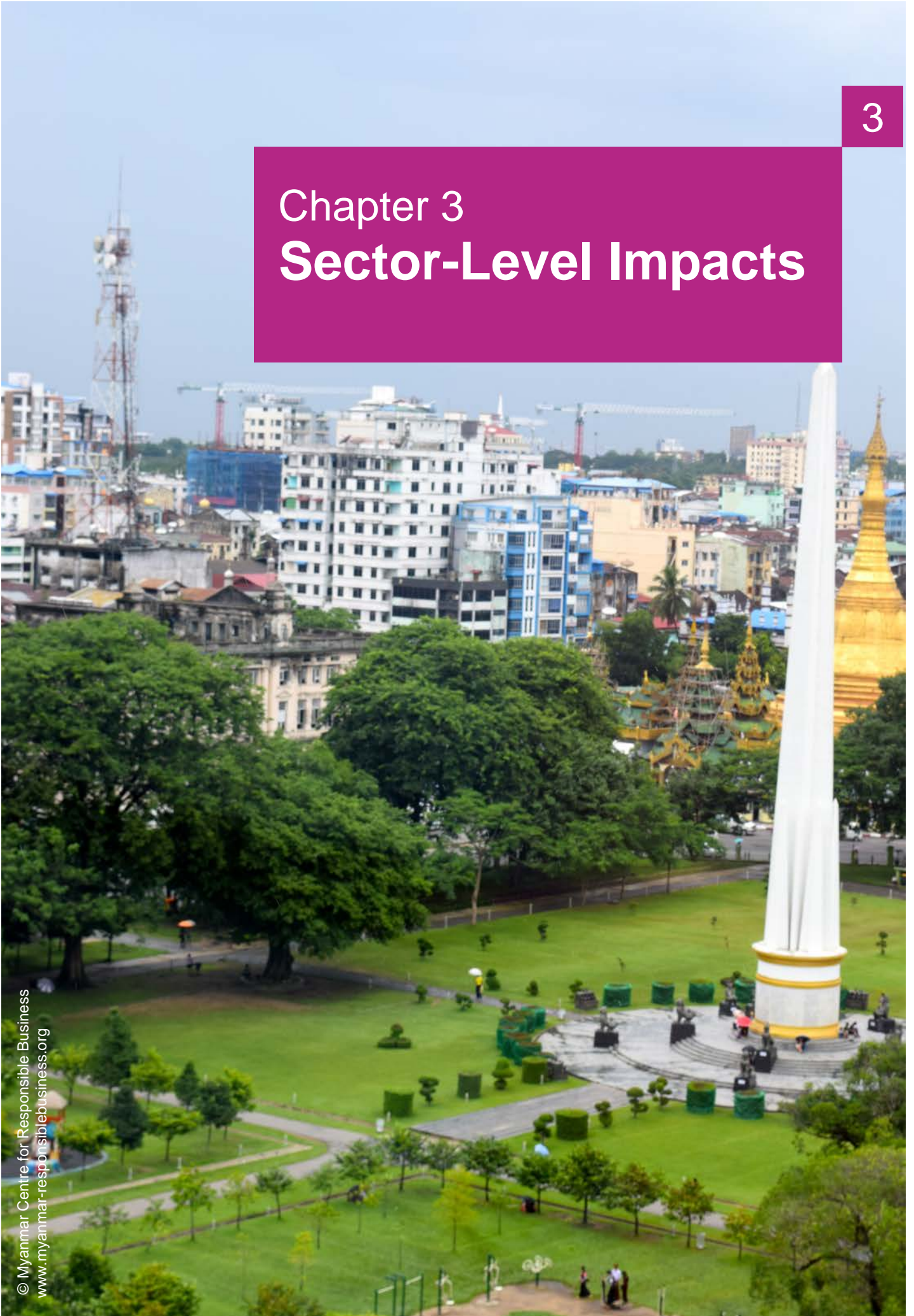Chapter 3
Sector-Level Impacts

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Sector-Level Impacts

In this Chapter:
- **A.** Introduction
- **B.** Current State of the ICT Sector in Myanmar
  - Telecommunications
  - Internet Infrastructure and Internet Services
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A. Introduction

As the number of Internet users, and mobile penetration rates, in Myanmar continue to increase, various opportunities and potential human rights risks require the attention of Government, private sector, and civil society organisations. This section of the Report examines aggregate or "sector-wide" impacts on human rights – both positive and negative – which can result from the ICT rollout in Myanmar. These include economic, social and governance impacts on human rights, such as the right to an adequate standard of living, education and highest attainable standard of physical and mental health.

This Chapter is intended to highlight the importance to Government of consideration of the broader implications of its policies and laws (or lack thereof). For companies, it identifies wider risks the Myanmar operating context poses to responsible business conduct and in turn the wider impacts that business operations can create for Myanmar society and therefore the wider context of its "social license to operate" beyond its legal license to operate. Where gaps exist, there may be a need for collective action, possibly with a range of stakeholders. For civil society, the Chapter sets out an overall picture of the sector and useful information on the wider impacts of the sector, both negative and positive. And finally for donors or other development partners providing support and assistance, the Chapter is a reminder of the wider context for their support, the interconnections between many of these issues and a prompt to consider the wider implications beyond the four corners of their projects.

Table 24 shows the ICT value chain that is emerging in Myanmar. Tables at the end of this Chapter provide details of some of the main companies operating in each part of the value chain in Myanmar.

Table 24: The ICT Value Chain in Myanmar with an Explanation of Key Terms

Fibre optic cable	Fibre optic cables allow for digital information to be transmitted over long distances and at high speeds. These cables are typically installed underground in trenches or underwater along ocean seabed for international Internet connectivity.
Tower companies	Tower companies are responsible for site acquisition i.e. leasing land from landowners. They often sub-contract tower construction (including civil work and tower erection). In some cases they can also manage power generation (diesel generators or hybrid with battery). Once the tower is built, they lease space on the tower to network operators who install their equipment on the tower.
Power generation	Power is required for base-transceiver stations (BTS) located at tower sites. Power is also required for larger data centres used in telecommunications. Depending on the business model, separate companies can provide and maintain diesel generators or hybrid diesel generator battery combinations for tower sites. These companies are responsible for fuel. In some cases, companies also sub-contract security to protect against tampering or fuel theft.
Network equipment providers	The role of the network vendor (or active network equipment suppliers) is typically to build, and in some cases manage, the telecommunication infrastructure that provides the basis for all fixed and mobile communications, including calls and data. A network vendor's main customers are telecoms operators (see below). A network vendor ensures that connectivity occurs across services, operators, and borders, and also ensures that the network is capable of handling the increasing demands for data and access, by supplying what is known as the "radio network". A vendor may also provide physical hardware, known as the "core network", to perform specific tasks, such as lawful interception. Once towers are constructed, the network vendor companies then fix their radio signal receiver and transmitter equipment on the tower. Transmitters can also be housed in nearby base stations, which are normally a few feet away from the tower. Mobile phones continually emit signals that are picked up by the nearest receiver on the nearest cell towers when a call is made or a text message sent. Once the call is connected, the transmitters in base stations then carry the information (such as a conversation) to the mobile phone of the intended recipient. When the user is in transit (for example on a bus) and moves out of range of one tower, the connectivity is maintained because the next closest tower picks up the communication.

