Mapping the Regulatory Environment of Community Networks in India, Myanmar & Philippines

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APC ASSOCIATION FOR PROGRESSIVE COMMUNICATIONS

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Contents

Abstract

Community broadband networks have long existed as an alternative to commercial ISPs, but only recently emerged as response to both market and government failures in the provision of rural broadband. The paper is an effort to look closely at the telecom policy, regulatory framework, spectrum, broadband definitions and innovating licensing processes that are affecting community networks in Asian Pacific countries – India, Myanmar & Philippines. The research paper is written and published with the support of Association for Progressive Communications (APC) as part of its project activity.

Abbreviations

AWMN	Athens Wireless Metropolitan Network
BT	Build-Transfer
BSNL	Bharat Sanchar Nigam Ltd
CCN	Cellular Community Networks
CN	Community Networks
DOT	Department of Telecom, India
DEF	Digital Empowerment Foundation
ITU	International Telecommunications Union
MOTC	Ministry of Transport and Communications
MeiTY	Ministry of Electronics & Information Technology
MCIT	Ministry Communications and Information Technology
MCPT	Ministry of Communications, Posts and Telegraphs
NBP	National Broadband Plan
NOFN	National Optic Fibre Network
NTC	National Telecommunications Commission
PTD	Posts and Telecommunications Department
TRAI	Telecom Regulatory Authority of India
SDG	Sustainable Development Goals
SACFA	Standing Advisory Committee on Radio Frequency Allocation
USAF	Universal Access and Service Fund
WPC	Wireless Planning Commission
WTO	World Trade Organization
VNO	Virtual Network Operator
VNOAI	Virtual Network Operators Association of India

Introduction

If information is the oxygen of modern economic development, then internet provides the essential circulatory system. The Internet has become an increasingly important tool for the development of any country, providing access to information, fostering and enhancing the regional and international cooperation and knowledge sharing. Internet continues to influence every aspect of life from education, health care to businesses. Economic activities, both at domestic and international level, are increasingly dependent on internet for their efficient and effective functioning.

Asia Pacific region is home to over 4 billion peoplecovering over 50 countries and territories. On one hand Countries like China, India, Indonesia, Philippines and Japan account for more than half of the world's mobile subscriber base, according to GSMA, on the other hand, only 7% of the people in the region have fixed broadband access (ESCAP). Connecting the unconnected is one of the major concerns for governments. The biggest barrier to widespread connectivity is the high-cost of infrastructure. With most telecom companies unwilling or unable to build infrastructure in far flung rural areas, large swathes of the world have remained in the media darkness. It is evident that people who are disconnected from the digital ecosystem are largely at the bottom of the pyramid and reside in rural and inaccessible areas. This underlines the need of transformative internet access through integrative policies, community-driven tools and innovative solutions that can be rapidly deployed by under and un-served communities.

Community Networks (CNs) act as a bottom-up approach based on community driven infrastructure development to connectivity. Across the world, there are more than 100 community-based network models, located in Asia Pacific (India, Nepal, Pakistan, Indonesia, Australia, Afghanistan, etc.), North America (Canada and US), Europe (Germany, Austria, Hungary, Spain, Greece, Sweden and Croatia). These networks are typically self-managed networks providing internet access where commercial networks do not find it to be economically viable to operate. Moreover, these networks are also supplementing universal access goals and providing digital opportunities for rural communities to empower themselves. Each community network is in itself unique and different from each other.

However, these networks do face the number of challenges from regulatory to spectrum, backhaul connectivity to funding sustainability. These networks are not formally recognized by their respective government improving the internet penetration in their country. Digital Empowerment Foundation (DEF) and the Internet Society (ISOC) conducted a policy paper, 'Community Networks: Regulatory issues and gaps – Experiences from India' (Srivastava, 2016). The policy paper used DEF's Wireless for Communities (W4C) network project strategy for improving the availability of affordable broadband as a case study in understanding the legal and regulatory challenges of spectrum allocation and management, licensing regulation, and bandwidth issues in India. Based on this paper, Digital Empowerment Foundation and Association for Progressive Communications (APC) initiated research project to map out the regulatory environments of community networks in India, Myanmar and Philippines.

The biggest barrier to widespread connectivity is the high-cost of infrastructure. With most telecom companies unwilling or unable to build infrastructure in far flung rural areas, large swathes of the world have remained in the media darkness.

The paper analysed the policy regulatory environments affecting community networks in Asian countries – India, Myanmar & Philippines. The paper intersects the framework in five parameters – policy & regulatory mechanism; spectrum availability, licensing & management; broadband & backhaul, universal service fund and innovating solutions (MVNOs).

Countries covered in this research paper – India, Myanmar and Philippines recognise telecom infrastructure as the backbone for the growth of the region's economy. These countries do have national broadband policies; however, Myanmar and Philippines have command-and-control policy framework to manage their telecom infrastructure. The table 1 identifies the status of India, Myanmar and Philippines in above-mentioned parameters:

	India	**Myanmar**	**Philippines**
Telecom policy & framework	Yes	Yes	Yes
National broadband plan	Yes	Yes	Yes
Broadband definition	Yes	No	No
Unlicensed spectrum	Yes	Consideration	No
USOF	Yes	Consideration	Consideration
MVNO	Yes	No	No

India is the only country where couple of community network projects are operational, however, in Myanmar, a community network project, ASORCOM community Wi-Fi network was active till 2017. India and Philippines are the two countries where experimental licenses were given to provide communities direct access to spectrum. Lastly, the paper sets up few recommendations for policy makers and regulatory bodies to understand the benefits of community networks as a bottom up approach.

Research Objective

The prime objective of this research paper is to understand and map the policy and regulatory aspects favouring community networks in India, Myanmar and Philippines. The paper is an effort to look closely at the telecom policy, regulatory framework, spectrum, broadband definitions and innovating licensing processes that are affecting community networks in these three countries. The essence of this paper is to highlight the commonalities and differences amongst these countries. The specific objectives of this paper are:

1. Understand the policy and regulatory framework
2. Identifying spectrum licensing and management
3. Understanding the innovative licensing processes for community networks in these countries
4. Understanding funding framework to sustain these networks

The paper provides a set of recommendation points with qualitative analysis and evidence to determine what measurements need to be taken into account from the perspective of legal, regulatory and policy levels to leverage community networks and other sustainability aspects.

Methodology

The research for this report draws on academic literature, and government and regulatory documents to analyse existing policies and programmes in these three countries. Two mapping methodologies were adopted, one that examined existing policies and the existing literature available in this area.

This research paper draws on existing insights and recommendations made by International Telecommunication Union (ITU), Broadband Commission Reports and other existing reports, which provide guidance and international standards in areas of spectrum licensing, broadband definition and other regulatory frameworks. It also looked at reports by NGOs, academic and media reports that are relevant for this study purpose.

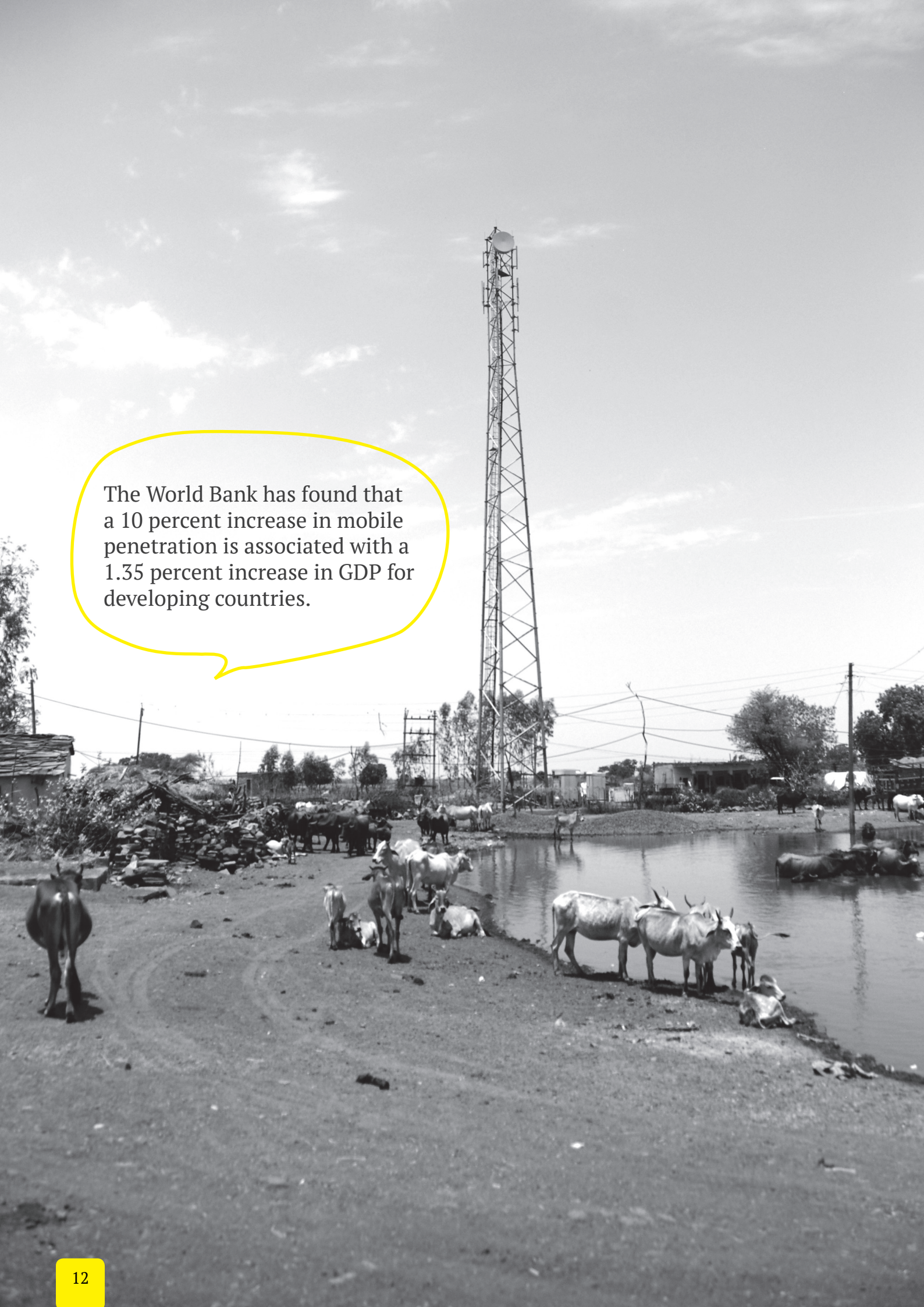
Section 1:

