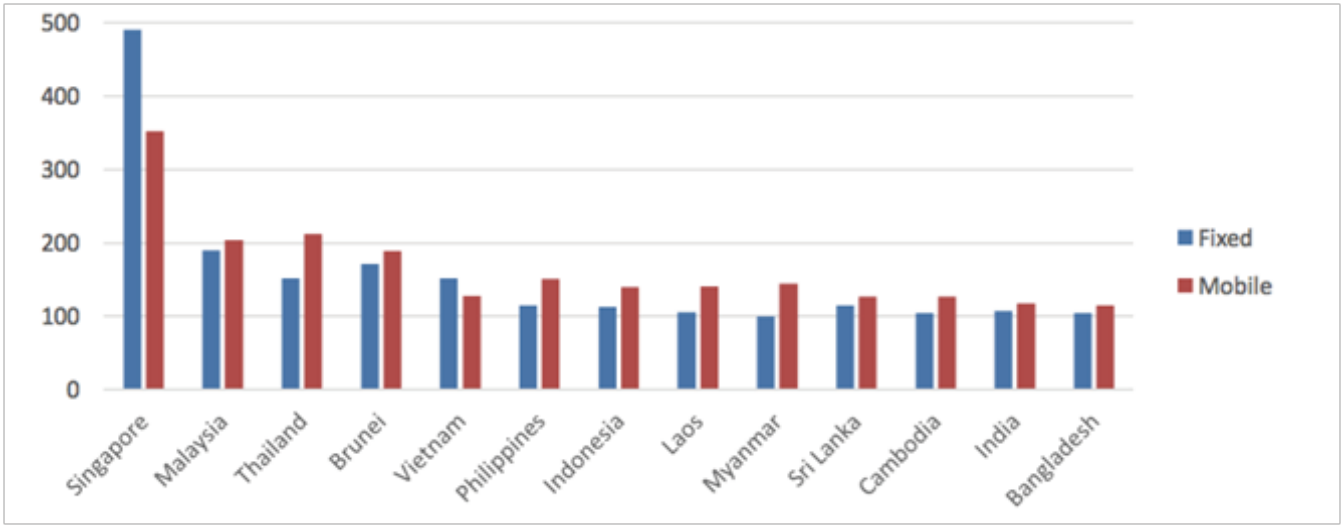
Exhibit 73: Fixed and mobile broadband penetration, South and Southeast Asia, (selected countries)



Source: Ovum

Exhibit 74 below shows Ovum's Broadband Development Index (BDI) rankings for both fixed and mobile in South and Southeast Asia. The BDI provides both a global and regional picture of telecoms consumer connectivity. The Index ranks the levels of connectivity in each country based on the speed of technology migration to super-fast broadband. The Index ranks countries on global and regional levels to allow a rounded view of the success of a country's migration to next-generation broadband technologies.

Exhibit 74: Broadband Development Index, South and Southeast Asi



Source: Ovum's Global Broadband Development Index

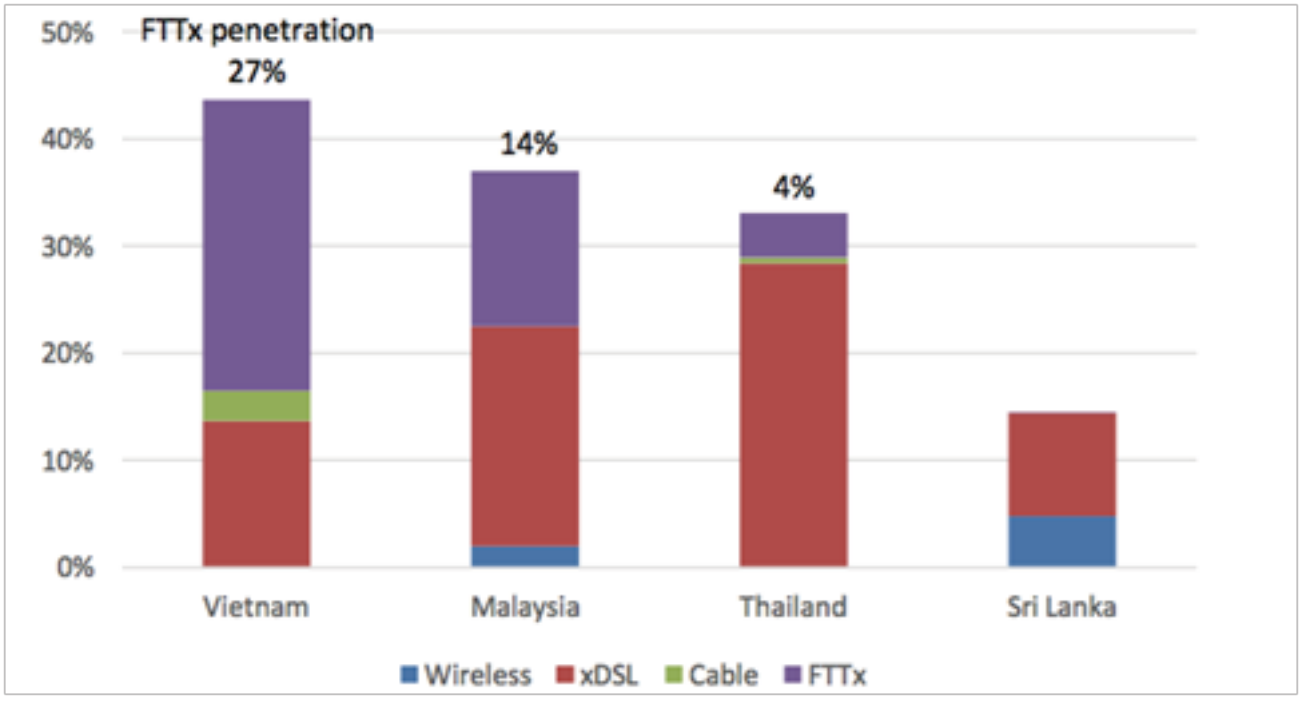
125. See www.ft.lk/article/572581/Prof--Samarajiva-calls-for-fiscally-responsible-policies

Sri Lanka's BDI sits just below the median in the selection of countries in Figure 2, being weighed down slightly by its comparatively low mobile broadband penetration. Although its fixed ranking fares slightly better, placing equal 5th with the Philippines, a closer look at the numbers reveals a bifurcated market, with the top three countries scoring above 150 (out of a possible 250), and the remaining seven including Sri Lanka falling at or below 115. Sri Lanka's current 'top of bottom' positioning is not ideal, however, it has the potential toc quickly move up the rankings by adopting various tools at the policy level to speed up rollouts. Exhibit 75 below compares Sri Lanka with Southeast Asia's healthiest markets, where FTTx not only accounts for a significant portion of overall fixed broadband subscriptions, but is also the fastest growing technology as operators move towards future-proofing their access networks. Where traditional xDSL has been flat or declining over the past year, fiber is increasing in double-digits.