	Mobile network operators	Operators are companies that provide mobile and Internet services directly to the user for a fee. The telecommunications industry is generally highly regulated by governments and telecommunications operators must have on-going relationships with governments in countries where they operate, as they require licenses to operate and to obtain frequency (spectrum) allocations. The contract to provide telecommunications services is between the Government and the operator; therefore the legal obligation to provide interception capabilities (when such a law is in place) lies with the operator. Inherent in all mobile networks is the ability to find users placing or receiving a call or message in order to connect the two. Without this inherent feature, there would be no connectivity. This means that at any given time, the location of someone carrying a mobile phone must be determined. Mobile network operators routinely collect this location information mainly to use for billing purposes and to determine if a call was made locally, or while roaming nationally or abroad.
	Internet service providers	Internet service providers (ISPs) provide customers with access to the global Internet, usually for a monthly or hourly fee. Internet service providers can offer fixed line or wireless connections. Mobile network operators also typically function as Internet service providers, as customers pay for wireless data access.
	Web based service providers	Web based service providers, (sometimes referred to as 'Over the Top' service providers) provide online services or platforms for users. This includes social networking, search engines, e-commerce, messaging applications, or cloud computing services.
	Software developers	Software developers create applications that run on ICT hardware, including mobile phones, wearable technology (e.g., smart-watches), laptops, desktop computers, and servers.

B. The Current State of the ICT Sector in Myanmar

The Current State of Telecommunications

Until 2012, Myanmar was at the bottom of the global league table for mobile penetration. In 2012, only North Korea (6.97%) and Eritrea (4.98%) had lower mobile penetration rates than Myanmar (7.06%)[107]. However, mobile penetration rate has increased rapidly since

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[107] International Telecommunications Union, "Statistics: Time Series by Country, Mobile Cellular Subscriptions" (last accessed August 2015).

then. The 2014 Census reports that 32.9% of the population had access to a mobile phone at the time the census was conducted in March-April 2014.[108] In the first quarter of 2015, Myanmar added more mobile subscriptions than any country in the world except for India and China.[109] A recent study of ICT needs and usage across 8,400 households in Myanmar found, amongst other things, that more than 90% of the wards/villages have coverage (i.e. can get a signal) and have re-load locations for topping up mobile pre-pay credit. However the purchase of SIM and handset was still limited to urban areas.[110]

The Ministry of Communication and Information Technology's (MCIT) policy framework for developing Myanmar's telecommunications sector centres on increasing overall tele-density/mobile penetration, improving the affordability of telecommunication services in urban and rural areas, and providing the population and enterprises the freedom to choose their telecommunications services and providers.

Figure 2: Myanmar Mobile Penetration Rate 2000-2015
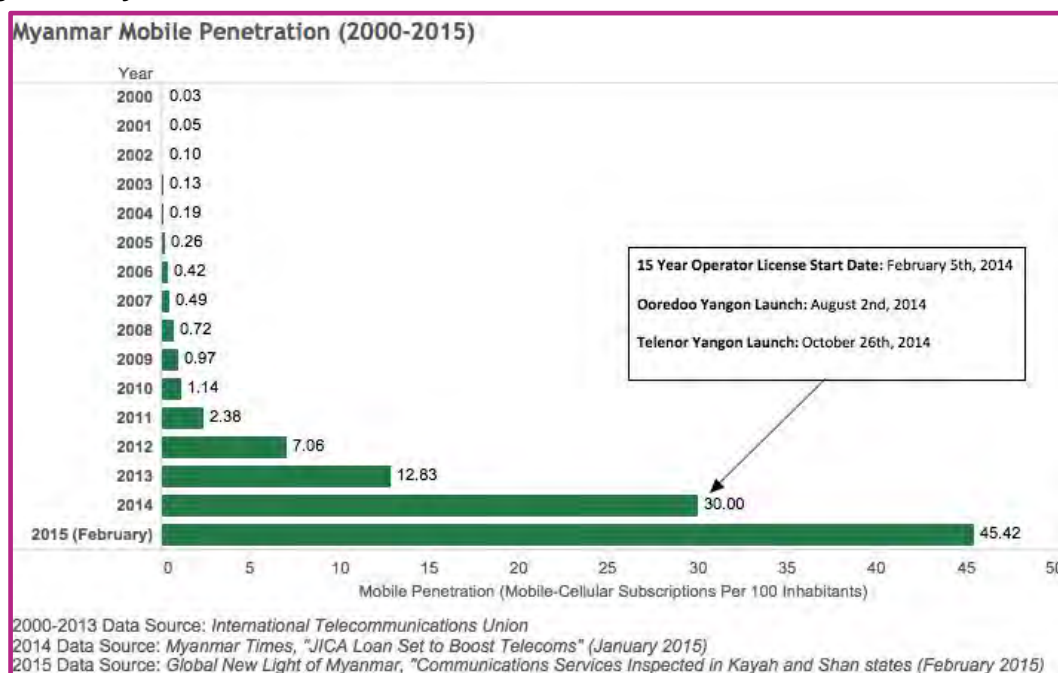
National Telecommunications Rollout

Issuing telecoms operator licenses provided an opportunity for the Government to set ambitious targets for improvement in the coverage and types of ICTs on offer in the country. MCIT awarded 15-year operator licenses to wholly owned subsidiaries of Norway's Telenor Group (Telenor Myanmar Limited), and Qatar's Ooredoo (Ooredoo Myanmar Limited) that took effect on 5 February 2014.

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[108] The Republic of the Union of Myanmar, "2014 Myanmar Population and Housing Census, Census Report Volume 2-A" (May 2015).
[109] Myanmar Times, "Myanmar third for mobile grown" (15 July 2015).
[110] See further, H Galpaya, "Knowledge, information and communication habits and needs in Myanmar: Stories from the field" ICTD2015 Conference (May 2015).

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The targets included in the licences set out an ambitious vision for improvement of voice and data service coverage throughout the country:

■ "Commercial launch no later than 9 months after the effective date of the Licence;
■ Geographic coverage for voice services of 25% and for data services of 10% within 12 months;
■ Geographic coverage for voice services of 75% and for data services of 50% within 60 months."[111]

The two international licensees each achieved 1 million subscribers within the first 2-3 weeks of operations.[112]

Each operator licence includes the requirement that after three years (assuming network rollout targets are met) each operator must contribute 2% of annual revenue to a Universal Service Fund managed by MCIT. This Fund is intended to subsidise the cost of telecommunications service in areas where infrastructure deployment is not economically viable for network operators. (For more on universal service, see below under "Cost of Telecommunications Access").

To support the rollout targets, MCIT also issued new draft rules for the telecommunications sector relating to Licensing, Access and Interconnection, Spectrum, Numbering and Competition, which was open for public consultation in November 2013.[113] Each class of licence permits companies to engage in the specific activities set out in Table 25 below. As of April 2015, MCIT issued several types of licences to 20 companies to provide these telecommunications services. These licences differ from the licences to operate national telecommunications networks held by Telenor, MPT, and Ooredoo. See also Tables 33 and 34 at the end of this chapter for further information.