Defining Community Network

Community networks refer to the telecommunications infrastructure that is set-up by local group of people to meet their communication needs. (J. Saldana, 2016) identify the community networks (CNs) as a participatory administration model where any participant/user[1] can add link segments to the network in a way that new segments can support the multiple network nodes. (Baig, Roca, Freitag, & Navarro, n.d) identified that CNs as subset of crowd-sourced network, which is characterised as free, open and neutral network. They have defined the network free because it is designed on the principles of non-discrimination and they are universal. It is called neutral because their technical solution is easily available and able extend the data to any participant, including for commercial purposes. Most of these open, free and neutral community networks are managed by non-profit organisations after pooling their existing resources and engagement with community members. Several examples - Gufi.net[2] in Spain, Freifunk (FF) in Germany, the Athens Wireless Metropolitan Network (AWMN) in Attica, Greece, FunkFeuer (0xFF) in Austria, Ninux.org in Italy, Nepal Wireless Network Project in Nepal and Digital Empowerment Foundation (DEF) in India have proven free, neutral and open community network models. The community networks also act as a sub-network of crowd-sourced networks. These open networks work on different models of sustainability and frameworks. Technically, these community networks are not only large scale, distributed and decentralised systems that comprises of nodes, links, content and services but they are also diverse, dynamic and governed by open peering agreement. In result, it avoids the barriers for anyone to participate in the network. Moreover, governance, ownership and knowledge of the network are open. These networks are decentralised, self-owned and self-managed by community members and various services that are provided by community on the basis of analysis of needs of that particular community. Mostly the community networks are built with simple, low-cost and shelf hardware.

Mostly community networks use wireless technology, involving the low-cost Wi-Fi equipment, based on the IEEE 802.11 family of standards and unlicensed spectrum bands – 2.4 GHz and 5 GHz. On the side of hardware, they use cost-effective and minimal hardware, exploiting 802.11/b/g/n specification and easy to find radio equipment(s) to extend Wi-Fi (Flickenger, 2002). These networks use different methods such as point-to-point or mesh networks to provide Internet connectivity where it is not available.

1. Participant refers to any individual who may become the user, provider, and manager of the network at the same time
2. *http://guifi.net/en*


The World Bank has found that a 10 percent increase in mobile penetration is associated with a 1.35 percent increase in GDP for developing countries.

Section II

Access to the internet: India, Myanmar & Philippines

Asia Pacific is the biggest contributor of the world's highest broadband penetration, including countries like Bhutan which joined the Internet only in 1999. Countries like Taiwan and Hong Kong have more mobile connections than people. Asia Pacific is the biggest contributor to the global subscriber mobile growth, contributing to two-third of the region's population. India and China, together account for two-thirds of the regions' subscribers and one-third of the global total.

As the telecom sector is an enabler for industry and consumer services, the knock-on effect that telecommunications have on wider industries is significant, and without telecom services, digital services as a whole would not exist[3]. The World Bank has found that a 10 percent increase in mobile penetration is associated with a 1.35 percent increase in GDP for developing countries[4].

Majority of Asia-Pacific countries have opted for gradual legislative chance by enacting additional laws for specific policy initiatives. Asia's first separate regulator was set up in 1979 in the Philippines, 7 out of the 15 countries--Australia, India, Malaysia, Pakistan, Philippines, Singapore, and Sri Lanka--have established separate regulatory agencies.

In all ASEAN countries, including Philippines and Myanmar, mobile phone usage has overtaken fixed line usage, and as the cost of mobile devices such as smartphones and tablets falls, there is a clear trend towards an even greater usage of mobile devices to access the Internet. The use of pre-paid data cards for mobile devices offers low-income users the option to buy data packages in small affordable units. Wireless is now often the preferred choice over fixed line access owing to the convenience of being able to carry the device (portability) and use it anywhere (mobility).

Internet access is improving in Myanmar, as more users go online via smart phones connected to newly available and fast 4G services, despite access being comparatively unaffordable. Private fixed-line internet connections remain

3. World Bank Statistics, March 2018
4. GSMA, The Mobile Economy Asia Pacific, 2017

rare. Only one in 1,667 people have a fixed broadband line, compared to one in 10 on average in Asia Pacific[5]. Prices for fixed broadband lines have decreased significantly, though there remains a regional variation.

Although fixed-line connections have remained static, mobile connections have continued to grow. The number of mobile connections increased by three million or 7 percent over the past year[6], reaching over 50 million in Myanmar[7]. Despite this growth, the number of mobile connections compared to the population size is still lower than in neighboring countries[8]. All of these connections are owned by just 50 percent of the population, who tend to have multiple SIM cards[9].

On the supply side, access to international bandwidth is priority for Myanmar alongside national backbone networks that can provide access to that bandwidth. Whereas on the demand side, two key elements are pricing and the availability of low-cost access devices. Pricing is a commercial issue for the service providers, and more open the market is to competition, the more innovative pricing packages can become.

Similarly, the mobile users in Philippines are rapid adopters of new technology. At the top level, 50% subscribe to mobile services, with 3G penetration within that being nearly 40%. Smartphone adoption meanwhile is around 25%, although some of these will be 2G users, implying high demand for mobile internet services from both low and higher end consumer[10].

India is currently the world's second-largest telecommunications market with a subscriber base of 1.2 billion and has registered strong growth in the past decade and half. Concentrated efforts have been made towards developing a robust infrastructure through accelerated fiber deployment, universal Right-of-Way (RoW) policy, allowing 605 MHz of spectrum for Wi-Fi services, establishing framework for public data office (PDO) and removal of cascading taxation from VNO (virtual network operator) regime. However, the growth of internet services in rural regions is yet minimal due to the lack of proper policy and regulations implementation.

5. The number of internet users was reported in 2017 as 13.75m, 13.44m, and 13.46m by Internet World Stats, ITU, and the CIA World Factbook respectively. A report on Myanmar in 2018 by Hootsuite identified that this number had grown to 18m users by the beginning of 2018, see https://hootsuite.com/pages/digital-in-2018, 34 percent of the population and a growth of 4m persons over the course of the year.

6. *https://hootsuite.com/pages/digital-in-2018*

7. In a joint announcement in February, MPT, Telenor, and Ooredoo said that they had 25 million, 19 million, and 9.5 million subscribers each: http://mpt.com.mm/en/myanmars-mobile-network-operators-date-successfully-exceeded-50-million-subscribers/

8. Lower than Thailand, Indonesia, Singapore, and Malaysia, but the same as Vietnam: https://www.telenor.com/wp-content/uploads/2018/02/Telenor-Realising-Digital-Myanmar-Report-06-February.pdf.

9. Subscribers number 101-105% of the population size, as people often have multiple SIM cards: https://hootsuite.com/pages/digital-in-2018 and https://www.telenor.com/wp-content/uploads/2018/02/Telenor-Realising-Digital-Myanmar-Report-06-February.pdf 50% is the number of unique owners, which means that each unique owner owns two sim cards on average. This has increased from about 34% in 2016: *http://www.itu.int/net4/ITU-D/idi/2017/index.html#idi2017economycard-tab&MMR*

10. GNI per capita between $1,045 and $4,125, http://data.worldbank.org/news/2015-country-classifications

Section III

Mapping of regulatory & policy environment for community networks in India, Myanmar and Philippines

Generally, community networks are based on the wireless technology, involving the low-cost Wi-fi equipment based on IEEE 802.11 family of standards and the unlicensed 2.4 GHz and 5 GHz spectrum bands. The licensed spectrum bands are only used by private or government entities holding the licenses for commercial purposes. On the other hand, unlicensed spectrum can be freely used without any license for non-commercial purposes or the development of Wi-Fi networks. Moreover, CNs provide the connectivity using the Wi-Fi technology and with minimal hardware cost and integrated infrastructure using the fibre, for instance through the development of condominium fibre infrastructures. Unlike wired networks, community networks mainly use Wi-Fi technology, reducing the cost of infrastructure and reach-out to unconnected regions.

The success of any community network depends on the policy and regulatory environment of the country as well besides the other factors like organizational strategy and the community engagement. In this respect, the possibility of establishing and operating the community networks may be directly or indirectly affected by the public policies and regulations at the local, national and/or international levels. Though every country has policy and regulation for the growth of telecom and internet growth in their country, most of the countries lack clarity or specific policies and regulations for community networks.
The paper identifies the regulatory framework favouring and challenges in relation to community networks in India, Myanmar, and Philippines. The paper will reflect on the policy and regulatory frameworks regarding access to the national broadband policy and definition, licensing, spectrum availability and management, access to passive infrastructure and backhaul, and universal access and service.