With regard to international bandwidth connectivity Sri Lanka is particularly well served by a variety of submarine cable links. These include:

- SEA-ME-WE 3
- SEA-ME-WE 4
- SEA-ME-WE 5
- Dhiraagu-SLT Submarine Cable Network
- WARF Submarine Cable
- Bharat Lanka Cable System
- Bay of Bengal Gateway

Exhibit 75: Share of broadband subscriptions by technology, selected SE Asian Countries, 1Q16



Source: Ovum

Sri Lanka has much work ahead in its broadband development as its mobile and fixed line broadband adoption rates have been tempered due to indifferent policies, leadership transitions, and demographic hurdles such as low urban population penetration. However, these issues are not unique to Sri Lanka, and other countries have overcome these types of issues through concerted government efforts to reshape telecoms policy and effect real change.

Sri Lanka is well positioned, as it has the luxury of learning from other country's best practices and applying lessons learned to its own context. As well, its comparatively small landmass combined with respectable incomes bodes well for balancing supply with demand.

One of the biggest challenges for Sri Lanka is to ensure investor interest (and returns) so that networks are actually built out, and in a timely manner. Access networks are typically where the tightest bottlenecks occur, and addressing the problems will require focused policy measures from the government. In addition, Sri Lanka needs to address how it can migrate its high 2G customer base to 3G and 4G users. This may involve addressing issues such as affordability, digital literacy and content suitability.

9.8 Broadband in the Kingdom of Thailand

9.8.1 Key summary points

Significant policy and regulatory changes are being made in Thailand to facilitate the new Digital Thailand Plan including but not limited to (i) new sector legislation, (ii) structural changes to TOT and CAT in order to make them viable and to accelerate fixed broadband deployments, (iii) reviews of fixed network deployment regimes/rules and (iv) and range of other content, demand, skillsets, education etc which reflect the breadth of the Plan. Other key elements remain to addressed such as (i) IMT spectrum roadmap plan in order to significantly increase IMT spectrum allocations in Thailand, and (ii) licensing, access and related regulatory frameworks for the TOT/CAT restructuring and the national broadband network.

9.8.2 Legislative and Policy Background

In September 2016, Thailand's Ministry of Information and Communication Technology ('MICT') was dissolved and replaced by the Ministry of Digital Economy and Society. The new ministry assumed the responsibilities of MICT. MDES is therefore responsible for the policy direction of the sector, as well as oversight of the state-owned operators, TOT and CAT. The Ministry coordinates with other relevant ministries, neighbouring countries and international bodies to address issues such as interference and cross-border coordination, technical standards, government investment and agency resourcing.

The Telecommunications Business Act (2001) and the Act on Organisation to Assign Radio Frequency and to Regulate the Broadcasting and Telecommunications Services (2000) constitute Thailand's modern legislative framework. Together the Acts establish the National Broadcasting and Telecommunications Commission ('NBTC') (formerly the National Telecommunications Commission), which has extensive powers in relation to the management of the sector, as well as Thailand's telecommunications business licensing framework, including provisions relating to competition, access and interconnection, equipment and standards, and the setting of maximum fee and tariff rates.

In addition, a suite of Bills which are intended by the Government to support the development of Thailand's Digital Economy are currently being considered. These Bills address, inter alia:

- Creation of a Digital Committee for Economy and Society;
- Reformation of the governing Ministry;
- Amendment of existing legislation;
- Implementation of a new laws on Cybersecurity and Personal Data;
- Promoting and funding the Digital Economy;
- Minor amendments to the existing regulatory bodies in the ICT sector.

In April 2013, the NBTC issued three notifications relating to infrastructure sharing, MVNOs and domestic roaming. These were, namely:

- Notification Regarding Mobile Infrastructure Sharing, which imposes mandatory infrastructure sharing obligations on mobile licensees on a non-discriminatory basis;
- Notification Regarding Mobile Virtual Networks, which imposes obligations on licenced operators to provide wholesale mobile services to licensed MVNOs on a non-discriminatory basis;
- Notification Regarding Domestic Mobile Roaming Services, which imposes mandatory obligations on licenced operators to allow other visiting network users to roam on the visited network in areas where their home network does not provide coverage.

Under the infrastructure sharing notification, refusal to share infrastructure can only be made if the existing infrastructure is insufficient for access or sharing is not technically feasible. Consistent with global exemplar practice, infrastructure to be shared under the Notification consists of:

1. Towers and masts;
2. Area around the station;
3. Buildings or containers used to install equipment, including power supply, air conditioners, safety systems and other facilities;
4. Feeder cables;
5. Antenna systems;
6. Transmission systems used to connect to a Radio Node Controller ('RNC') or Base Station Controller ('BSC').

The stated aim of these regulations is to improve competition, speed up the launch of 3G services and assist licensees in fulfilling their network rollout commitments. This new regulation comes as part of the NBTC's push to liberalize the Thai telecommunications market, with the aim of benefiting end users and the Thai economy as a whole. The Infrastructure sharing regulations were met with strong opposition from various stakeholders including CAT Telecom and its union.

9.8.3 Thailand Digital Economy Plan

In Thailand there is a strong view that broadband services can contribute greatly to the growth of the GDP of the country by helping to drive technology and innovation through connectivity and increases in productivity. To translate the Government 's digital economy policy as delivered before the Thai National Legislative Assembly on 12 September 2014 into practice the MDES (previously the MCIT) and the Ministry of Science and Technology ("MOST") were instructed to co-develop the Thailand Digital Economy and Society Development Plan (or Digital Thailand Plan for short). The plan acts as a digital blueprint to revolutionize government operations, business practices and the lifestyle of the Thai people.

126. Future of the Thai Communications in the Age of Convergence, Thai National Broadcasting and Telecommunications Commissioner, May 2013.

In order to facilitate the establishment of the Digital Thailand plan, a number of reviews and policy pronouncements have been made. It has six major elements as summarised in Exhibit 76 below. Recognising inter alia that there are a number of challenges of having a national broadband network including (i) the need to expand broadband coverage, (ii) the lack of integration between various organisations have meant that investment has not been inefficient, (iii) the high cost of broadband services in Thailand compared with comparable markets and (iv) Thailand has relatively low broadband speeds compared to other countries in the Asia Pacific a number of actions have been planned.