Table 25: Classes of Telecommunications Licences in Myanmar

Class of Telecommunications Licence	Example of activities
Network Facilities Service (Individual)	Construct, maintain, operate, and provide telecommunications services over: ■ Terrestrial fixed line transmission facilities ■ Terrestrial radio transmission facilities ■ Mobile base stations ■ Submarine cable facilities

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[111] New Light of Myanmar, "Telecommunications Operator Tender Evaluation and Selection Committee issues press release" (28 June 2013), pg 5 and 16.
[112] TowerXchange, "The Myanmar tower rollout: FAQs (updated June 2015)".
[113] See the draft rules here http://www.mcit.gov.mm/content/proposed-rules-telecommunications-sector.html and comments by MCRB http://www.myanmar-responsiblebusiness.org/news/comments-mcit-proposed-rules-telecommunications-sector.html

	■ International Gateway Services facilities ■ Satellite earth station facilities ■ Other Myanmar-based satellite facilities that can transmit telecommunications services
Network Facilities Services (Class)	Deploy and maintain passive network infrastructure for civil engineering and non-electronic elements, including but not limited to: Towers; Masts; Ducts; Trenches; Poles; Dark fibre.
Network Services	Provision of the following telecommunications services: ■ Resale of wire-line connectivity services ■ International and domestic network transport and switching services ■ Resale of International Gateway Services
Application Services	Provision of the following telecommunications services: ■ Public payphone services ■ Public Switched data services ■ Audio text hosting services provided on an opt-in basis ■ Directory services ■ ISP services ■ Public Access centre services ■ Messaging services ■ Private line voice and/or data services (including leasing Wide Area Network capacity to third parties) ■ Value-Added services

Source: VDB-LOI, "Telecom Myanmar Update" (September 2014)

Improving Coverage and Mobile Phone Reception

Mobile towers provide improved reception for mobile phone users. Each mobile tower has a range of 1-5 miles; the closer the user is to the tower the better their signal will be. Nearly eight months after the launch of Telenor and Ooredoo, mobile towers dot the rural horizon or are perched on rooftops in many of Myanmar's major cities. As of March 2015 there were over 5,000 mobile towers providing voice and data coverage to Ooredoo, Telenor, MPT, and MECtel customers (see further the Tables at the end of this chapter).

On average a mobile tower can take approximately 3 weeks to construct, excluding weather delays, or difficulties obtaining the required permits authorising land use, re-zoning, and construction. Each operator has subcontracted land acquisition and construction to specific tower companies, who typically subcontract elements of the process (e.g. civil work) to additional companies. By May 2015 it was reported that the two international mobile network operators had signed a second round of purchase orders

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for telecommunications towers after long delays due to protracted negotiations over pricing and terms.[114]

MCIT has not succeeded in implementing infrastructure sharing (i.e. requiring that towers host the network equipment of more than one operator). This means that each operator and their contractors are continuing to aggressively hunt and compete for tower sites in order to achieve their necessary area coverage to meet rollout targets. Slowing down the site leasing process to adequately engage communities during the scoping and construction phase of locating towers to hear and address their concerns works against this market and contractual imperative. This reflects a broader challenge operators currently face in Myanmar, between aggressive rollout commitments on the one hand and the need to ensure responsible and effective business practices that requires sufficient time and resources to implement. This is an example of a gap in Government approach that creates a disincentive for responsible business conduct.

Cost of Telecommunications Access

Prior to the licencing of new mobile network operators in Myanmar, SIM card prices had historically been high, often costing thousands of US dollars. In April 2013, the State-owned Myanma Posts and Telecommunications (MPT) began selling SIM cards to winners of a public lottery at a price of 1,500 MMK (around $1.50).[115] During the lottery's first month, an initial batch of 320,000 SIM Cards was made available with each administrative ward receiving a limited allocation of 100 SIM cards.[116] Many lottery winners sold their SIM cards to third party brokers and phone shops. Overall SIM prices were reduced, but black market prices remained too high for most users to afford.

Telenor and Ooredoo also began selling SIM cards for 1,500 MMK in the latter half of 2014 when their networks were launched. Android smartphones can now be purchased for as little as 50,000 MMK, in some areas, making owning a mobile phone with Internet access financially realistic for many people for the first time in Myanmar's history. In May 2015, the Union Parliament suspended a newly imposed 5% commercial tax on mobile phone top-ups until the next fiscal year following public dissent.[117] Similarly, in July 2015, state-owned Myanma Posts and Telecommunications (MPT) halved the price of landline phone installation. The rate had previously been 650,000 MMK (roughly $565) – well beyond reach for the majority of households, and was brought down to 325,000 MMK, potentially signalling a Government priority to liberalise the fixed line market.[118]

In August 2015, MCIT launched a tender for the design of Myanmar's universal service strategy. The tender outlined support for MCIT and the regulator Post & Telecommunications Department (PTD), and the universal service strategy's implementation in a number of pilot areas, in order to "accelerate the development of rural

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114 Myanmar Times, "Bad reception Telenor and Ooredoo pick new tower firms" (25 May 2015).
115 Reuters, "In Myanmar, cheap SIM card draw may herald telecoms revolution" (24 April 2013)
116 Telegeography Research Services, "Govt: You Can't Win the SIM Card Lottery if You Don't Buy a Ticket" (April 2013)
117 Myanmar Times, "Parliament suspends 5% tax on top-up" (28 May 2015).
118 Irrawaddy, "State-Owned Telecom Slashes Landline Fees as Users Go Mobile" (15 July 2015).

telecommunications infrastructure and services in locations that are unlikely to attract sufficient private investment."[119]

The Current State of Internet Infrastructure and Internet Services

The nation-wide rollout of telecommunications networks in Myanmar comes at a time when the reach of the global Internet has reached an unprecedented scale. Globally, there are now more Internet-connected devices than people.[120] Many users in Myanmar are connecting to the Internet for the first time. While mobile penetration has steadily increased following the Ministry's liberalisation of the sector, fixed-line Internet penetration remains low. The 2014 Census reports that as of March-April 2014 only 6.2% of the population had access to the Internet at home.[121] ISPs have struggled to balance Myanmar's limited Internet capacity with customer demand. In November 2014, MPT and Yatanarpon Teleport stopped accepting applications for new fibre connections, in order to concentrate on increasing capacity of existing connections.[122]

Internet Rollout

While new mobile towers have improved voice coverage nationally, Internet speed remains poor due to the quality of Myanmar's underlying Internet backbone and an immense demand for Internet services. Connectivity to the global Internet is important, because the majority of content users are attempting to access is hosted on servers outside Myanmar. This includes Myanmar specific content and international software services. For example, the popular Myanmar language news site "7 Day News" is currently hosted on servers maintained by Amazon Web Services in Singapore.[123] For many Myanmar companies, the decision to host their website outside Myanmar is due to lower cost and increased reliability of electricity. Popular services such as Facebook, Google Search and Gmail, YouTube, and Viber also require international Internet access. These services connect with servers located outside of Myanmar, where data is stored and processed. For example, Google currently has 13 data centres globally, all located outside of Myanmar.