Regulatory mechanisms in Asia-Pacific

Regulatory reform depends upon on any country's circumstances - in particular, its regulatory background and administrative and political institutions.
Asia Pacific countries have adopted variety of structural and regulatory reforms in the telecommunications sector for two reasons 1) to promote the development of the industry, expanding basic service availability and 2) to

further enhance the infrastructure providing greater diversity of advanced telecommunications[11]. The telecommunication reform in the region can be characterised as ownership reforms by privatisation[12] of a monopoly telecommunication operator and the establishment of a separate regulatory agency[13] through changes in telecommunication legislation. Most of Asian countries opted for gradual legislative change by enacting additional laws for specific policy initiatives, whereas few countries chose to overhaul the entire system by introducing the comprehensive new legislation. Asia's first separate regulator was set-up in Philippines in 1979. Out of 15 countries, seven countries - Australia, India, Malaysia, Pakistan, Philippines, Singapore, and Sri Lanka established their separate regulatory agency. Other six countries Hong Kong, Indonesia, Japan, Korea, New Zealand, and Thailand adopted partially or fully World Trade Organization (WTO) Reference Paper on Regulatory Principles[14].

The Asian Pacific region differs from other regions as it introduced the limited or controlled competition and the nature of ownership reforms. Most of Asia-Pacific countries introduced the competition reforms in such a way that growth of a national telecommunication operator (i.e. incumbent) is protected from direct competition or uncontrolled competition, in particular from overseas competition[15]. Many countries in the region have created innovative arrangements such as Build-Transfer (BT) schemes and traditional joint ventures, so that private investment is allowed in the sector, while the government retains the majority control. Several Asian countries preferred to work with the legacy of legal restrictions on ownership and to use structural tools such as BT schemes to achieve infrastructural development. Two of the arguments that are used to support government control - underlying national security concerns or beliefs such as that the assets which control the processes of national economic development should remain in the state hands. In short, a key feature of telecommunication reforms in Asia-Pacific region lies in the fact that regulators have focused on 1) balancing the dual aims of protecting strategic national assets while expending supply to meet demand and 2) adopting polices that limit industry vulnerability to overseas competition.

Strong legal infrastructure for the telecommunication sector not only eases the process of implementing policy objectives but also attracts private players and foreign investment into

11. Economies such as China, Bangladesh, India, Indonesia, Pakistan, Philippines, and Sri Lanka, which have less than five main telephone lines per 100 inhabitants, fit into the first category, while economies such as Australia, Hong Kong SAR, Japan, Korea, New Zealand, and Singapore, which have about 40 or more lines per inhabitants, fit into the second. See International Telecommunication Union (1998a)

12. Corporatization--the transformation of the national carrier from a government department to a commercial entity as a way of ownership restructuring--is most frequently the sale of a minority of shares, either to a strategic investor or as a public offering. Rather than full privatization, the Asia- Pacific region has utilized corporatization of state-owned telecommunication companies.

13. 1t implies the separation of regulatory functions from telecommunication operations

14. The WTO Agreements on Basic Telecommunication Services (1997) is a multi-lateral accord to increase access to telecommunication markets worldwide. Out of the 69 countries that signed the Agreement, 16 are from the Asia-Pacific region. The regulatory implications of the WTO Agreement for the Asia-Pacific countries are significant in that most of the participating governments adhere also to the Reference Paper that outlines key regulatory principles aimed at avoiding anti-competitive behavior in their local markets. With that purpose, the governments in the region have to establish mechanism to ensure separation of regulation from operation, interconnection on non-discriminatory terms and conditions, transparency in licensing process, universal service obligation in a transparent, non-discriminatory, and competitively neutral manner. See International telecommunication Union (1997)

15. This also has been a typical case for countries where an incumbent telecommunication operator constitutes a significant part of the total market capitalization. In such circumstances, privatization of the incumbent has been used to promote the development of the local stock exchange, while the degree of market competition has been under the state control to keep the stock exchange attractive to foreign capital. Privatization of national operators in Indonesia, Malaysia, Pakistan, Korea, and Singapore has helped the development of local stock exchanges.

The success of any community network depends on the policy and regulatory environment of the country as well besides the other factors like organizational strategy and the community engagement.

the sector[16]. After realising that adequate legislative framework can have positive effects on the telecommunication sector, many Asian countries have introduced the new telecom legislation in the sector. The changes in telecommunication legislation in the region have taken a variety of forms depending on cultural, economic and social characteristics as well as the timing of the reform. Most of Asian countries have either introduced new legislations or amended the existing legislation.

One of the reasons for controlling telecommunications infrastructure is because of the large scale of establishing the network infrastructure which is generally established by the government. Countries like Indonesia and Philippines introduced specific legislations to support exclusive monopoly periods over certain segments or to force operators to undertake specific actions such as to allow interconnection. In Indonesia, the MTPT Decreee 60/1995 granted the incumbent operator (Telkom) exclusive rights to provide the nationwide legal fixed-line services until 2010 and domestic long-distance services until 2015. In the Philippines, the Executive Order (EO) 59[17] was made mandatory to establish interconnection between all operators and allowed the regulator to intervene in the interconnection disputes that were not solved within 90 days. As a whole, countries in Asia Pacific take the legislative reforms in response to the new telecommunication environment have a series of board options; separation of regulatory liberalisation of the market by introducing competition into market segments. Telecommunication reform legislation in the Asia Pacific is given below in the Table 1.

16. Some economists have argued that "transaction costs" associated with the political process of an economic policy are the primary reason markets do not function as effectively as suggested by neoclassical economic theory. For an analysis of new institutional economics or transaction-cost economics in the context of industrial organization, see Williamson (1989), North (1990), and Dixit (1996)

17. EXECUTIVE ORDER NO. 59; *http://ntc.gov.ph/wp-content/uploads/2015/10/LawsRulesRegulations/RAs_PDs_EOs/EO_59.pdf*

Table 1: Telecommunication reform legislation in the Asia Pacific

Country	Year	Main laws/ regulations	Main Provisions
Australia	1991	Telstra Corporation Actw	Provides for price controls on Telstra along with matters relevant to the government's role as Telstra shareholder.
	1996	Telstra Act (Dilution of Public Ownership)	Provides for the sale of one third of Telstra
	1997	Telecommunications Act	Provides for licensing carrier and service provider rules, consumer measures and technical regulations.
India	1997	Telecom Regulatory Authority of India	Establishes TRAI as the new regulator and rules its functions and structure
Indonesia	1993	Government regulation 8/1993	Creates framework for organizing telecommunications
	1993	Decision of the Minister of Tourism, Posts and Telecommunications (MTPT)	Facilitates cooperation in arranging basic
	1995	KM.39/KS.OO2/MTPT MTPT Decree 124/1995	Allows private sector participation in the national network
Japan	1984	Telecommunications Business Law	Governs such items as permission, authorization, etc., regarding the telecommunications business.
	1997	NTT (Nippon Telegraph & Telephone) Law	Reorganizes NTT into two regional companies for eastern and western Japan and one long distance company under a holding company, to take effect in 1999.
Korea	1995	Telecommunications Business Law	Provides for licensing, registration of telecommunication operators, competition safeguards, rights of telecommunication service users, and construction/ maintenance of telecommunications facilities.
	1995	Telecommunications Basic Law	Provides for ministerial authority regarding promotion of telecommunications technology, management of telecommunications network, and organization/operation of the Korea Communications Commission (KCC).
New Zealand	1987	Telecommunications Act	Provides government with power to regulate and establish rights for access to land or lay cable.
	1990	Telecommunications (Disclosure) Regulations	Imposes information disclosure requirements on Telecom New Zealand on prices and terms/conditions under which certain services are supplied.
	1994	Telecommunications (International Services) Regulations	Establishes registration for certain international services.
Pakistan	1996	Pakistan Telecommunications (Reorganisation) Act XVI	Creates framework for the telecommunication system, including establishment of Pakistan Telecommunication Authority (PTA), regulation of telecommunication industry, transfer of telecommunication services to the private sector, etc.
Philippines	1979	Executive Order (EO) 546	Creates regulatory agency.
	1993	EO 109	Provides for universal access.
	1993	Public Telecommunication	Provides for mandatory interconnection.
	1995	Policy Act (RA 7925)	The Telecom Policy Act of 1995.
Singapore	1992	Telecommunication Authority of Singapore (TAS) Act	Defines the functions and powers of TAS in the area of licensing and regulation.
Thailand	1934	Telegraph and Telephone Act	Empowers the Post and Telegraph Department (PTD) to monopolize the provision of telecommunication services to the public, which are at present, transferred to the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT).