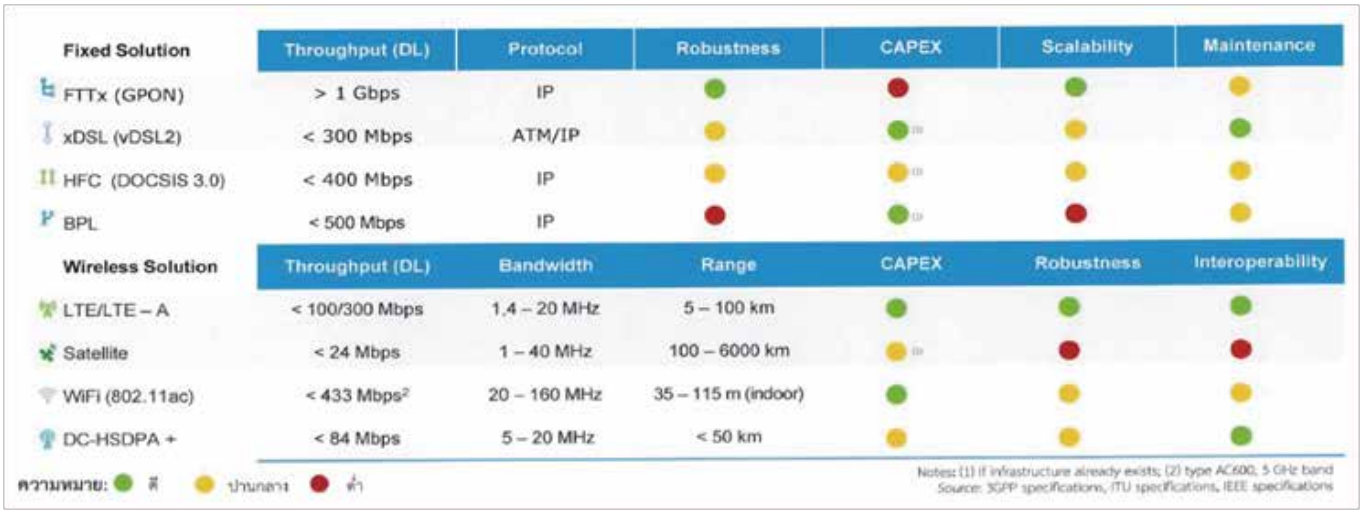
Exhibit 76: Key elements of the Digital Thailand plan

In relation to Strategy 1, these actions include (i) roll out nationwide broadband infrastructure, (ii) turn Thailand into an ASEAN connectivity hub, (iii) develop digital infrastructure policy and (iv) reform the state-owned enterprises of TOT and CAT. [127] Other actions include integrating the fixed and wireless broadband networks and reduce retail broadband prices. On the reduction of broadband prices while the Broadband Commission (including the ITU and UNESCO) states that the affordable price for broad band services of 5 percent of average income per month the Royal Thai Government's goal is lower at 2 percent of average income per month.

The current recommendations in terms of preferred technology and the advantages and disadvantages are set out in Exhibit 77 below. The broadband speed targets have been set on the basis of incomes such that a target speed has been set of 10 Mbps for active groups Q1 and Q2, 15 Mbps for Q3 and Q4 while 30 Mbps has been set as the target for active group Q5.

127. One issue which is not confirmed is whether the current CAT monopoly on submarine cable systems into Thailand will be extended.

Exhibit 77: Preferred technologies[128]



Fixed Solution	Throughput (DL)	Protocol	Robustness	CAPEX	Scalability	Maintenance
FTTx (GPON)	> 1 Gbps	IP				
xDSL (vDSL2)	< 300 Mbps	ATM/IP				
HFC (DOCSIS 3.0)	< 400 Mbps	IP				
BPL	< 500 Mbps	IP				

Wireless Solution	Throughput (DL)	Bandwidth	Range	CAPEX	Robustness	Interoperability
LTE/LTE – A	< 100/300 Mbps	1.4 – 20 MHz	5 – 100 km			
Satellite	< 24 Mbps	1 – 40 MHz	100 – 6000 km			
WiFi (802.11ac)	< 433 Mbps[2]	20 – 160 MHz	35 – 115 m (indoor)			
DC-HSDPA +	< 84 Mbps	5 – 20 MHz	< 50 km			

ความหมาย: สี ปานกลาง ต่ำ

Notes: (1) If infrastructure already exists; (2) type AC600, 5 GHz band
Source: 3GPP specifications, ITU specifications, IEEE specifications

It should be noted that the policy envisages that LTE and LTE-A network will do heavy lifting both in terms of wireless broadband and in terms of rural coverage. However, there is no mention of spectrum in the Deloitte paper other than the need to have a spectrum roadmap. It is critical for this policy to be successful for there to be additional spectrum released for use in Thailand including but not limited to 700, and 2600 MHz, plus 1400 MHz (post 2020) and the remainder of 1800 MHz. Thailand has maybe 50 to 60% the spectrum allocated in Malaysia and other comparable markets. If sub-1 GHz spectrum is not to be made available in Thailand, then the cost of rural deployment under the Digital Thailand Plan will be double or more than the cost of 700 MHz deployment.

Based on the analysis undertaken by Deloitte, some of which is summarised in Exhibit 78 below, recommendations on a new model have been made. This new model for SOEs separates retail and wholesale functions and set up new companies which are owned by MDE (previously MCIT) and MOF to govern the wholesale business. This structure is detailed in Exhibit 79 & 80.

128. The analysis of technologies does not discuss shared access like LTE-U and LAA. Such LTE variants will in time replace/compliment Wi-Fi as they are better and more spectrally efficient. Hybrid solutions like fibre to the street and then LTE @ 2.6 GHz for the last mile maybe a good solution for Thailand.