As far back as the 1990s, the workings of the Internet backbone were compared to a road freeway or highway system by experts and politicians.[124] One component of a strong backbone is the collection of fibre optic cables that can be either submarine or terrestrial. The way information travels along these cables and is routed to different places is similar to vehicles travelling along lanes on a highway. Not only does Myanmar currently have a limited number of lanes for information to travel around the country, Myanmar also has a limited number of lanes connecting users to the global Internet. Myanmar is currently served by only one submarine Internet cable, South East Asia-Middle East-Western-Europe-3. Myanma Posts and Telecommunications (MPT) is a member of global

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[119] See MCIT, "Invitation for Expression of Interest: Myanmar's Universal Service Strategy" (6 Aug. 2015).
[120] See: https://www.apnic.net/
[121] The Republic of the Union of Myanmar, "the 2014 Myanmar Population and Housing Census, Census Report Volume 2-A" (May 2015).
[122] Aung Kyaw Nyunt, "Fiber Connection Freeze from Leading ISPs", Myanmar Times (November 2014).
[123] See Website and IP location at http://check-host.net/ip-info?host=http://www.7daydaily.com/.
[124] See US Vice President Al Gore's "Speech at Royce Hall, UCLA Los Angeles, California" (11 January 1994). See also Page 6, Nicholas Economides, "The Economics of the Internet Backbone" (2005).

consortium for the South East Asia–Middle East-Western Europe 5 cable and the Asia-Africa-Europe-1 cable and will also jointly manage the AAE-1 cable landing station in Ngwe Saung in 2016.[125] The addition of these international links, combined with further over-land fibre optic cables extending into neighbouring countries Thailand, India, and China will improve the capacity of Myanmar's Internet. Private companies such as Singapore's Campana Group have announced plans to deploy additional submarine cable.[126] Other firms are installing thousands of kilometres of terrestrial fibre cable inside Myanmar, providing increased connectivity to major cities and last mile connectivity to remote areas.

Currently, if many Internet users are streaming videos, downloading music, and posting photos at the same time, there will be a 'traffic jam' as bandwidth is congested. As of January 2013, Myanmar Computer Federation estimated Myanmar's Internet backbone bandwidth to be 14 gigabits per second.

Table 26: Comparison of Broadband and Mobile Download Speed across ASEAN

Country	Average Broadband Download Speed	Average Mobile Download Speed
Singapore	121.8 mbps	17.5 mbps
Thailand	19.9 mbps	5.4 mbps
Vietnam	18.5 mbps	1.7 mbps
Cambodia	9.1 mbps	5.8 mbps
Brunei	7.7 mbps	10.1 mbps
Malaysia	7.0 mbps	6.6 mbps
Indonesia	6.5 mbps	4.1 mbps
Myanmar	6.5 mbps	2.5 mbps
Laos	5.8 mbps	3.1 mbps
Philippines	3.6 mbps	4.4 mbps
ASEAN Average	20.64 mbps	6.12 mbps

Source: *Net Index, May 5th, 2015*

Table 27: Case Study from the ASEAN Region – Vietnam

Part of Vietnam's development strategy is to strengthen the information and technology sector by spreading countrywide broadband information infrastructure, through wireless broadband. [127] From 6.9 million subscribers of mobile data communications in 2008, the figure was estimated to rise to 22.4 million in 2014. The number of mobile subscribers will reach 23 million, giving the country tele-

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[125] Submarine Cable Networks, "China Unicom Announces to Land AAE-1 Cable in Myanmar" (November 2014) and "SEA-ME-WE 5 Consortium Concludes Construction Agreement" (March 2014).
[126] Myanmar Times, "MYTHIC set to compete" (February 2015).
[127] International Telecommunications Union "Wireless Broadband Masterplan for the Socialist Republic of Viet Nam" (October 2012).

density (number of mobile phones for 100 people) of nearly 141 percent, among the highest such figures in the world (up from 130 in 2011).[128] The growth is fuelled by the increased use of pre-paid technology and easier availability of low-cost handsets.

The International Telecommunication Union's ICT Development Index (IDI) which measures countries across the digital divide and potential showed in its 2011 report[129] that Vietnam had increased its IDI score from 2.76 in 2008 to 3.53 in 2010, ranking 81st out of 152 nations measured. The growth was primarily due to increased broadband penetration.[130]

Current Configuration of Access to Global Internet

The diagram below is a simplified version of how Myanmar's Internet traffic is routed to the global Internet through high-speed hubs.

Figure 3: How Myanmar's Internet Traffic is Routed
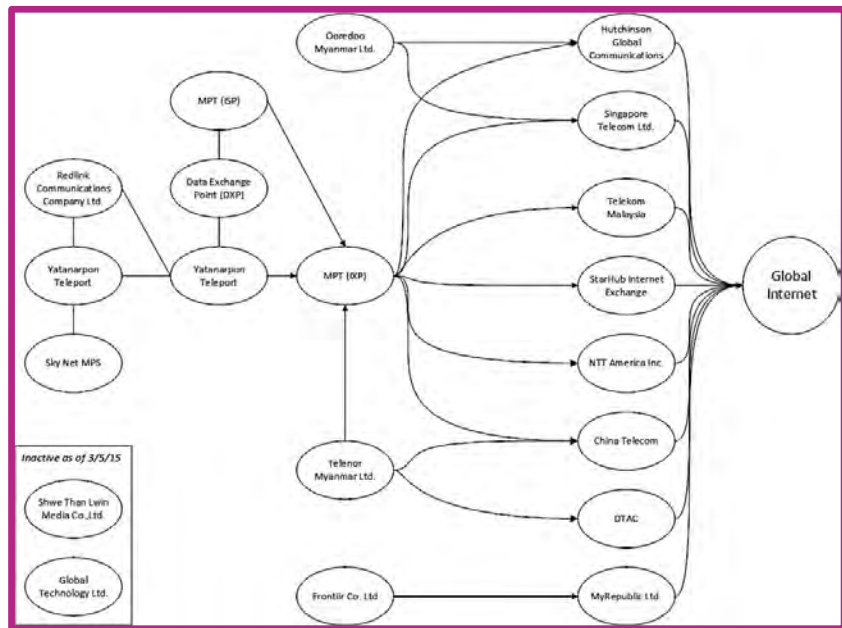
Source: Yatanarpon Teleport, Hurricane Electric BGP Tool Kit, http://bgp.he.net/ (May 2015)

While the diagram demonstrates an increased number of companies offering international Internet connectivity, it also shows that Myanmar is still at risk of an Internet service disruption due to the current configuration of Internet services[131]. MPT carries the majority of Internet traffic, including serving approximately 8.4 million mobile customers (Telenor

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[128] According to some reports, Vietnam's tele-density now stands at 145 per 100 people. (See: https://www.techinasia.com/vietnam-100-people-145-mobile-phones)

[129] ITU, "Measuring the Information Society" (2011).

[130] Tuoitrenews, "One in three Vietnamese use smartphones" (13 September 2014).

[131] 'Fibre cuts slow internet speeds', Myanmar Times, 17 August 2015

and Ooredoo currently serve 6.4 million and 3.3 million mobile customers respectively).[132] If MPT's routing were disabled, this would effectively disable Internet access for 8.4 million mobile subscribers, and fixed-line Internet subscribers from Redlink (wireless broadband), Elite fibre to the home, Fortune fibre to the home, and Yatanarpon Teleport from accessing the global Internet.