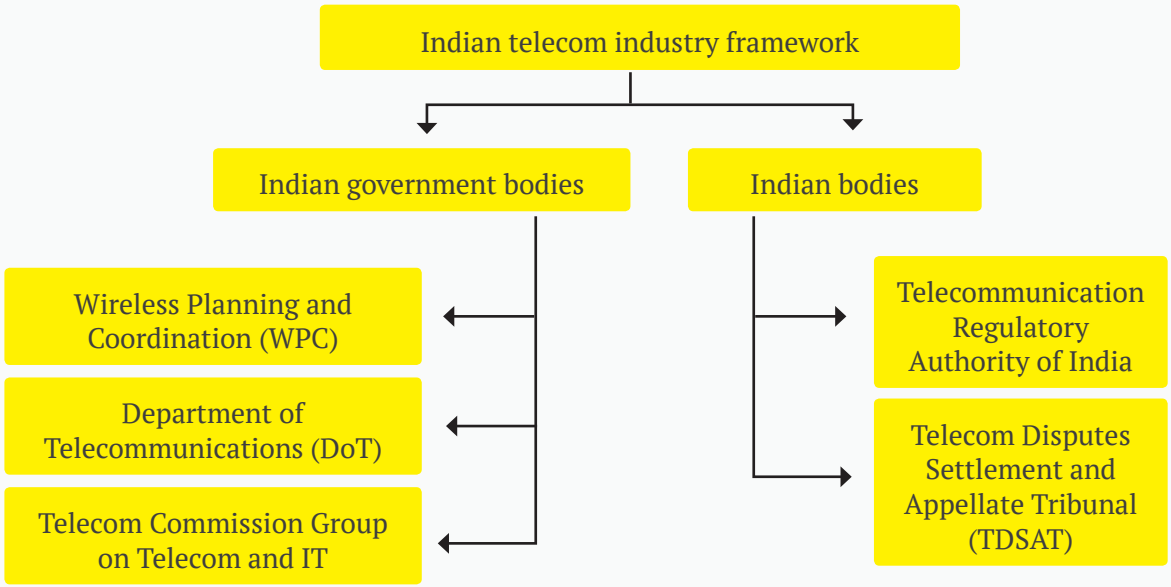
Source: *International Telecommunication Union (ITU)/Telecommunication Development Bureau (BDT) Regulatory Database.*

India

The Indian telecommunication infrastructure is primarily managed by the Department of Telecommunications (DOT)[18]. There are different bodies that manage the different sections of telecommunications infrastructure under the Ministry of Electronics & Information Technology (MeiTY):

1. The Wireless Planning and Coordination (WPC) wing of the Ministry of Communications was created in 1952 and is the National Radio Regulatory Authority. It is responsible for the radio frequency spectrum management, which includes licensing and it caters to the needs of all wireless users which includes both government, and private users in the country. It is divided into:
    a. Licensing and Regulation (LR)
    b. New Technology Group (NTG)
    c. Standing Advisory Committee on Radio frequency allocation (SCAFA)[19]

2. The Department of Telecommunications (DoT) is responsible for granting licenses and takes care of the frequency management of telecom.
3. Group on Telecom and IT handles the adhoc issues of the telecom industry.
4. Telecommunication Regulatory Authority of India (TRAI) acts as a sole independent regulator of the business of telecommunication in the country. The main objective is to encourage growth in the telecommunications sector in India by forming a transparent and fair policy environment that also supports healthy competition in the telecom market.
5. Telecom Disputes Settlement and Appellate Tribunal (TDSAT) takes care of disputes and disposal of appeals.National Telecom Policy (NTP) – 1999 opened the market for private players in all segments.



18. Department of Telecommunications; http://dot.gov.in/profil

19. SCAFA is the entity that makes the recommendations which relate to all the radio frequency allocations, the allocation plan and recommendations on the various issues related to the International Telecom Union (ITU).

The policy clearly recognized the need for strengthening the regulatory regime and restructuring the departmental telecom services into the public sector corporation so as to separate the licensing and policy functions from the government.

After 2000, the Indian telecom sector has seen significant policy reforms. The regulatory reforms in the telecom sector from 2000-2011 can be broadly classified into the following three phases:

Phase 1 – 2000–2003: Telecom sectors were opened up to competition.
Phase 2 – 2004–2007: Regulator-encouraged competition and also set the stage for future growth.
Phase 3 – 2008–2011: More choices were brought in for consumers in terms of technology and services.

The telecommunication infrastructure in India is managed in 22 telecom circles, which are further grouped into four different local service areas (LSA), depending on the classification of population, density, subscriber base and also revenue potential. The Table 2 provides some analysis done and is grouped under LSA circles:

Table 2: Different variables across local service areas

LSA Variables	Metro	A	B	C
No of population circles	3	5	8	6
No of millions (subscribers)	107.5	377.8	430.7	162.2
Population density (population/km^2)	18137.26	1440.27	1221.04	392.12
Subscriber density (subscribers/km^2)	36612.19	1646.43	1552.27	546.43
Mobidensity %	240	100	75	60
Penetration	2.29	1.01	0.88	0.70
W.Avg Operator	8.6	9.1	8.9	8.3

Myanmar

The telecommunications sector is viewed as one of the fundamental pillars for Myanmar to improve the economic growth (Chhor, 2013). The first telegraph lines were built in Myanmar in 1861 and the first regulatory reforms of telecommunications sector was established in Myanmar Telegraph Act, 1885 and

the Myanmar Wireless Telegraph Act, 1934 (TeleGeography, 2013)[20]. However, the telecommunications services were not offered till 1884. While Myanmar was under military control, its telecom markets were firmly regulated by the Ministry of Communications and Information Technology (MCIT), which was formerly referred to as the Ministry of Communications, Posts and Telegraphs (MCPT)[21].

The Computer Science Development Law was issued in 1996 to develop computer networks in Myanmar (Ure, 2008). The government developed an Information and Communication Technology (ICT) master plan in 2002 to harness the ICT industry, emphasizing the potential employment opportunities and identify priority areas such as ICT infrastructure, legal and regulatory frameworks, human resource development and education. Moreover, the government passed the Electronic Transaction Law in 2004 to support the electronic transaction technologies (UNESCAP, 2004) (SEACOOP, 2010).

Until 2012, the state-owned monopoly Myanmar Posts and Telecommunications (MPT) dominated Myanmar's telecommunication sector and MPT was the primary provider of telecommunication services in the country. Furthermore, Posts and Telecommunications Department (PTD) has acted as Myanmar's telecom regulator. Both MPT and PTD are operating under MCIT and were founded in 1972. Myanmar now has three Internet service providers (ISPs) that include MPT, Yatanarpon Teleport (YTP), which is partially owned by government and Redlink Group, a privately-owned company, which is owned by family members of government officials.

Table 3: Laws and regulations in Myanmar

Year	Law and Regulation
October, 1885	Myanmar Telegraph Act (India Act XIII)[22]
January, 1934	Myanmar Wireless Telegraph Act (India Act XVII)[23]
March, 1989	State-owned Economic Enterprises Law[24]
October, 1993	Amendment of Myanmar Wireless Telegraph Act[25]
September, 1996	Computer Science Development Law[26]
April, 2004	Electronic Transactions Law[27]

20. Myanmar Wireless Telegraph Act, 1934; *http://www.burmalibrary.org/docs13/THE_BURMA_WIRELESS_TELEGRAPHY_ACT.pdf*

21. In November 2012, Myanmar's Parliament changed the name of the Ministry of Communications, Posts and Telegraphs (MCPT) to the Ministry of Communications and Information Technology (MCIT).

22. http://www.mcpt.gov.mm/mcpt/myanmar-telegraph-act.htm

23. http://www.mcpt.gov.mm/mcpt/myanmar-wireless-telegraphy-act.htm

24. http://www.mcpt.gov.mm/mcpt/miscellaneous.htm

25. http://www.mcpt.gov.mm/mcpt/amendment.htm

26. http://www.mcpt.gov.mm/mcpt/myanmar-computer-science-development-law.htm

27. http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan041197.pdf

28. http://www.mcpt.gov.mm/mcpt/miscellaneous.htm-0

January, 2011	Myanmar Special Economic Zone Law[28]
October, 2013	Telecommunications Law[29]
December, 2013	Licensing rules[30], Interconnection and access rules[31], Spectrum rules[32], Numbering rules[33] and Competition rules[34]

Philippines

The telecommunications industry operates in Philippines under close government regulation agencies – the Department of Transportation and Communication (DOTC)[35] and the National Telecommunications Office (NTC)[36]. DOTC is primarily responsible for formulating telecommunication policy in the country. The department is also policy, planning, coordinating, implementing, regulating and administrative entity of the executive branch of the government. Whereas NTC acts as quasi- judicial body, a regulatory arm of the telecommunication industry. It also has power to regulate, supervise and control all telecommunication services.

Table 4: Powers & functions of the department and the regulator

DOTC	NTC
Formulate and recommend national policies and guidelines for the preparation and implementation of integrated and comprehensive communications systems at the national, regional and local levels	Grant CPCN/PA to install, operate and maintain telecommunication broadcast and CATV services
Establish and administer comprehensive and integrated programs for communications	Grant license to install, operate and maintain radio stations
Assess, review and provide direction to communications research development programs of the government	Establish, prescribe and regulate areas of operation of particular operators of public service communications

29. http://www.mcit.gov.mm/content/telecommunications-law.html
30. http://www.mcit.gov.mm/sites/default/files/1 - MCIT - Final Licensing Rules - 122013 CLEAN.pdf
31. http://www.mcit.gov.mm/sites/default/files/2 - MCIT - Final Interconnection Rules 122213 CLEAN.pdf
32. http://www.mcit.gov.mm/sites/default/files/4 - MCIT - Final Numbering Rules – 122213 CLEAN-1.pdf
33. http://www.mcit.gov.mm/sites/default/files/4 - MCIT - Final Numbering Rules – 122213 CLEAN-1.pdf
34. http://www.mcit.gov.mm/sites/default/files/4 - MCIT - Final Competition Rules – 122213 CLEAN.pdf
35. Department of Transportation and Communication (DOTC); *http://www.dotr.gov.ph*
36. National Telecommunications Office (NTC); *http://ncr.ntc.gov.ph/*

Administer and enforce all laws, rules and regulations in the telecommunication sector	Determine and prescribe charges or rates pertinent to the operation of such public utility and services with some exception
	Allocate/sub-allocate and assign the use of radio frequencies
	Monitor the operation of all telecommunication and broadcast activities
	Enforce applicable domestic and international laws, rules and regulations, prosecute violations thereof and impose appropriate penalties/sanctions

Source: NTC

NTC not only regulates the operations of telecommunication operators' facilities, services provided, rates charged, but also gives permits to buyers to purchase telecommunication equipment. Even though NTC acts as an independent agency, it works under the administration of DOTC. However, in terms of quasi-judicial functions, its decisions are appealable only to the Supreme Court.