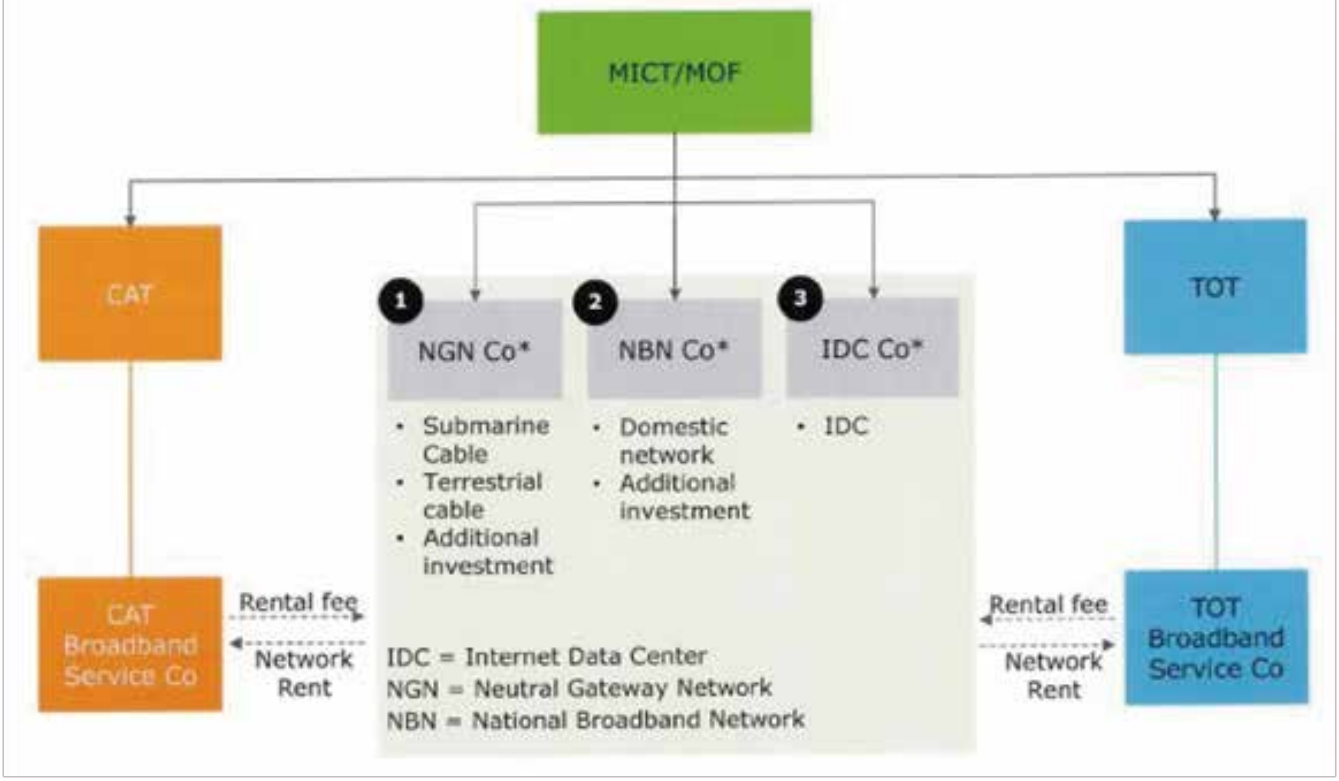
Exhibit 78: Key issues relating to SOEs

Area	Key issues
Efficient operation	• Existing SOE operators are inefficiently operated due to investment and policy limitations • SOEs cannot compete in the retail market and are losing market share
Network expansion funding	• Private operators will only invest in financially viable areas with profit maximization objective • Investment in remote areas will not be possible without strong government policy or effective infrastructure sharing
Leverage existing asset	• SOEs have abundance of telecom infrastructure with low utilisation, including key infrastructure such as submarine cables
Infrastructure sharing	• Infrastructure sharing has been limited due to legacy BTO regime, unfair pricing and trust issue among operators • There have been very good signs for infrastructure sharing among private operators but sharing with SOE is still very limited
Level playing field and conflict of interest	• Infrastructure providers are competing in the retail service market. The new entity should be independent and not operator in the retail market.

Source: Deloitte, October 2016s

This new model will see TOT and CAT infrastructure structural separated but not merged in a new super company structure (see Exhibit 79).[129] Interestingly, it is understood that no new Government funds or a capital injection needed from the analysis needed. This is surprising given the significant injection of Government funds needed by all other global national broadband projects including in Australia, Malaysia, New Zealand, and Singapore. The new service model will be based on open access embracing (i) equivalent commercial pricing, (ii) non-discrimination and (iii) and transparency of wholesale pricing and SLA.

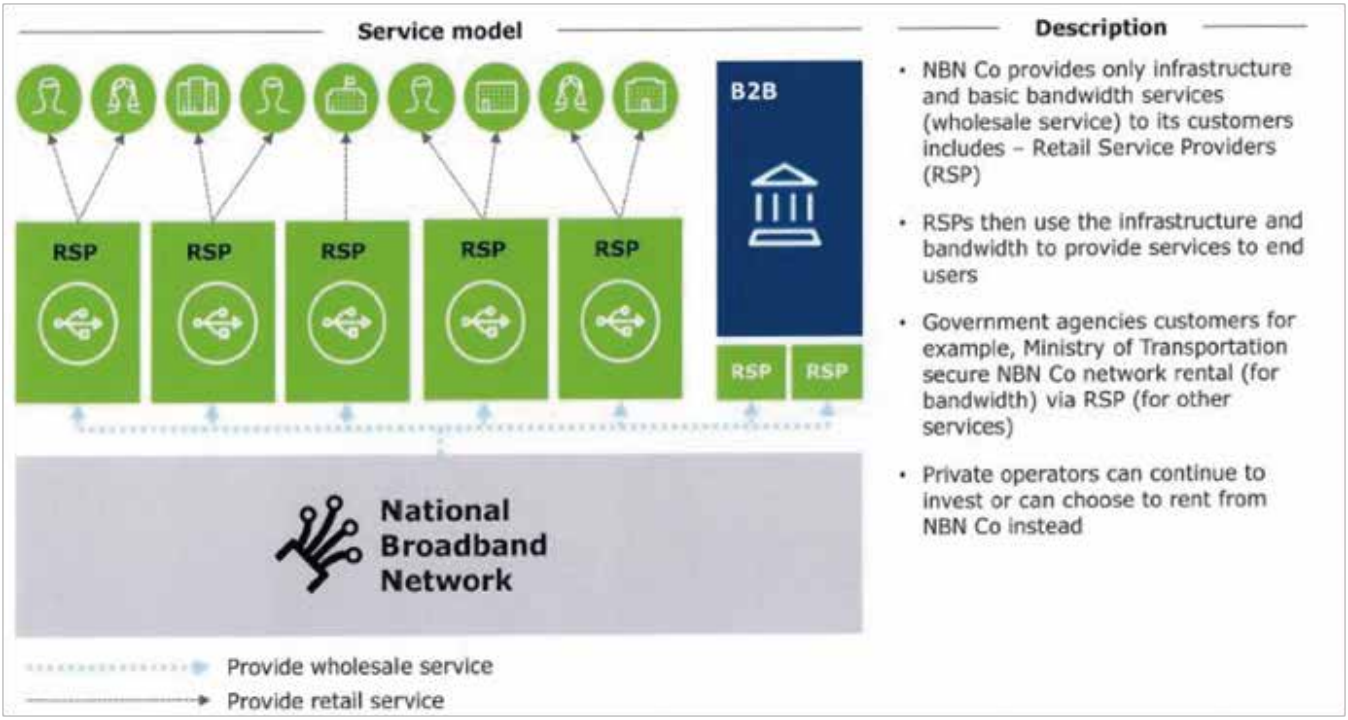
Exhibit 79: Operating model target



Source: Deloittes, October 2016

129. There is likely to be a second step say in 12 to 24 months where the companies are integrated. Otherwise they will just compete, which is fine at one level but not encouraged by the Digital Thailand Policy. It is also critical that there be concurrently a SOE reform process over a number of years similar to what has happened in a number of markets (e.g. Malaysia see www.pcg.gov.my) to improve the internal performance of SOEs.