Cost of Internet Access

The price of Internet access in Myanmar (both fixed line and mobile) remains a barrier for many potential customers. A study of broadband infrastructure in the ASEAN region by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) highlighted the disproportionate cost of Internet access in Myanmar relative to nominal GDP per capita compared to its ASEAN neighbours.

Table 28: Comparison of Broadband Access Costs Across ASEAN

Country	1Mbps broadband subscription (including installation) as a percentage of nominal GDP per capita
Myanmar	132.8%
Cambodia	48.75
Lao PDR	27.4%
Philippines	11.2%
Vietnam	7.05%
Indonesia	5.5%
Thailand	0.5%
Singapore	0.1%

Source: UNESCAP, "An In-Depth Study of Broadband Infrastructure in the ASEAN Region"
(August 2013)

In March 2015 Myanmar joined the Alliance for Affordable Internet (AFAI). The Alliance is an ICT sector coalition that focuses on combining advocacy, research, and knowledge sharing to influence broadband policy. AFAI's goal is to realise the "UN Broadband Commission's target of entry-level broadband priced at less than 5% of monthly income".[133] Following a signing ceremony in Yangon, a multi-stakeholder meeting was held between members of civil society, private sector and Government[134] to establish priority areas for implementation in Myanmar which were identified as infrastructure sharing, taxation, data collection, and a Universal Service Fund. Quarterly multi-stakeholder meetings are envisaged. While it is unclear how all this will be implemented, Myanmar's draft Telecommunications Masterplan has outlined some first steps, including the aspiration that broadband Internet expenditure for typical usage does not exceed 5% of Myanmar citizens' income.[135] The approach of working through sector issues in a multi-

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[132] Jared Ferrie, "SIM Sales Soar as Myanmar Races to Catch Up in Telecoms" (May 2015)
[133] Alliance for Affordable Internet, "Vision and Strategy" (last accessed August 2015).
[134] Alliance for Affordable Internet, "Working Toward Universal, Open & Affordable Internet in Myanmar" (March 2015).
[135] See Myanmar "Draft Telecommunications Masterplan" (July 2015), pg. 7.

stakeholder way is something that would have been unprecedented even a few years ago.

C. Sector-Wide Impacts

Economic Impacts

In the 2014-2015 fiscal year, foreign investment in the telecommunications sector in Myanmar has been estimated to contribute over $2 billion of $8.1 billion in total foreign direct investment (FDI).[136] In terms of total FDI, the Myanmar Directorate of Investment and Company Administration (DICA) ranks 'Transport and Communication' fourth behind oil and gas, power, and manufacturing.[137]

A robust ICT sector can be economically transformative, reshaping existing industries through increased efficiency and productivity, facilitating cross-sector growth, and raising GDP per capita. The World Bank has estimated that in developing countries, a 10% increase in tele-density (defined as the number of telephone connections per 100 people) correlates with a 0.8% increase in GDP per capita, while a 10% increase in Internet penetration (Internet connections per 100 people) and broadband penetration (broadband connections[138] per 100 people) result in 1.12% and 1.38% increases in GDP per capita respectively.[139]

It has been estimated that by 2030 the ICT sector could contribute $6.4 billion to Myanmar's GDP and employ approximately 240,000 people. [140] It will be important however, for the Government and companies investing to consider what is appropriate technology for the country. Some types of ICT are more appropriate to the Myanmar context now and in the near future and therefore represent higher priorities, while other technologies may represent high costs, with low benefits, given its state of development.

Impacts on Agricultural Productivity

ICTs can improve the availability and sharing of market information (pricing and demand), via SMS text messaging or voice calls. The agricultural value-chain in Myanmar is comprised of farmers, fisherman, input suppliers (seeds, fertiliser, pesticide, etc.), processors, brokers, direct buyers, and transport/logistics providers. While specific studies on the economic impacts of ICTs on Myanmar's agricultural sector are lacking, the World Bank notes that in other regional markets the effect of increased market information from ICTs on farmer income and prices is generally positive, while traders leveraging ICTs can

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[136] Deal Street Asia, "Myanmar 2014-15 FDI Swells to 8.1b: Govt Agency" (April 2015).
[137] See DICA's "Foreign Investment by Sector (April)" (last accessed August 2015).
[138] The World Bank defines broadband as high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fiber-to-the-home/building and other fixed (wired)-broadband subscriptions.
[139] Christine Zhen-Wei Qiang, "Mobile Telephony: A Transformational Tool for Growth and Development", (4 May 2015).
[140] McKinsey Global Institute, "Myanmar's Moment: Unique Opportunities, Major Challenges" (Jun 2013),p43.

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also boost margins.[141] Outside of providing market information, ICTs can also be used to distribute pest or weather alerts and subsequent management advice. In Myanmar, Ooredoo has released a mobile agriculture application called 'The Farmer' which is designed to promote knowledge sharing among farmers, and to boost crop yields through highlighting best agricultural practices.[142] In the future, technologies like wireless sensing will improve farmer's ability to collect and utilise information. This might include measuring the nutrient content of soil or measuring nitrogen levels in crop, which can further boost productivity.[143]

Impacts on Small and Medium Sized Enterprises (SMEs) and Services

Increased access to market information through ICTs is also impacting SMEs. During MCRB's field research, merchants in Shan State noted that ICT usage has decreased travel time and logistics cost. Instead of traveling to the Chinese border at Muse to assess market conditions, merchants now use messaging applications such as Line, WeChat, and Viber to check available stock, coordinate bulk purchases, and arrange transport for goods e.g. textiles from Muse to Taunggyi.

Adoption of ICTs is supporting the growth of new businesses and start-ups in Myanmar. Improved telecommunications access has also resulted in new payment options for e-commerce. Myanmar's national payment network recently offered cardholders (nearly 900,000 in Myanmar) the ability to pay for purchases online using their debit cards.[144] While logistics and shipping pose a challenge to e-commerce providers in Myanmar, local e-commerce offerings are beginning to emerge.[145] McKinsey estimates that Myanmar's consuming class could expand to 19 million people by 2030.[146] Services are also experiencing growth. A call centre based in Yangon serving customers of mobile-network operators reports receiving around 30,000 calls per week.[147]

In addition to e-commerce platforms and services, start-ups have emerged in Myanmar offering educational mobile applications, classified listings for automobiles and jobs, health services, social networks, and search-engines. Many start-ups continue to face operational challenges including hiring qualified employees and accessing capital. To support entrepreneurship, UNESCAP has recommended that policy makers "*subsidise start-up costs partially through seed capital and start-up loan programmes*".[148] While access to capital is a problem, ICT start-ups face additional challenges related to 'copy-cat' applications given Myanmar's lack of intellectual property protections and challenges monetising their services. Paid applications or direct carrier billing are currently not available in the Google Play app store, forcing start-ups to rely on advertising revenue.