Spectrum availability, licensing & management

Access to affordable and available spectrum is the foundation of ensuring access to ICT services and the future network development. It is also recognised in the United Nations Sustainable Development Goals that demands for 'significantly increase[ing] access to ICT and striv[ing] to provide the universal and affordable access to the Internet in least developed countries by 2020'[37],[38] Provision of adequate spectrum will ensure whether any ICT application or community will be flourishing or languishing. For the development of equal society and to reap the social and economic benefits of ICTs, policy makers must ensure that adequate spectrum is available for community development.

The radio frequency (RF) spectrum is vital for wireless communication infrastructure[39]. Most operations on the RF spectrum require a license provided by a national regulatory body or the government. For this purpose, globally, telecom operators are encouraged to bid for spectrum licenses, which gives them

37. Sustainable Development Goals, United Nations, https://sustainabledevelopment.un.org/post2015/transformingourworld.

38. The United Nations International Telecommunication Union's (ITU) Development sector (ITU-D) Recommendation 19, "Telecommunications for rural and remote areas ," highly ghts the nexus between development, access, and the importance of access to spectrum: "in remote and rural areas, spectrum use might be improved by the use of new spectrum-access approaches." Telecommunications for rural and remote areas , Recommendation 19, ITU-D, at 554, https://www.itu.int/en/ITUD/TIES_Protected/WTDC14/WTDC14-FinalReport-E.pdf

39. Ponappa, S. (2010). Understanding Spectrum. Business Standard. Retrieved November 21, 2011, from http://www.business-standard.com/india/news/shyam-ponappa-understanding-spectrum/387446/ 2 Horvitz, Robert. Personal Interview. 9 Sept. 2011

exclusive right to operate the specific frequencies for 10 to 20 years. However, spectrum is considered as natural resource. Thus, many countries have allocated some spectrum which do not require license and can be used for community development. This spectrum is called unlicensed spectrum bands. Unlicensed spectrum refers to a spectrum band that has pre-defined rules for both the hardware and deployment methods of the radio in such a manner that interface is mitigated by the technical rules defined for the bands rather than it being restricted for use by only one entity through a spectrum licensing framework. According to the ITU, both vision and commitment are required when implementing policies for use of unlicensed spectrum to ensure the most optimal sharing of the resource. During the 2003, ITU World Radiocommunication Conference (WRC), spectrum ranging between 5 GHz to 6 GHz was allocated as unlicensed bands for the countries like the United States and United Kingdom and Canada have unlicensed these frequencies consistent with the decision made at the WRC (Longford & Wong, 2007). The FCC delicensed the 5.15-5.35 GHz and 5.725-5.825 GHz frequencies, and also added 5.47-5.725 GHz to the unlicensed national information infrastructure (U-NII) band. The EC proposed that all of its member states delicense the 2.4 GHz and 5 GHz bands in 2003, which resulted in an increase of Wi-Fi bands in most EC member states[40]. The EC has also de-licensed the 433-434-megahertz (MHz) band, along with Australia, Malaysia, New Zealand, and Singapore[41]. In Brazil, dynamic frequency selection (DFS) is only required in the 5.470-5.725 GHz band, while China expanded the number of unlicensed channels in December 2012 to add U-NII-1, 5150 ~ 5250 GHz, U-NII-2, 5250 ~ 5350 GHz (DFS/TPC).

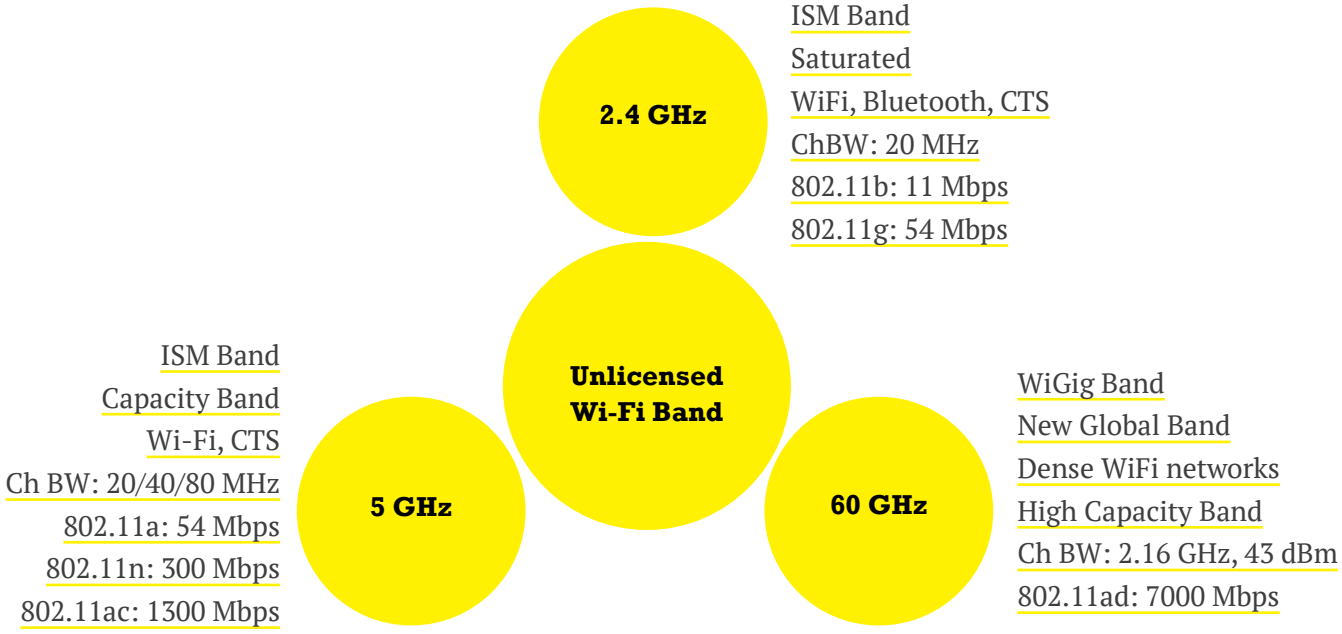


Fig 2: Unlicensed Bands to be Globally Harmonised

40. No author. (20 July 2005). "Commission frees up frequencies for Wi-Fi." EurActiv. Retrieved from: https:// www.euractiv.com/infosociety/commission-frees-frequencies-wifi/article-142740.

41. For more information, see: https://www.itu.int/en/ITU-R/study-groups/workshops/RWP1B-SRD-UWB-14/ Presentations/International,%20regional%20and%20national%20regulation%20of%20SRDs.pdf.

The unlicensed 2.4 GHz bands have lately become very noisy and crowded in urban areas due to high penetration of WLAN and other devices that are communicating in the same frequency range such as microwave ovens, cordless phones and Bluetooth devices. The 5GHz unlicensed bands provide the advantage of less interference and higher bandwidths, but links are usually shorter due to the higher absorption rate of these frequencies resulting in greater signal loss (Srivastava, 2016). So, managing the natural resource as a common pool resource of unlicensed spectrum is alternative method.

India and Philippines are the two countries where experimental licenses were given to provide communities direct access to spectrum. India has issued an experimental license for community network projects. For example, the Indian government issued licenses in the 470-582 MHz band to carry out experiments of Television White Space-type rules and regulations to IIT Mumbai, an academia institute (Belur, 2018). These licenses helped the Dynamic Spectrum Alliance (DSA) to study whether spectrum below 1 GHz could be authorized on an unlicensed or lightly-licensed framework in India as it is in Singapore, the Philippines and elsewhere. Philippines government allowed the flexible licensing policies that allowed community-based networks to partner with private operators to provide the service for profit. Private operator in Philippines is providing free equipment to community networks[42].

India

The spectrum management and its regulation are the collective responsibility of more than one agency in India. As mentioned in the previous section, WPC plays the main role in spectrum management, whereas TRAI and the DOT under the Ministry of Electronics and Information Technology are decision-makers. According to WPC, the following bands are free for use by low power devices[43]

- 26.957 MHz to 27.383 MHz (citizen band)
- 335 MHz (for remote control of cranes)
- 865 MHz to 867 MHz
- 2.4 GHz to 2.4835 GHz
- 5.825 GHz to 5.875 GHz

The Table 4 gives the unlicensed frequency ranges and the applications that can work at those frequencies.

Unlicensed frequency ranges in India	Application/Specifications
50 - 200 kHz	Very low power devices
13553 - 13567 kHz	Very low power radio frequency devices, indoor only

42. USAID, Closing the Access Gap: Innovation to Accelerate Universal Internet Adoption , at 4749 (Feb. 2017), https://www.usaid.gov/sites/default/files/documents/15396/Closing-theAccess-Gap.pdf. See, e.g., Endaga, Inc., Customer Profile: Airwave Missions Papua, Indonesia, http://static.endaga.com/f/airwave-profile.pdf

43. License free bands in India (spectrum-vectrum). https://wisense.wordpress. com/2014/12/08/license-free-bands-in-India-spectrum-vectrum/ [Accessed: 01-November-2018].