Exhibit 80: Business and distribution model



Source: Deloitte, October 2016

Deloitte recommendations go on to talk about corporate governance in line with international standards and effective regulatory enforcement. We would assume these will include inter alia the licensing of NBN Co and/or NGN Co and as a minimum the frameworks addressing access rules, infrastructure sharing, competition rules (which apply to new NBN Co/NGN-Co), and lastly whether the new NBNCo/NGNCo need to develop Reference Interconnection/ Access. Furthermore, are RSPs to be licensed like MVNOs? If so, is there to be any limits say for 2 to 3 years to help them grow some scale.

Concurrently with such policy moves at the MDES level, the NBTC has been tasked with undertaking a review of the current rules associated with fixed (especially fibre) deployment in Thailand including a review of certain exclusivity rules (in Bangkok to TOT and CAT), the optimal wayleave rights, ducting requirements/rules associated with both greenfield and brownfield areas and infrastructure sharing. The NBTC review will be finished in Q1, 2017

9.8.4 Broadband penetration in Thailand

In terms of broadband penetration according to the ITU's 2015 Global ICT Development index Thailand's 2015 fixed (wired)-broadband subscriptions was 8.21 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 79.87. The same index found that Thailand's international internet bandwidth per Internet user (Bit/s) was 46,826. These statistics are broadly consistent with recent statistics on the fixed and wireless broadband markets released by the MCIT (now MDES) set out in Exhibit 81 and Exhibit 82 below.

Exhibit 81: Fixed broadband market in Thailand130

Operator	Subscribers (million)	Market share (percent)	Technologies
Trueonline	2.38	37%	HFC, VDSL2, FTTB/FTTH
Triple T	2.01	31%	ADSL2+, VDSL, FTTH
TOT	1.69	26%	ADSL+, VDSL2, FTTB/FTTH
CAT	0.16	2%	HFC, BPL, xDSL, FTTH
AIS Fibre	0.14	2%	VDSL, FTTB/FTTH
Others	0.06	1%	
Total	**6.2**	**100%**	

Source: MCIT, October 2016

Exhibit 81: Wireless broadband market in Thailand

Operator	Subscribers (million)	Market share (percent)
AIS	39.2	46%
DTAC	25.7	30%
Truemove	19.4	23%
CAT	0.34	0%
TOT	0.1	0%
Total	**84.8**	**100%**

NB. Operators utilise 2G, 3G, 4G/LTE and LTE-A services.
Source: MCIT, October 2016

130. Data from the FTTH Council is that as at December 2015, there was a total of 2.17 million homes passed by FTTH/B in Thailand.

9.9 Broadband in the Socialist Republic of Vietnam

➢ 9.9.1 Key summary points

Vietnam's telecommunications market including broadband continues to strongly with over 100 percent growth in FTTH connections over 2015 and 2016 facilitated by reforms to its legislation. With the Vietnam likely to be the first ASEAN market to secure the digital dividend in 2017/18 after the start of the analogue TV switchover (which is a credit to the MIC and spectrum regulator the ARFM), key issues ahead are (i) the move to 4G/LTE services in the existing IMT bands where Vietnam has deliberately delayed its introduction given its experience of 3G services (ii) the allocation processes for the digital dividend spectrum in 700 MHz band which would be a prime candidate for rural deployment, (iii) continuing reforms to the incumbent VNPT and (iv) the planned equitisation (privatisation) of Mobifone including the introduction of a equity investor and future IPO of the company.

➢ 9.9.2 Legislative and Policy Background

The Prime Minister and the Minister of Communications (on behalf of the Prime Minister) have issued a number of policies and strategy document on information and communication technology developments. The key telecommunications policy is formally set out in the Prime Minister's Decision No. 158/QD-TTg of 18 October 2001, which ratifies VNPT's development strategy until 2010 and Orientation until 2020. This policy decision provides a comprehensive range of sector development objectives and targets, along with key underlying strategies for their achievement.

The other policies include inter alia:

- The Strategy on Viet Nam information and communication technology development to 2010 and orientations towards 2020 (Prime Minister's Decision No. 246/2005/QD-TTg on 6 October 2005);

- The Planning on development of Telecommunications and Internet until 2010 (Prime Minister's Decision No. 32/2006/QD-TTg on 7 February 2006);

- The Planning on development of Information and Communication Technology in the Central key economic region up to 2010 and orientations towards 2020 (Decision No. 13/2007/QD-BBCVT on 15 June 2007 of MIC Minister, on behalf of Prime Minister);

- The Planning on development of Information and Communication Technology in the Southern key economic region up to 2010 and orientations towards 2020 (Decision No. 14/2007/QD-BBCVT on 15 June 2007 of MIC Minister, on behalf of Prime Minister);

- The Planning on development of Information and Communication Technology in the Northern key economic region up to 2010 and orientations towards 2020 (Decision No. 15/2007/QD-BBCVT on 15 June 2007 of MIC Minister, on behalf of Prime Minister);

- The Planning on Digital Content Safety to 2010 (Prime Minister's Decision No. 63/QD-TTg on 13 January 2010);

- Prime Minister's Decision No. 336/2005/QD-TTg on 16 December 2005 on approving of the national planning spectrum radio;

- Prime Minister's Decision No. 22/2009/QD on 16 February 2009 approving of transmission planning, radio broadcasting, television until 2020;

- Prime Minister's Decision No. 125/2009/QD-TTg on 23 October 2009 on the planning of national radio frequency;

- Prime Minister's Decision No. 63/QD-TTg on 13 January 2013 approving of development of country's information security to 2020; and

- Prime Minister's Decision No. 1753/QD-TTg on 22 September 2010 approving of the National Strategy on "Transforming Viet Nam into an advanced ICT country".