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[141] The World Bank aggregated data from 10 regional studies measuring the impacts of additional market data facilitated by ICTs on farmers, traders, and consumers. See Page 208 of the World Bank's "ICT in Agriculture Sourcebook" (last accessed August 2015) for further analysis.
[142] For further information, see Ooredoo Myanmar "mAgriculture" (last accessed August 2015).
[143] The World Bank, "Increasing Crop, Livestock, and Fishery Productivity through ICT" (2012).
[144] "2C2P and Myanmar Payment Union Launch Myanmar's First E-Commerce Payment Platform"(Feb 2015)
[145] See http://www.kaymu.com.mm/ and http://www.zawgyimart.com/
[146] McKinsey Global Institute, "Myanmar's Moment: Unique Opportunities, Major Challenges" (Jun 2013) p59.
[147] Mizzima, "I didn't expect the market to open so fast" (February 2015).
[148] UNESCAP, "A New Policy Framework for Myanmar's SME" (February 2014), p26.

Impacts on Tourism

ICTs are supporting the growth of the tourism sector in Myanmar, which was estimated to contribute $905 million to the Myanmar economy in 2014.[149] In September 2014, the Ministry of Immigration and Population launched an e-visa system, available to tourists from 41 countries.[150] This system is accessible online, allowing tourists to apply for and pay the visa fee online. Tourist visa are usually approved in 72 hours. ICTs are also supporting improvements to booking and reservation management for airlines and hotels. Most of Myanmar's major airlines now offer online ticketing options, while hotels and guesthouses are listing rooms on websites such as Agoda, Expedia or Booking.com (to the detriment of local hotel and flight booking agents)[151]. In top tourist destinations such as Bagan and Inle Lake, small business owners are using social media to promote their services to visiting tourists and build a brand. Tourists are able to post reviews and photos, which can increase (or decrease) repeat or future business.

Improved telecommunications is also supporting expanded payment options for visitors. While still not widely accepted, some restaurants and hotels are beginning to accept payment by credit card. This, in addition to the number of ATMs now in operation throughout Myanmar's major cities, provides tourists with greater flexibility to make unplanned purchases for example of souvenirs and crafts, providing local economic benefits.

Impacts on Migration – Communication and Remittances

MCRB's field assessment found that it remains common for recent graduates of technological universities in Myanmar to migrate to Thailand or Singapore for better job opportunities. While a new graduate could earn $200-$300 per month at a local Myanmar ICT company, field research indicated entry-level salaries in comparable roles ranged from $1300 to $2000 per month in Singapore.

Remittances from skilled and unskilled Myanmar migrant workers provide essential support to livelihoods, education, and health.[152] It is estimated that inbound remittances to Myanmar total approximately $8 billion per year with half of transactions taking place outside of formal systems.[153]   This is approximately 13% of Myanmar's $59.4 billion 2012 GDP.[154] While some are able to send money home with friends, many rely on informal systems such as the 'hundie' network for remittances. This system is based on a network of agents and brokers who can transfer money between countries. Fees can range from 0.01 to 2% depending on exchange rate fluctuations. In other informal transfer systems fees can reach as high as 20%.[155]

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[149] Mizzima News, "Myanmar Tourism to Earn US$900 Million in 2014, (December 2014).
[150] The Straights Times, "Myanmar Targets 5 Million Tourists with E-Visa" (September 2014).
[151] Myanmar Times "Local tourism companies face online competition" (26 May 2015).
[152] Andy Hall, "Myanmar Migrant Workers, Briefing and Recommendations" (April 2012).
[153] Aye Thidar Kyaw, "Hundi Remittance Lives On" Myanmar Times (July 2014).
[154] UNDATA, "Myanmar 2012 GDP Data" (last accessed August 2015)
[155] Gwen Robinson, "The True Cost of Expat Workers Sending Cash Home Remain Hidden" Financial Times (March 2013).

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Informal systems are generally based on trust and personal relationships, leaving customers with few options for remedy if complications arise during the remittance process. Use of ICTs (both online banking and mobile money) provides an opportunity for increased transparency and accountability for both parties involved in the transaction. Use of ICTs can also improve the speed, reliability, and convenience of sending money domestically and internationally.

Furthermore, the enhanced connectivity of the country now means that Myanmar banks can offer online banking services and international remittances or payments. There are currently four banks[156] permitted by the Central Bank of Myanmar to provide formal remittance transfer from Malaysia, Singapore, and Thailand through partner banks. Fees for remittance services may be flat rate or variable rate, depending on the bank's partner agreements and the total amount of money being sent.

However, usage of formal money transfer systems is limited for a variety of reasons. For some, proximity to bank or money transfer branches is problematic. In many rural communities, bank or transfer branches do not exist. In the event that branches are nearby, many are reluctant to use formal services due to a broader distrust of Myanmar's banking system. Required paperwork is also problematic for migrants, some of whom do not have national registration cards, work permits, or passports. Alternative money transfer services such as Western Union, Money Gram, and Xpress Money are also now available in Myanmar due in part to increased connectivity, but often include higher transaction fees than using the hundie system.

Mobile Banking and Mobile Money

Distrust of the formal banking system is rooted in historic experiences such as demonetisations of Myanmar's currency in the 1980s and the 2003 bank runs. MDRI-CESD has estimated that formal banking penetration is only around 10% in urban areas and "*considerably lower in rural areas*".[157] Sending money in Myanmar can be time-intensive and unreliable for both banked and unbanked individuals. If an individual does not use a bank account, transferring in money may require someone to hand carry or ship the money on a bus to its intended destination. 'Carrying costs' are often deducted along the way by couriers, resulting in short payments or receipt disputes.

As mobile penetration continues to increase in the country, there is an opportunity for a variety of new financial services that utilise mobile technology. Online banking (sometimes differentiated as 'mobile' or 'Internet' banking) typically refers to customers accessing formal banking services through a mobile or desktop device connected to the Internet. For mobiles, a bank-specific smartphone application is typical, whereas desktop access is typically through a bank's website. In Myanmar, a variety of banks currently offer online banking services which allow customers to view their account balances, send money to fellow customers, check exchange rates, and find ATM locations nearby. In order to use

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[156] Asia Green Development (AGD), AYA, KBZ and CB Banks
[157] See, MDRI-CESD, "Cash In Context: Uncovering Financial Services in Myanmar" (2015), pg 15.

an online banking service (app or desktop based), a user would need to be a bank customer with a checking or savings account.

In contrast to online banking, mobile money (or mobile payments) services are targeted towards unbanked users. Two thirds of Myanmar's population live in rural areas. A recent report on financial inclusion by Proximity Designs noted long physical distances from a village to the bank and limited business hours deter potential customers who already perceive setting up a formal bank account as a complicated, time intensive process.[158] Mobile money services attempt to address these issues through a simplified new customer registration process and a network of agents located throughout the country providing cash in and cash out services. After adding money to their account, a user is able to send money to other users, or pay for goods such as mobile top up. For money transfers, mobile money can increase convenience as well as enhance transparency, eliminating transport costs and creating a digital record of transactions visible on both sides of the transaction.