26.957 - 27.283 MHz	Low power wireless equipment (max. effective radiated power of 5 W)
335 MHz	Low power wireless equipment for the remote control of cranes
402 - 405 MHz	Medical RF wireless devices (max. radiated power of 25mW) with channel emission bandwidth within 300 kHz
865 - 867 MHz	Low power wireless device (max. transmitter power of 1 - 4 W effective radiated power) with 200 kHz carrier bandwidth
865 - 867 MHz	Radio frequency identification devices (RFID) (MTP of 1 - 4 W ERP) with 200 kHz carrier band width
2400 - 2483.5 MHz	Low power wireless equipment (e.g. WiFi) (max. transmitter output power of 1 - 4 W ERP) with spectrum spread of 10 MHz or higher
5150 - 5350 MHz	Low-power equipment for wireless access systems (max. mean effective isotropic radiated power of 200 mW and max. mean effective isotropic radiated power density of 10 mW/MHz in any 1 MHz bandwidth) indoor only
5725 - 5825 MHz	Low power equipment for wireless access systems (MMEIRP of 200 mW and MMEIRP density of 10 mW/MHz in any 1 MHz bandwidth) indoor only
5825 - 5875 MHz	Low power equipment (MTOPof1-4WERPower) with spectrum spread of 10 MHz or higher

In India, community network operators usually use the unlicensed spectrum 2.4 GHz and 5.8 GHz for providing the connectivity. For example, W4C is a non-profit initiative of DEF supported by Internet Society (ISOC) and various other partners over the years. Launched in 2010, W4C's goal is to connect rural and remote locations of India where mainstream ISPs are unwilling to provide Internet connectivity (usually because their operations would not be commercially viable). W4C uses line-of-sight and low-cost Wi-Fi equipment based on the 2.4 GHz and 5.8 GHz unlicensed spectrum bands to create community-owned and community-operated wireless networks in rural and remote locations of India (Srivastava, 2016).

Whereas, social nonprofit organisation in Dharamshala, Himachal Pradesh, Airjaldi[44] uses the National Optic Fibre Network (NOFN) as it's backhaul and these two unlicensed bands for providing the internet in unserved regions.

Moreover, the Department of Telecommunications (DoT) notified in Feb 2019 that there is no need for permits for the spectrum in the range of 5150-5250 MHz band, 5250- 5350 MHz and 5725-5875 MHz. The Gazette notification by

44. *https://airjaldi.com/*

the Department of Telecommunications (DoT) delicensed 605 MHz of the 5GHz band[45]. The availability of delicensed Wi-Fi spectrum also increases the capacity for indoor usage from 300 MHz to 605 MHz. With the availability of 605 MHz of delicensed spectrum in the 5 GHz band additionally, the number of hotspots would help bridge the existing huge digital divide.

Myanmar

The spectrum is currently regulated and allocated on an administrative basis by Postal and Telecommunication Department (PTD). Presently, valuable spectrum is critically under-utilized in Myanmar. There was one telecommunication service provider that is Myanmar Posts and Telecommunications (MPT). There is no spectrum policy to monitor and identify the spectrum that is already in use and protection of assigned frequencies. Spectrum management in Myanmar was not able to keep up with current changing technology, business practice and economic policy (ITU, 2012). According to the ITU (Section 5.150 of Volume 1 of the Radio Rules), the following bands are identified as unlicensed spectrum bands:

- ✓ 13 553-13 567 kHz (centre frequency 13 560 kHz)
- ✓ 26 957-27 283 kHz (centre frequency 27 120 kHz)
- ✓ 40.66-40.70 MHz (centre frequency 40.68 MHz)
- ✓ 2400-2500 MHz (centre frequency 2 450 MHz)
- ✓ 5725-5875 MHz (centre frequency 5 800 MHz)
- ✓ 24-24.25 GHz (centre frequency 24.125 GHz)

However, PTD identified regulatory issues concerning the deployment of equipment in unlicensed bands. PTD notes the use of high-power equipment in bands identified for license exempt equipment, normally used by low-power operations. Presently there are no radio standards or regulations specifying the technical criteria for the operation of equipment in this band. In some countries, bands used for unlicensed equipment may also be authorized for higher power stations; however, only stations meeting radio standard specification for exemption may operate without license. Without radio standards and effective import control, equipment will be imported from various countries. Countries like India have radio equipment standards, equipment certification and labelling requirements for equipment approved for license exempt operation.

Myanmar government stated that they are experiencing a high degree of reported interference in the unlicensed spectrum 2.4 GHz and 5.8 GHz bands[46]. Though the Myanmar government considers the unlicensed spectrum, however, there is no specific spectrum regulation for community-based networks. Alternative Solutions for Rural Communities (ASORCOM)[47], a community wireless network, was built in the Siyin Valley for 20 villages with around 8,500

45. *https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1566382*
46. Spectrum Roadmap: Meet the Needs Over Next 5 Years; *http://lirneasia.net/wp-content/uploads/2016/05/Spectrum-Roadmap.pdf*
47. *http://asorcom.net/*

people living there. The Siyin Valley is a mountainous region in Chin state in the northwest of Myanmar, with peaks reaching up to over 2,100 metres. The network operated between April 2013 and 2017, before the arrival of mobile services in the area forced the project to evolve to meet new community needs. The network was set up by the Siyin-Chin Youth Network Organisation (SCYNO)[48]and the Siyin Project[49].These two organisations were eager to help and develop the communities where many of their members had grown up, and whose needs they were familiar with. When the project first started in 2013, they used the cheapest wireless devices available in town: a TPLink brand long-range wireless access point.

Moreover, the project faced the challenge from the Myanmar government and their few devices were taken away and the permission was not given to them for operating the network. Thereafter, the project was redesigned and used unlicensed spectrum bands 5GHz for the backhaul connection and 2.4 GHz devices were used for the connection inside the villages. The old TP-Link devices were also used for wireless access point connectivity inside the buildings (Suantak, 2018). They were gradually replaced with Ubiquiti devices which supported mesh firmware. For some areas, such as school compounds, Commotion5 mesh firmware with Ubiquiti devices was used.

Though it is possible to authorise both licensed and unlicensed equipment in a shared band, however, it is necessary that radio standards along with operating conditions and appropriate procedures need are followed to minimize the risk of radio frequency interference. PTD recommended not to mix licensed and unlicensed systems in the same frequency bands.

Philippines

The Republic Act 7925 (An Act to Promote and Govern the Development of Philippine Telecommunications and the Delivery of Public Telecommunications Services) states two basic principles for spectrum allocation and assignment, namely:

(a) Allocation should be given to the best-qualified applicant

(b) When demand for specific frequencies exceed availability, an open tender bidding process shall be used.

The National Telecommunications Commission (NTC) awards the license based on the specific services and on the basis of a predetermined set of criteria such as a possession of a legislative franchise, track record, existing infrastructure and financial stability. NTC also monitors the use of spectrum allocation and reserves the right to recall and reallocate unused channels (Llanto, 2006). NTC defines the problem of spectrum scarcity as follows "Electromagnetic waves propagate outward in all directions. A transmitter generally seeks to communicate with a particular receiver; the transmitting antenna directs the majority of the signal

48. SCYNO was formed by Siyin youth with the aim of doing social work for communities in Myanmar.

49. The Siyin Project was also formed by Siyin youth to raise funds outside of Myanmar to support SCYNO and other activities

toward that receiver and the receiving antenna is most sensitive to signals coming from the direction of the transmitter. However, an antenna radiates signals at lower levels and can receive signals from all directions. An interfering signal will be amplified and detected just like the desired signal once it enters the receiver. If the interfering signal is sufficiently large, it can prevent the desired signal from being properly demodulated and understood" (Llanto, 2006). NTA points out that the use of radio spectrum needs to be regulated, access to be controlled and rules to be enforced because of the possibilities of interface among uncoordinated uses.

Unlike other South East Asian countries like Singapore and Hong Kong, Philippines still uses an administrative allocation and assignment approach or a 'beauty contest' system. The current framework of the spectrum regulatory mechanism is not favourable for small and community players to participate. All the channels on GSM mobile cellular bands (900/1800/2100 MHz) have been allocated to incumbent mobile network operators. Moreover, licenses cover the entire country with no "use-it-or-lose-it" provisions, forbidding local actors. There is no such policy that allows spectrum for cellular community networks (CCNs) and allows them to operate legally.

Broadband & Backhaul

ITU and UNESCO established the Broadband Commission for Digital Development 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. ITU defines the broadband as *"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*[50]*."*

The Asia-Pacific region is characterised by a vast disparity in the maturity of fixed broadband infrastructure levels resulting in a variety of initiatives required to boost fixed broadband penetration. Some countries are focusing on building and enhancing the core infrastructure, such as national backbone networks, required to deliver fixed broadband, while others are focusing on increasing fiber coverage and providing higher speeds. Increased competition in the fixed broadband market is being driven by national broadband initiatives focused on providing affordable broadband through regulated wholesale networks, further fixed mobile convergence is increasing competitive pressure.

The definition of broadband is varying widely among countries and international

50. White paper on broadband regulation and policy in Asia Pacific; https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2016/APAC-BB-2016/Final_White_Paper_APAC-BB.pdf

organisations from at least 256 kbits/second on the low end to faster than 1.5 Mbits/s on the high-end. Asia Pacific region including APAC region, the entry-level broadband definition are as follows:

Table 5: Entry broadband definition in practice in Asia Pacific

No definition	**Lao, Myanmar, Philippines**	
Has Broadband Definition (up/down)	256 kbps	Fiji, Pakistan
	512 kbps	India, Bhutan, Cambodia, Indonesia, Nepal, PNG, Sri Lanka
	1 Mbps	Bangladesh, Samoa
	2Mbps	Brunei
	Others	Vanuatu (download 21 Mbps / Upload 12 Mbps)

TRAI, Indian regulator, defines broadband as "a data connection using any technology that is able to support interactive services including Internet access and support a minimum download speed of 512 Kilobits per second (Kbps)[51]". In comparison to other South Asian country like Bangladesh, India is far behind.