In terms of the law, the key legislations and subsidiary legislations that have been issued include inter alia:

- Law on Telecommunications (No. 41/2009/QH12) issued by the National Assembly on 23 November 2009;

- Law on Radio Frequency (No. 42/2009/QH12) issued by the National Assembly on 4 December 2009;

- Government's Decree No. 28/2009/ND-CP issued on 20 March 2009, on the regulation and sanctioning of administrative violations in the management, provision and use of services and electronic information on the Internet; and

- Government's Decree No. 25/2011/ND-CP dated 6 April 2011 detailing and guiding the implementation of a number of articles of the Telecom Law.

In 2009, the National Assembly issued a Law on Telecommunications ("Telecommunications Law") and a Law on Wireless Radio Frequency ("Wireless Law") which took effect in July 2010. The purpose of the laws is to encourage all economic and private sectors to develop their telecommunication services, investments and infrastructure.

Highlights of the Telecommunications Law are as follows:

- Aims to both encourage investment in the telecommunications industry and to bring the current law inline with Vietnam's WTO commitments in the sector;

- Expansion of category of those who are allowed to participate in the telecommunications sector in that all organisations established under the Law of Enterprise have the right to provide telecommunication services and establish telecommunication infrastructure;

- Sets out new methods of managing telecommunication resources, especially the high commercial value bands, the licenses for which shall be mainly granted through examination or auction;

- Organisations or individuals who obtain their rights through an auction shall be entitled to transfer the said rights to another party at their discretion; and

- Foreign investment regulation shall be in line with Vietnam's WTO commitments whereby joint venture enterprises with foreign capital majority will be allowed to carry out telecommunications business lines but shall be prohibited from investing in telecommunications infrastructure. In broad terms this may mean that foreign investor is able to invest up to 49 and 70 percent of facility and non-facilities based operators respectively. [131]

Highlights of the Wireless Law are as follows:

- The law consolidates the numerous regulations currently governing the licences for wireless radio frequencies.

- Clearly define the ways and means by which wireless radio frequencies may be exploited for profit in order to both promote growth in the area and generate revenue. There shall only be one government body authorised to manage and license wireless radio frequencies for the whole country, and will come under the management of the Ministry of Information and Communication.

131. Subject to Vietnam's commitments under the TPPA.

- Introduces two new ways by which a member of the public may obtain the right to use a wireless radio frequency namely via auction and examination. These methods will however only be available in relation to high value bands or where the usage demand exceeds the supply capacity as determined by the MIC.
- Sets out provisions in relation to the standard and technical specifications of wireless radio frequencies, and clearly defines the responsibility of those who use or exploit wireless radio frequencies for complying with the regulations on safety of electric radiation.

Critical to optical fibre deployment in Vietnam is Articles 58 to 60 of the Vietnamese Telecommunication Law 2011 where in general, the government plays an active role and as the agent to address and reduce any barriers to broadband development for operators (see Exhibit 83).

Exhibit 83: Extract from the translation of the Vietnam Telecommunications Law

Article 58. Land used for telecommunications works

1. Based on the planning on inactive telecommunications technical infrastructure and land use planning and plans already approved by competent state agencies. People's Committees at competent levels shall assign land for construction of telecommunications works important for national security or for use as public-utility telecommunications service provision spots in their localities.
2. When formulating investment projects on construction of telecommunications works important for national security or for use as public-utility telecommunications service provision spots, investors shall clearly identify land areas needed, plans on payment of compensations for ground clearance and project implementation after their projects are approved and assigned land by competent state agencies.
3. People's Committees at all levels shall, within the ambit of their tasks and powers, assume the prime responsibility for. and coordinate with investors of projects on telecommunications works in. working out and implementing plans on ground clearance, payment of compensations for land and asset damage and protection of land areas for their projects as specified in Clause 1 of this Article.

Article 59. Designing and construction of telecommunications works

1. Traffic works, electricity poles and transmission lines, water supply and drainage pipelines and other technical infrastructure works must be designed and constructed to ensure the installation and protection of telecommunications transmission lines and works.
2. The construction of telecommunications works must be in line with the planning on inactive telecommunications technical infrastructure and compliant with this Law and other relevant laws. Inactive telecommunications technical infrastructure constitutes a mandatory content of basic designs of systems of traffic, energy supply, public lighting, water supply and drainage technical infrastructure works and other technical infrastructure works.
3. Organizations and individuals that construct telecommunications technical infrastructure in association with investment in and installation of telecommunications equipment and cable lines shall notify such to local telecommunications management agencies.

Article 60. Common use of technical infrastructure

1. The common use of traffic, energy supply, public lighting, water supply and drainage, telecommunications technical infrastructure and other technical infrastructure works must ensure effectiveness and thrift, protect the landscape and environment, and be in line with the urban planning and socio-economic development planning.
2. The Government shall specify the common use of traffic, energy supply, public lighting, water supply and drainage, telecommunications technical infrastructure and other technical infrastructure works.

➢9.9.3 National Strategy

The Prime Minister signed Decision No. 1755/QD-TTg to approve the National Strategy on "Transforming Viet Nam into an Advanced ICT country" ("the Strategy") on 22 September 2010. The Strategy reflects the political determination of the party of Viet Nam and the Government in developing ICT industry to keep pace with countries in the region and the world. The annual growth rate of the ICT industry income is to reach at least 2 to 3 times the growth rate of the GDP, and the contribution of ICT industry to GDP should be 8 to 10 percent by 2020.

All related ministries and agencies are responsible for the implementation of the Strategy, with the MIC playing the leading role, and is responsible for building detailed implementation plans, monitoring and facilitating the implementation across the country.

The MIC has been working actively in implementing the Strategy and there are already positive signs with contributions on ideas and proposals of specific projects from domestic and foreign enterprises.

The key objectives of the Strategy are:

- To develop ICT human resources to international standards;
- To build ICT industry, especially software industry, digital content industry and IT services;
- To become a leading economic sector so as to contribute significantly to GDP growth and exports;
- To set up a broadband information infrastructure in the whole country;
- To apply IT effectively in all socio-economic aspects, and national security and defence.

Steering views of the Strategy are:

- Accelerating the development of Viet Nam's ICT on the basis of ensuring continuity with creative measures, targeting higher objectives with higher speed;
- Reasonably developing on the basis of optimizing internal resources and taking advantage of international knowledge and resources;
- Efficiently utilizing the state budget, attracting more investment from local and foreign enterprises; and
- Applying highest priorities and preferences in accordance with the law on the development of high technology, research and training for IT parks, research and training institutions and all enterprise individuals who provide IT products and services.