In December 2013, the Central Bank of Myanmar issued the "*Mobile Banking Directive*" allowing banks to offer mobile money services.[159] The Central Bank of Myanmar is reportedly in the process of drafting mobile money regulations that would allow entities outside of financial institutions – such as mobile network operators – the ability to provide mobile money services. Telenor has announced plans to partner with Yoma Bank to offer mobile money services, pending the necessary regulatory frameworks for non-bank-led mobile payments.[160] While Ooredoo has not announced specific mobile money plans for Myanmar, Ooredoo is a member of the GSMA's Mobile Money Interoperability (MMI) Programme. MPT and MECtel have partnered with Myanmar Mobile Money. In addition to targeting domestic payments, some operators have expressed interest in also targeting international remittances from sent from Myanmar to migrant workers in Thailand and Malaysia.[161]

Governance impacts

This section examines the ICT sector's contribution to improved governance in Myanmar through its ability to enable inclusive engagement between citizens and Government, increased transparency, accessibility of information, and citizen participation. Positive governance impacts can occur through e-Government programs, commitment to open governance, and civic technology (see Table 29).

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[158] See Proximity Designs, "Afford Two, Eat One: Financial Inclusion in Rural Myanmar" (2014), pg 83.
[159] Edwin Vanderbruggen and Altas Dharamsi, "Easy Money? Mobile Banking, Mobile Money, and Myanmar's Financial Regulation" (May 2014).
[160] Jeremy Mullins, "Stay Tuned for Mobile Banking Services from Yoma and Telenor say CEOs", Myanmar Times (November 2014).
[161] On 21st May 2015, Telenor Myanmar held Sustainability briefing in Yangon. During the Q&A portion of this session, an audience member asked about Telenor's mobile money plans. Telenor Myanmar explained that pending needed regulation, Telenor Myanmar would partner with Yoma Bank. Longer term, Telenor Myanmar indicated they are hoping to partner with Telenor Thailand (DTAC) or Telenor Thailand (DiGi) to pursue international remittances through mobile money.

Improving Open Governance & the Open Government Partnership (OGP)

The Myanmar Government has committed to joining the Open Government Partnership (OGP) by 2016. The OGP is an international platform of 68 governments aimed at making their governments more open, accountable, and responsive to citizens. However Myanmar is not yet eligible to participate in the OGP. Prospective members are evaluated on objective data using a point system and must earn a minimum score of 75 across four categories: fiscal transparency, asset disclosure by public officials, access to information, and citizen engagement. In addition, prospective members must make a specific commitment to the OGP principles and develop an effective consultation process with civil society to develop a national action plan.[162]

OGP is about changing the culture of government to one where it is open by default and where citizen participation is a routine part of policy development. If citizens can engage in public debate, provide input, and make contributions this will lead to more responsive, innovative and effective governance. OGP is particularly about promoting accountability, requiring government actors to justify their actions, act upon criticisms or requirements made of them, and accept responsibility for failure to perform with respect to laws or commitments. If the Government of Myanmar carries through with its commitments to the OGP, the initiative has the power to transform the relationship between the Government and its citizens through the use of ICT.

Although the Government Steering Committee and Working Committee have been announced, both committees lack a website or readily available public information on their plans and activities, and also lack diverse stakeholder representation, including civil society participants. Myanmar CSOs have raised concerns that there may be more pressing priorities than OGP including constitutional reform, justice and a genuine peace process, rule of law, and urgent legal and judicial reform.[163]

Table 29: The Emergence of Civic Tech[164]

Focus Area	Definition
Visualisation and Mapping	Enable users to make sense of and gain actionable insight from civic data sources, specifically through the visualisation and mapping of that information
Data Utility	Empower users to analyse Government data and leverage data to improve service delivery
Data Access and Transparency	Promote Government data availability transparency and accountability
Voting	Support voter participation and fair election processes
Public Decision Making	Encourage resident participation in large-scale deliberative democracy and community planning efforts
Resident Feedback	Provide residents with opportunities to interact with Government

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[162] See OGP, "How to Join" (last accessed August 2015).
[163] Burma Partnership, "Statement from Open Government Partnership Awareness Workshop for Civil Society" (January 2015).
[164] See: Knight Foundation, "What does the civictech landscape look like?" (last accessed August 2015).

| | officials and give feedback about public service delivery |

Source: Knight Foundation, "[The Emergence of Civic Tech: Investments in a Growing Field](#)" (2013)

E-Governance Master Plan

See [Chapter 2](#) on ICT Government Institutions, Policies and Legal Framework.

ICTs and Law Enforcement

During the 2007 Saffron Revolution, ICTs facilitated the flow of information domestically and internationally, highlighting the violent Government crackdown on peacefully protesting Buddhist monks, even though mobile penetration in Myanmar was less than 1%. Today, national mobile penetration is approaching 50%. As more people in Myanmar have access to mobile devices with cameras, this has increased transparency around the conduct of law enforcement. In March 2015, photos and video of student protesters in Letpadan being beaten by police were uploaded online and ICT users accessed local and international news reporting on the protests from their mobile devices.

ICTs can support checks and balances on law enforcement. But law enforcement is also expanding operations into the digital realm. Following police crackdown on student protesters in Yangon, activists reported their phones being tapped and social media accounts being hacked by law enforcement agencies. (See 4.4 Surveillance)

Table 30: Case Study on ICTs and the Kenya Election

The disputed 2007 Presidential election in Kenya resulted in an outbreak of post-election violence that left over 1,000 people dead and over 600,000 people displaced. Post-election inquiries into the violence acknowledged the role of SMS messages and online blogs in exploiting tensions between ethnic communities and inciting violence.

In the run up to the 2013 elections, concerns of another outbreak of violence and fears over the potential of SMS to simultaneously send messages that incite violence led the Kenyan mobile operator Safaricom to take action. Recognising the potentially negative role of bulk SMSs sent by politicians during the last elections, Safaricom decided to develop its own code of conduct in vetting bulk SMS content that political parties, politicians and aspirants wished to send in the run up to the 2013 elections. In 2012, Safaricom developed *Guidelines for Political Mobile Advertising on Safaricom's Premium Rate Messaging Service.*[165] Under these guidelines, anyone intending to send bulk SMS of a political nature would first have to submit an application to Safaricom, which would vet the content to ensure they did not contain instances of hate speech. In addition to this, Safaricom sought and received the support of the Government and the Communications Commission of Kenya (CCK) to develop and

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[165] Bloggers Association of Kenya, "[Safaricom Issues Tough Guidelines For Political Messaging](#)" (15 June 2012).

release *Guidelines for the Prevention of Transmission of Undesirable Bulk Content/Messages Via Electronic Communications Networks* [166] in October 2012, which then applied to all mobile network operators in the country.

See: IHRB, *Corporate Responses to Hate Speech in the 2013 Kenya Presidential Elections. Case Study: Safaricom* (2013)

ICTs and the Forthcoming Elections

ICTs have played a key role in sparking democratic movements. Governments have sometimes responded by shutting down all or parts of networks, as happened during the 2007 Saffron Revolution in Myanmar and the 2011 Arab Spring in Egypt. But ICTs have also been implicated in incitement of violence (see Kenya case study, Table 30). Governments in many countries have proposed imposing other restrictions that can have widespread impacts on users.

With elections due in November 2015, social media will facilitate political discourse. While social media have been shown increase a user's exposure to diverse viewpoints[167] in some cases it has been found to do the opposite. A recent study of the diffusion of information over social media for U.S. voters found that "*voters of all groups are disproportionately exposed to like-minded information*".[168] Many social media platforms are designed to surface information that is "relevant *to users*" based on their social media contacts, 'Liked' or 'followed' pages, and reading habits.[169] For example, in a Myanmar context the Facebook followers of controversial monk U Wirathu are most likely Friends or followers of like-minded individuals. This could result in statements classified as dangerous speech (statements which could provoke an emotional response) spreading at a rapid pace. See also Chapter 4.2 on Hate Speech.