Amongst Asian Pacific countries, all three countries (India, Myanmar and Philippines) have national broadband plan (refer Table 6). In Philippines, the National Broadband Plan (NBP) was introduced in 2016, aiming to extend the reach and access speeds by accelerating the rollout of fixed (e.g., fibre-optic) and wireless broadband technologies.

Even all three countries have broadband action plan but it does not support small operators to take the backhaul connectivity for their purpose. Limited existing infrastructure, including the availability of backbone fibre, network towers, lack of backhaul connectivity and the high cost of providing fixed line services disconnect rural regions in all these three countries.

Table 6: National Broadband Plans

Country	Year	Plan
Bangladesh	2009	National Broadband Policy 2009 -2015; Broadband National Policy 2009; 'Digital Bangladesh' - Bangladesh's 'Vision 2021'
Bhutan	2008	Broadband Master Plan
Cambodia	2014	Cambodia's ICT Master Plan 2020
China	2013	12th Five-Year Plan for Telecom Industry Development; "Broadband China" 2013
East Timor		No

51. *http://tec.gov.in/pdf/Studypaper/Study%20paper%20on%20BB%20Definition.pdf*

Indonesia	2014	Indonesia Broadband Plan 2014-2019; RPI: Peluncuran Rencana Pitalebar Indonesia (Indonesia Broadband Plan) 2014-2019
India	2011	National Telecom Policy 2012 and National Optical Fibre Network Plan
Pakistan	2007	National Broadband Programme 2007; National IT Policy 2013 (Draft)
Philippines	2016	National Broadband Plan 2016
Myanmar	2016	Wireless Broadband Masterplan for the Union of Myanmar, Draft Telecommunications Masterplan 2015
Malaysia	2010	National Broadband Initiative
Maldives		No
Mongolia	2011	National program on Broadband Network 2015
Nepal	2015	National Broadband Policy, 2071 (Draft)
Laos		No
Russia	2012	The Goals of the Ministry of Telecom and Mass Communications of the Russian Federation 2012–2018; Information Society Strategy/ Information Society Programme 2011-202
South Korea	2009	Ultra-Broadband Convergence Network
Singapore	2015	Intelligent Nation 2015 (or iN2015); Next Generation Nationwide Broadband Network
Sri Lanka	2012	e- Sri Lanka
Thailand	2010	The National Broadband Policy
Vietnam	2016	Programme for the development of the country's high-speed telecoms infrastructure

Till 2004, there was no uniform standard for broadband access and connectivity in India. Internet access was available at various speeds in a range from 64 kilobits per second to 128 kilobits second. The high-speed Internet connection through broadband was introduced in the NTP-2004. In 2011, the broadband definition was increased from 128 kbps to 512 kbps.

India launched the National Optic Fibre Network (NOFN) in 2011 aimed to connect 250,000 villages in India and the government's 2012 National Telecom

Policy[52] called for 'broadband access for all', the fixed broadband connections in India is only 1.4%[53].

In order to address the poor availability of backhaul connectivity. Unlike urban areas where optic fibre network is largely deployed to provide the backhaul connection, about 80% of the rural BTS in India are on microwave system. Due to the lack of backhaul connectivity, only wimax and mobile broadband become possible solutions for providing connectivity in remote areas. Thus, to make the society 'information highway', the NTP-2012 conceived to bring the broadband connectivity in remote areas of the country.

The Philippines formally connected to the Internet in 1994, but even today the Internet remains largely unregulated[54]. There are six domestic Internet Exchange Points (IXPs) in the country with the Open Internet Exchange (PHOpenIX) acting as a "neutral" Internet exchange that is managed and operated as a nonprofit by the Department of Science and Technology. However, there remains a lack of interconnectivity between the major ISPs. As a result, an estimated 97% of local traffic[55] is routed externally through places such as Hong Kong and the United States before returning to the country. In an effort to boost connectivity, the NTC in 2011 instructed ISPs to interconnect using PHOpenIX. The NTC faces challenges in dealing with ISPs because the Philippines considers the Internet as a deregulated "value-added" service[56]. Value-added services, unlike telecom services, are not subject to government regulation. Unless it puts up its own network, a telecommunications entity operating as a value-added service provider is subject to only a few requirements imposed by law[57]. Accordingly, the NTC as the primary regulator has no power to impose IP peering (a voluntary process in which two Internet networks connect and exchange traffic)[58]. As a result, IP peering in the Philippines is a commercial affair, in which ISPs charge other providers who want to connect to them. Meanwhile, in other countries such as Indonesia, telcos and ISPs are peered for free[59].

USOF & Community networks

The Universal Access and Service Fund (UASF), also known as Universal Service Obligation Fund (USOF) is one of the key financing mechanisms that is used to connect the sparsely populated rural areas. UASF/USOF are funding mechanism established by national governments to promote universal access to telecommunication services. They financially motivate telecommunication service operators to provide service in locations that would not be commercially

52. meity.gov.in/writereaddata/files/National%20Telecom%20 Policy%20(2012)%20(480%20KB).pdf
53. International Telecommunication Union 2017 data
54. Sec. 3(h) of the country's Republic Act 7925 defines a value-added service provider as "an entity which, relying on the transmission, switching and local distribution facilities of the local exchange and inter-exchange operators, and overseas carriers, offers enhanced services beyond those ordinarily provided for by such carriers.
55. "NTC Drops Mandatory ISP Interconnection [The Manila Times, Philippines]," NFV Zone News, 29 August 2011, http://www.nfvzone.com/news/2011/08/29/5738498.htm.
56. A value-added service is all service beyond standard voice calls and fax
57. Republic Act No. 7925, §11.
58. "What Is Peering?" Netnod, http://www.netnod.se/ix/what-is-peering
59. Carmela Fonbuena, "Pressure on PLDT to Solve PH's Slow Internet," Rappler, 16 September 2014

viable otherwise. Mostly these funds are often used with market-based reforms to correct access gaps that market mechanism may generate. Each country has specific mechanism of contribution to the fund, disbursement of the fund and identification of priority areas to fund. Most of Asian Pacific countries, a percentage of the telecom operators' gross or net annual revenue is levied[60]. Some countries charge an overall regulatory fee every year. Depending on the country where they are implemented, UASF are designed to help address gender, age and geographical gaps in terms of access, price and quality[61]. For example, India and Malaysia take gender inclusion into consideration or countries like India, Malaysia, New Zealand, Pakistan and Thailand take design services for persons with disabilities while disbursing USAF.

Has USO and USOF	Bangladesh, Bhutan, Fiji, Indonesia, Myanmar, Nepal, Pakistan, PNG, Samoa, Vanuatu	
Means to collect USOF	Levy on operator revenues	India (5% from telecom operators) Bangladesh (1% from only mobile operators) Indonesia (0.75% from all operators) Myanmar (2% from all licensees) Nepal (2% from all licensees) Pakistan (1.5% from all operators)
No USOF	Philippines	

In India, USOF[62] is an independent body within the telecom department that subsidises telecom infrastructure rollouts in rural India. At present, telecom operators contribute 5 per cent to USOF in India[63]. The idea of establishing the USOF to strike a balance between the provision of universal access to services to all uncovered areas. The USOF fund in India aims to:

1. Incentivise telecom service providers to venture into rural and remote areas;
2. Facilitate rural roll out of infrastructure;

60. ITU, "Universal Service Fund and Digital Inclusion for All Study", June 2013. Available from *https://www.itu.int/pub/D-PREF-EF.SERV_FUND-2013* .

61. GSMA, "Survey of Universal Service Funds: Key Findings", April 2013, *http://www.gsma.com/publicpolicy/wpcontent/uploads/2013/04/GSMA-USF-Key-findings-final.pdf*.

62. *http://usof.gov.in/usof-cms/home.jsp*

63. *https://www.financialexpress.com/industry/industry-body-pushes-for-cut-in-levy-asks-government-to-slash-overall-levies/1680031/*

3. Reduce costs and, hence, end user prices;
4. Increase the affordability of telecommunications services.

Whereas in Myanmar, the 2013 Telecommunications Laws permits the Ministry of Transport and Communications (MOTC)[64] to establish a Universal Service Fund (USF) ensuring that all people in a country have access to and are able to use telecommunications services. For this, the licenses of all four operators with a National Telecommunications License (NTL) – Ooredoo, Telenor and MPT, as well as the fourth entrant MNTC/MyTel – are required to pay a USF levy. The USF levy is 2% of relevant revenue on an annual basis. The MOTC can then instruct the Post and Telecommunications Department (PTD) to develop programmes and projects for the construction of basic telecommunications infrastructure and to extend telecommunication services in the underserved areas of the country[65].

Though, both countries have universal service fund, however, it is used by the government to establish the telecom infrastructure in rural regions and to conduct various programmes. Both countries have not utilized the USO funds. According to DoT data, India has used just 30 per cent of the USOF it has collected since the fund was set-up in 2002-03. By comparison, Colombia used 84 per cent of USOF in 2011 according to global cellular industry body, GSMA[66]. DoT usually provides USOF funds to the state-run operator Bharat Sanchar Nigam Ltd (BSNL) to improve connectivity in rural areas, however the services provided are not competitive, while private operators are not willing to go to rural areas because it is not commercially viable. Similarly, Myanmar has not utilized its USO funds. Moreover, the funds do not allow community players to leverage the universal service funds to establish the network and providing the connectivity in rural regions.

In the Philippines, the universal service obligation (USO) aim is built into the licensing of full-service/multiple-service carriers which are required to construct local lines as well as develop a variety of other services.