In March 2016, the Vietnamese Government announced a new broadband plan that targets fixed broadband internet coverage at a minimum of 40 percent of households and individual subscribers in the country by 2020. In addition, it is planned to have over 60 percent of internet subscribers in Vietnam connected to minimum downlink speeds of 25Mbps, and 100 percent of public internet access points nationwide to use a fixed broadband service by 2020. Over 50% of Internet access points will use fixed broadband services with minimum speed downlinks of 50Mbps by 2020. [132]

132. http://www.computerweekly.com/news/4500278154/Broadband-will-reach-40-of-Vietnam-households-by-2020-claims-government accessed 20161029

➢9.9.4 Key broadband statistics

Vietnamese telecommunications operators saw impressive business results in 2015, according to figures from the MIC. The total revenue of the sector was estimated at VND340 trillion (USD15.1 billion) and profit at VND56 trillion (USD2.5 billion), while contributing over VND46.9 trillion (USD2.1 billion) to the State budget.

Earlier, according to a report by the Ministry of Information and Communications, the number of mobile subscribers nationwide declined by nearly 20 million to 122 million subscribers last year as inactive users were removed from the statistics. However, the mobile subscriber density remained high with 140 subscriptions for every 100 people.

Exhibit 84: Key indicators of Vietnam's major operators

	Revenue (2015)	Profit	Revenue Growth from 2014	Subscribers (2015)	
VNPT	VND89.1 trillion (USD4 billion)	VND3.3 trillion (USD147 million)	7.5%	33.7m 29.7m (mobile)	~11%
Mobifone	VND36.9 trillion (USD1.7 billion)	VND7.4 trillion (USD329 million)	8.3%	~54m	3.8%
Viettel	VND222.7 trillion (USD9.9 billion)	VND45.8 trillion (USD2.0 billion)	13%	66.4m	~5.4%
Hanoi Telecom (Vietnamobile)	VND11 trillion (USD442 million)	n.a	n.a	~11.0m	n.a

Source; MIC, Telegeography, Vietnamnews, author analysis

Vietnam now has 35 million internet users out of 90 million people. There are 26 infrastructure firms, 3 to 4 of which are key businesses in the field, while 10 businesses have FTTH backbone transmission infrastructure. In total the number of broadband Internet subscribers was estimated at about 7.6 million.
The number of FTTH subscribers exceeded the number of ADSL in November 2015, and now the number of FTTH subscribers is 2.5 times higher at 5.5 million FTTH subscribers.
Competition in Vietnam among telecommunications operators in the FTTH market has become intense with service providers try all possible means to secure each other's subscribers. FTTH deployment was facilitated by changes introduced in the Telecommunications Law.

VNPT is leading the FTTH market. A report released at a meeting with MIC showed that its number of FTTH subscribers increased by twofold within the first nine months of 2016. FTTH growth is more than 100 percent per annum. VNPT accounts for 41 percent of the market share, an increase from the 33 percent last year. It holds 72.1 percent of ADSL market share. According to the MIC, the total domestic bandwidth capacity is 905 Gbps and the total international bandwidth capacity 1.4 million Gbps.

In relation to wireless broadband, the MIC and spectrum regulator ARFM was preparing for 4G with operators trialling LTE in the 1800 MHz band with full commercial launch in early 2017.

In June 2016, after earlier switching off analogue television signals in Đà Nẵng, Vietnam switched off the analogue TV services in Vietnam's major urban centres Hà Nội, Thành phố Hồ Chí Minh (HCMC), Cần Thơ and Hải Phòng. [133] It is expected to turn off analogue TV services in the remainder of the country to secure the digital dividend in the 700 MHz by 2018. The DVB-T2 terrestrial digital TV standard has been selected by the regulator.

In other major structural reforms, Vietnam has taken steps to introduce more competition and restructure VNPT as summarized in Exhibit 85 below.

Exhibit 85: Proposed Equitisation of Mobifone and VNPT restructuring

In early 2014, VNPT began its process of restructuring and has completed three phases up until August 2016. The process of restructuring was initiated as VNPT targets to conduct its 'equitisation' in the 2016-2020 period.

In 2014, VNPT officially transferred the ownership of MobiFone, a major mobile network operator, to the MIC after the Prime Minister, Nguyen Tan Dung approved VNPT's restructuring plan. The said transfer has made MobiFone a one member limited liability company with the State holding 100 percent of its charter capital of over USD703 million – an effort to uphold the State capital

In addition, through the equitisation plan, VNPT has been ordered to reorganize its operations under a new legislation that states that a company or individual cannot hold over 20 percent of the shares in more than one telecoms operator.[134] Following the said decision, VNPT will roll its telecommunication member companies to operate into one firm called VNPT – Vinaphone whereby it would operate as a separate entity governing its own finances.

Despite the transfer of ownership of MobiFone in 2014, which caused VNPT to lose 40 percent of revenue and 60 percent of profits, VNPT has retained its market share and customer benefits. In the first six months of 2016, its total revenue was VND61.3 trillion (USD2.75 billion) and profits were VND2.2 trillion (USD99 million), an increase of 23.5 percent year-on-year. Further, new mobile subscribers reached more than 6.4 million, an increase of 47.5 percent year-on-year. Internet subscribers stood at 250,000 which was an increase of over 60 percent year-on-year. VNPT seeks to push further for better development by especially concentrating in the widespread implementation of 4G and has also proposed for the government to allow it to secure a 20 percent in MobiFone.

In order to strengthen its capital sources, VNPT has also requested for permission to make full use of the future amount from re-selling its stake in MobiFone once it has completed an IPO.

➢9.9.4 Key broadband statistics

In terms of broadband penetration according to the ITU's 2015 Global ICT Development index Vietnam's 2015 fixed (wired)-broadband subscriptions was 6.48 per 100 inhabitants and its active mobile-broadband subscriptions per 100 inhabitants was 31.04. The same index found that Vietnam's international Internet bandwidth per Internet user (Bit/s) was 20,749.

133. http://www.computerweekly.com/news/4500278154/Broadband-will-reach-40-of-Vietnam-households-by-2020-claims-government accessed 20161029

134. www.telegeography.com/products/commsupdate/articles/2016/01/04/vietnamese-trio-report-revenue-profit-growth-for-2015/

10

Appendix B: Telecommunications in the Trans Pacific Partnership Agreement

There are two main Chapters of the TPP dealing with sector issues of importance to the telecommunications sector namely Chapter 13 Telecommunications and Chapter 14, Electronic Commerce as well as a number of horizontal measures.

TELECOMMUNICATIONS – CHAPTER 13

The TPP provisions on telecommunications embrace competition are all based on a general objective among the TPP countries that there should be more regulatory certainty for telecommunications service providers operating and investing in the TPP countries. As such, the TPP countries have agreed to ensure access to telecommunications facilities under fair and reasonable terms, to allocate scarce resources (such as spectrum) in a non-discriminatory manner, and to be transparent in their regulatory process. Importantly, broadcasting or cable distribution is excluded except for IPTV.

The key elements of Chapter 13 dealing with telecommunications are as follows:

- **Mobile roaming** rates between the 12 TPP countries may fall, as the TPP requires "the parties shall endeavour to cooperate on promoting transparent and reasonable rates for international mobile roaming service that can help and promote the growth of trade among the parties and enhance consumer welfare" (see Article 13.6). The TPP countries will also be asked to share information on retail mobile roaming rates for voice, data and text messages no later than a year after the TPP commences (see Article 13.6);

- **TPP** places obligations on major suppliers of public telecommunications services to interconnect (see Article 13.5), and are required to accords other operators no less favourable treatment than it provides to its subsidiaries etc (see Article 13.7). Each TPP Party is required to maintain competitive safeguards with the purpose of preventing major suppliers of engaging in or continuing with anti-competitive practices (See Article 13.8);

- TPP countries must provide the businesses of TPP parties with **full access to purchased or leased telecommunications services** at reasonable rates (see Article 13.12). Such communications facilities must also be kept secure and have interconnection abilities to other operators (see Article 13.11);

- Prohibiting **resale of public telecommunications services** is banned under the TPP, and colocation, unbundling of network elements, access to incumbent network infrastructure such as poles, ducts, conduits and rights-of-way must be provided (See Articles 13.9, 13.10. 13.13 and 13.14);

- Major suppliers with **international submarine cable landing stations** must also offer access to these facilities under the TPP (see Article 13.15);

- **Number portability** is requirement for TPP countries, with partial exceptions for Brunei (all), Malaysia (fixed services), and Vietnam (fixed services) (see Article 13.5);

- TPP countries must have a **independent telecommunications regulator** (See Articles 13.16 and 13.6), but are free to define their own universal service obligations (USO) for providers as they wish (See Article 13.17),

- TPP countries shall allow operator the **ability to make the technology choices they desire** subject to legitimate public policy requirements. Governments are free however, where they finance advanced (ie broadband) networks to make financing conditions on the use of particular technologies (See Article 13.23); and

- **Radio frequency spectrum** allocation policies and regulations in TPP countries will also remain much as they are currently, with the proviso that they must be transparent and objective, timely and non-discriminatory (See Article 13.19).

ELECTRONIC COMMERCE – CHAPTER 14

Chapter 14 is premised on the basis that the TPP Parties recognise the economic growth and opportunities provided by electronic commerce and that it is important to have frameworks that promote consumer confidence in electronic commerce and of avoiding unnecessary barriers to its use and development.

- The TPP parties subject to applicable policies, merely "recognise the benefits" of the access and use of services and applications of a consumer's choice subject to reasonable network management, the connection of end-user devices of the consumer's choice, and the availability of information on network management practices. In essence, this is a weak '**net neutrality**' provision (See Article 14.10);

- TPP countries will have to adopt and accept electronic signatures for authentication, except in specifically outlawed circumstances (See Article 14.6). Paperless trading is also a requirement (see Article 14.9);

- While customs duties on transmissions and digital content cannot be applied, TPP countries are free to levy internal taxes (see Article 14.3);

- Each TPP Party is to maintain a legal framework governing electronic transactions consistent with the principles of the UNCITRAL Model Law on Electronic Commerce 1996 or the United Nations Convention on the Use of Electronic Communications in International Contracts, done at New York November 23, 2005 (see Article 14.5);

- Consumer protection for electronic commerce to prevent fraud and deceptive business activities must also be implemented under the TPP, along with legal frameworks to safeguard personal information subject to a number of carve outs (See Articles 14.7, and 14.8);

- Data sovereignty, or the ability for countries to restrict cross-border information sharing, is prohibited in accordance with the TPP, as is forcing companies to locate data centres and other computing facilities within national borders - except for some limited government-mandated circumstances (See Article 14.13);

- Countries are also expected to adopt anti-spam measures, cooperate on and develop cybersecurity (See Articles 14.14, 14.15 and 14.16);

- They are banned from demanding mass market software source code as a condition of sale or distribution in their territories, again with the exception of certain government demands that such laws and regulations that do not run counter to the TPP (see Article 14.17).

11
List of Acronyms and Abbreviations

ACMA	Australian Communications and Multimedia Authority
ADSL	Asymmetric Digital Subscriber Line
AR	Augmented Reality
ASEAN	Association of South East Asian Nations
CAGR	Compound Annual Growth Rate
Capex	Capital expenditure
CITC	Communications and Information Technology Commission of Saudi Arabia
DSL	Digital Subscriber Line
EU	European Union
FCC	Federal Communications Commission of the United States
FDI	Foreign Direct Investment
FTTB	Fibre-To-The-Building
FTTC	Fibre-To –The-Curb
FTTH	Fibre-To-The-Home
FTTx	includes FTTH, FTTB, FTTC etc.
GDP	Gross Domestic Product
GNI	Gross National Income
GSMA	GSM Association
ICTs	Information Communication Technologies
ICT4D	ICT for Development
IMT	International Mobile Telecommunication
IoT	Internet of Things
ITU	International Telecommunication Union
LDCs	Least Developed Countries
LTE	Long-Term Evolution
LTE-A	Long-Term Evolution Advanced
MDGs	Millennium Development Goals
M2M	Machine-to-Machine
NBN	National Broadband Network
NBP	National Broadband Plan
NGN	Next-Generation Network
OECD	Organisation for Economic Cooperation and Development
Opex	Operating Expenditure
PPP	Public-Private Partnership
QoS	Quality of Service

RCEP	Regional Comprehensive Economic Partnership
SAARC	South Asian Association for Regional Cooperation
ROW	Right of Way
SDGs	Sustainable Development Goals
SMEs	Small- and Medium-Sized Enterprises
STEM	Science, Technology and Mathematics
TPP	Trans-Pacific Partnership
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USF	Universal Service Fund
USOs	Universal Service Obligations
VoLTE	Voice over Long Term Evolution
WDR	World Development Report
WRC	World Radiocommunication Conference
xDSL	Refers to different variations of DSL, such as ADSL, SDSL, VDSL
2G	Second-generation mobile
3G	Third-generation mobile
4G	Fourth-generation mobile
5G	Fifth-generation mobile

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