Mobile Virtual Network Operators (MVNO)

A Virtual Network Operator (VNO) or Mobile Virtual Network Operator (MVNO) is a Service Delivery Operator, who does not necessarily own its underlying network(s) but relies on the network and support of the infrastructure providers, telecommunication suppliers/operators for providing telecom services to end users. According to GSMA, as of the end of 2015, there are 1038 MVNOs and

64. *https://www.motc.gov.mm/*

65. Universal Service Strategy for Myanmar; *https://www.motc.gov.mm/sites/default/files/Universal%20Service%20Strategy%20%28Draft%29_0.pdf*

66. Telecom firms may soon pay less for universal service obligation; *https://www.business-standard.com/article/economy-policy/telecom-firms-may-soon-pay-less-for-universal-service-obligation-114090901107_1.html*

According to DoT data, India has used just 30 per cent of the USOF it has collected since the fund was set-up in 2002-03

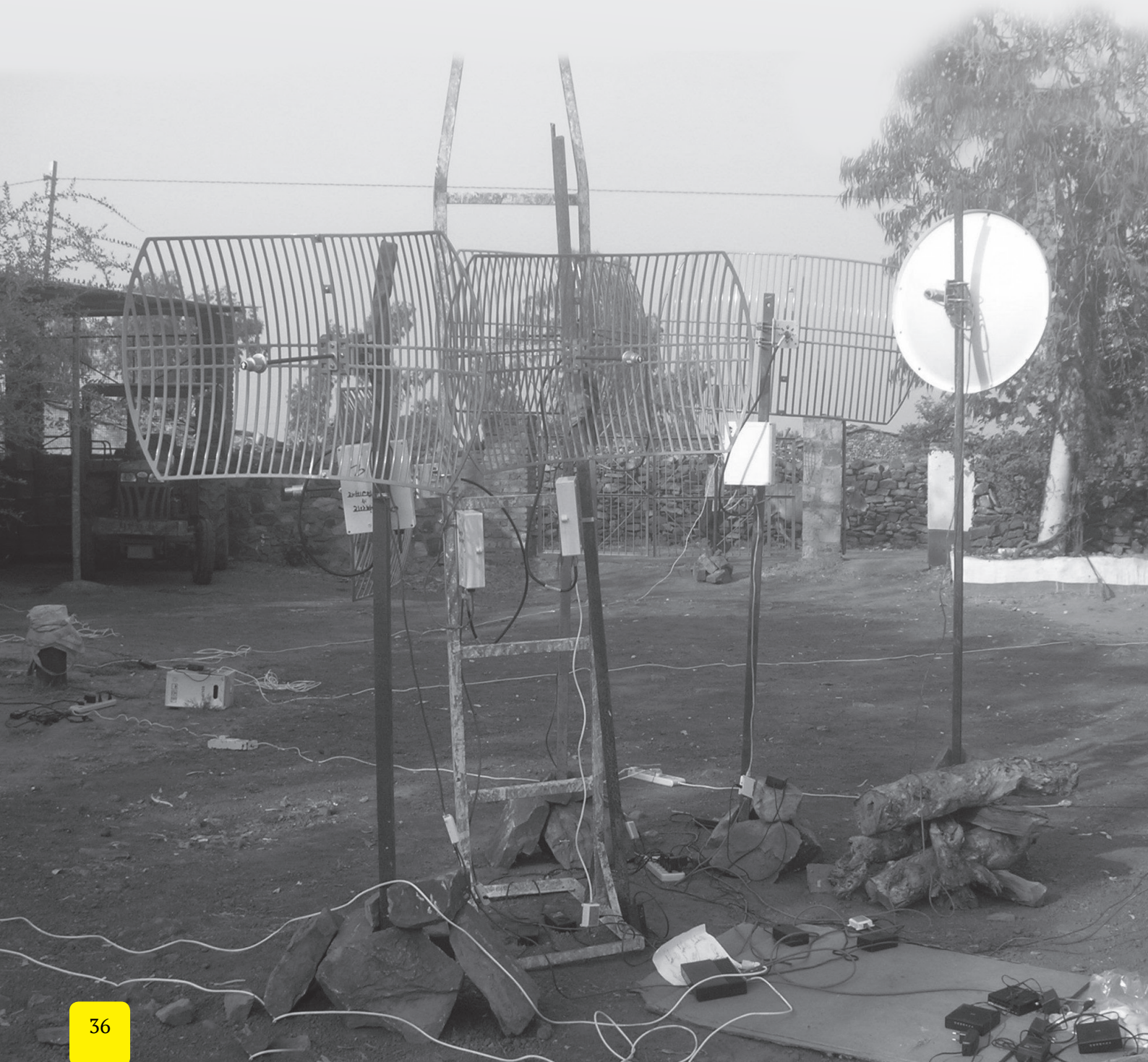
277 MNO sub-brands. Globally, MVNOs together account for around 10% of the total million users. In Europe virtual operators have over a hundred million subscribers.

Favouring the community networks, India is the only country that initiated MVNO licensing process. Whereas Philippines and Myanmar do not have any license process for MVNO. In India, over the last two decades, the licensing regime for access services also underwent periodic transformations to accommodate technological evolution and changing market requirements. In 2013, the evolution of the licensing framework starting from the separate licensing framework for various services to the UL regime with the objective of providing a single license for all types of telecom services. The Department of Telecommunications (DoT) opened up the sector for VNOs and issued guidelines for the grant of UL(VNO) vide letter dated 31st May 2016. There are several clauses in the UL (VNO) which are directly taken from the Unified licensed to TSPs. The Virtual Network Operators Association of India (VNOAI), as an industry body was established by the DoT offering the convergence of VNOs and VNO industry participants to build healthy ecosystem that facilitates the growth of a thriving VNO industry in India.

Conclusion

It is very important for the policy makers and regulatory bodies to understand the benefits of community networks as a bottom up approach. Below are some of the proposed recommendations.

Additional spectrum to delicensed – Below table describes that additional spectrum can be delicensed in India for the growth of telecom and internet penetration in rural regions.



Requested bands for unlicensing	Application	Current Application	Regions where exemption is in Place
433 - 434 MHz	Data telemetry	Low power short range devices	Australia, Singapore, Malaysia, New Zealand
902.5 - 915 MHz	Low power	Additional requirements of cellular telephone systems, train control, mobile train radio systems	US
900 MHz	Low power wireless equipment	Micro cellular low powered telecommunication systems	US
926 - 926.5 MHz	Low power	902.5-915MHz: Low power cordless telephone systems;	US
1880 - 1900 MHz	Low power cordless communication	Micro cellular wireless access systems (fixed/mobile) based on TDD access techniques	Europe
2483 - 2500 MHz	Broadband Access		
5150 - 5350 MHz	Broadband Access	Low power equipments for wireless access systems indoor only	US, UK

Innovative Licensing
Innovative approaches to spectrum management like granting spectrum at a reasonable rate exclusively to the unreserved areas can increase the opportunities for community networks to gain access to the spectrum. Experimental licenses are another set of licenses to the spectrum which could be provided to the rural regions or the community network operators.

Increase transparency in the regulatory decisions
The rules and the decisions need to be available to the public in a form that the layman understands. The rules are complicated and hence, communities prevent increasing their knowledge in this area of operation.

Flexibility in regulation
The Regulatory bodies need to be flexible enough with their operation and ensure that they follow best practices. This could help a lot in terms of spectrum sharing, in offering unlicensed/licensed free spectrum etc.

Creating public private partnerships
Projects that create public private partnerships needs to be increased.

Increase in the engagement
The challenges faced by the communities in the rural region are very different and requires more engagement of the government with the rural communities in order to understand the basic problems. Training could be provided to the communities to set up their own network, etc. The community should be taught on how to use Internet in their day to day lives. For example, it could be used in agriculture, or e-banking and other services.

Bibliography

Baig, R., Roca, R., Freitag, F., Navarro, L. (n.d.). guifi.net, a crowdsourced network infrastructure held in common. Retrieved from *http://people.ac.upc.edu/leandro/pubs/crowds-guifi-en.pdf*

Belur, S. B. (2018). ADDRESSING SUSTAINABILITY IN RURAL CONNECTIVITY: A CASE STUDY OF GRAM MARG COMMUNITY-LED NETWORKS. In *Community Networks* (pp. 150-156). Global Information Society Watch (GISW).

Chhor, H. D. (2013). *Myanmar's moment: Unique opportunities, major challenges.* McKinsey Global Institute. Retrieved from; http://www.mckinsey.com/insights/asia-pacific/myanmars_moment.

Llanto, G. M. (2006). Reviewing the Philippines' spectrum management policy. *Philippine Institute for Development Studies* .

Longford, G., & Wong, M. (2007). *Spectrum policy in Canada: A CWIRP background paper. Community Wireless Infrastructure Research Project.* Retrieved 2017, from www.cwirp. ca/files/CWIRP_spectrum.pdf.

SEACOOP. (2010). ICT Policies, Programmes and Research Priorities in the 10 ASEAN Countries. *Retrieved from http://seacoop.eu/files/2010/03/ICT_policiesprogrammes_priorities_SEA.pdf.*

Srivastava, R. (2016). *Community Networks: Regulatory Issues & Gaps (Experience from India).* Digital Empowerment Foundation (DEF) & the Internet Society (ISOC).

Suantak, M. (2018). THE COMMUNITY NETWORK AS A CONNECTIVITY STRATEGY FOR RURAL AND REMOTE MYANMAR. In *Community Networks* (pp. 184-186). Global Information Society Watch .

UNESCAP. (2004). Trade and Investment Policies for the Development of the Information and Communication Technology Sector of the Greater Mekong Subregion. . *Retrieved from http://www.unescap.org/tid/publication/t&ipub2336.pdf.*

Ure, J. (2008). *Telecommunications development in Asia.* . Aberdeen, Hong Kong: Hong Kong University Press.

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