Cultural Impacts

Localisation and Access to Information

The successful realisation of positive sector-level impacts ranging from economic growth, e-governance and social inclusion depends on increasing access to information to allow the full range of Myanmar's population to participate in Myanmar's growing 'information society'. To support that participation, ICTs must be localised for Myanmar users. This 'localisation' means adapting technology to support a user's local language and culture.

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[166] Communications Commission of Kenya, "Guidelines for the Prevention of Transmission of Undesirable Bulk Political Content via electronic Communications Networks" (August 2012).
[167] Pablo Barberá "How Social Media Reduces Mass Political Polarisation: Evidence from Germany, Spain, and the U.S." (October 2014).
[168] Yosh Halberstam, Brian Knight, "Homophily, Group Size, and the Diffusion of Political Information in Social Networks: Evidence from Twitter" (November 2014).
[169] On April 21, 2015 Facebook announced changes to its news feed designed to prioritise content that was relevant to users. See "News Feed FYI: Balancing Content from Friends and Pages" (April 2015).

This includes hardware, software, and educational material or user manuals. It also refers to meeting a user's local needs,[170] which can be achieved through supporting content creation in local languages and offering relevant applications. Content that is relevant to a farmer may be different from content relevant to a younger urbanite. [171]

Inclusive development in the ICT sector will depend on the accessibility of ICTs, beyond functioning telecommunications networks. Users must be able to interact with technology, produce and consume content, and communicate in their local language across a multitude of devices and software. For all services, providing users with the option of interacting with the software's user interface in their local language will support a user's familiarity with managing profiles, accounts, and devices. For social media, this might include translating community standards and instructions on how to use content reporting mechanisms into the local language. Analysis by the International Development Research Centre (IDRC) emphasises that the components of language localisation are interdependent and that localisation extends beyond basic communication, impacting "*matters of culture that are inherently political, economic and social in nature*".[172]

For users in Myanmar, interacting with online services is still a new experience, including how to set up accounts for email and social media services. Around various neighbourhoods in Yangon and Mandalay, street vendors offer to set up individual Facebook and Gmail accounts for new Myanmar users, charging from 1,000 to 5,000 MMK. Currently, localisation debates in Myanmar centres on which type of font to use. There are currently two options available to users: Zawgyi font (commonly used with 'Bagan Keyboard' app for Android phones) and Unicode fonts such as Myanmar 3.

Unicode itself is not a font, but a universal encoding system that enables people around the world to use computers in any language. Fonts themselves can be compliant with the Unicode standard. Unicode features standardised character ordering, which allows for consistent searching in search engines or databases, sorting, and information retrieval across multiple platforms, countries and languages. Outside of Myanmar the majority of websites are also encoded using Unicode (popular examples include Facebook and Wikipedia) and large commercial software and hardware providers such as Apple, Microsoft, and Google now support Unicode in their newest products by default.

Zawgyi is the predominantly used Myanmar language <u>font</u>, but uses a different system to Unicode to encode text to data and data to text. Characters in Zawgyi font can be entered in various ways, creating problems for search and retrieval, whereas Unicode is standardised. If a user does not have Zawgyi font installed on their Android device, they will not be able to read anything typed in Zawgyi. Regardless of the technical benefits of Unicode, the majority of Myanmar users continue to use Zawgyi font based on familiarity.

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[170] Sarmad Hussain and Ram Mohan, "Localisation in Asia Pacific" Digital Review of Asia Pacific (last accessed August 2015).

[171] See PAN Localisation, "Expanding Digital Literacy through Localized ICTs Experiences of PAN Localization Project 2007 – 2010" (2012), pg 46. The study found that the development and effective distribution of relevant local content,[171] combined with localised ICTs, built digital literacy faster. Researchers in the study noted, "*…After training on localised ICTs, non-users of the computer were not only using the computers for routine tasks but also provided trainings to others*".

[172] Chaitali Sinha & Raymond Hyma, "Connecting ICTs to Development: The IDRC Experience" (2013) p102

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While official data on Zawgyi's user base is not available, members of Myanmar's ICT community estimate 75-80% of users in Myanmar type in Zawgyi.

Some members of Myanmar's nascent developer community have opted to offer their applications in English only.[173] Others have taken steps to support broader information accessibility as Myanmar's ICT community migrates to full Unicode support. While Google Translate allows users to input text in Zawgyi, output text is in Unicode. The Myanmar Computer Federation (MCF), an umbrella organisation for computer-related groups and associations, now includes a Zawgyi-Unicode two way conversion tool on their website.[174] Previous attempts to compel users to switch from Zawgyi to Unicode have been unsuccessful when framed as a mutually exclusive choice between the two. However greater migration to Unicode will increase content that is searchable and retrievable through search engines and databases. This will have positive education, transparency and governance impacts.

Supporting Ethnic Language Use and Content

ICTs can positively impact people's ability to access and understand information. But in some cases, it can have the opposite effect. The IDRC notes *"…ICTs can also be used to crowd out minority languages due to content in a dominant language being more readily available and spread."* [175] With over 100 languages spoken in Myanmar, language localisation is essential to ensure all communities have the potential to benefit from new technology. Unicode is a powerful resource, providing support for Shan, Mon and Karen languages.[176] Allowing users to type in their local language enables content creation, which in turn can support users developing familiarity and comfort interacting with ICTs.

Table 31: Language Localisation Challenges in the Danu Community

> Myanmar's linguistic context is complex and continuing to evolve, evidenced by the Danu people of Shan State who speak a dialect of Burmese. During MCRB's field research in Shan State, Danu villagers noted that there is on-going debate around alphabet use in the Danu community. Because Danu people do not have their own alphabet, they have adopted Burmese alphabets to teach their children but spellings may vary between Burmese and Danu. Some Danu people are thinking of creating their own alphabet based on old Burmese alphabets dating back to the 16-18 century. In the future, ethnic language support for the Danu language would include keyboards and software to support the newly created alphabet.

While ethnic language fonts are not currently available on the Myanmar Computer Federation (MCF) homepage, MCF now provides links to Myanmar3 (Unicode font) and Pyidaungsu Font (a font package for iOS devices, the operating system designed and

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[173] For an example see, Tim Mclaughlin "The Uber of Myanmar" (March 2015).

[174] Myanmar Computer Federation, "Zawgyi – Unicode Conversion Tool" (last accessed August 2015).

[175] See IRDC, "Connecting ICTs to Development: The IRDC Experience" (2013), pg 101.

[176] As an example, Shan Unicode resources are located at http://www.shanunicode.com/.

used by Apple). By highlighting access to these language resources, and MCF's Zawgyi-Unicode conversion tool online, this should benefit users. As the ICT sector grows, there will be further opportunities to direct users to centralised language resources. In Cambodia for example, the Khmer Software Initiative website contains a collection of software, fonts, and resources that can localise proprietary software (such as Windows or Apple OSX) while also providing a variety of localised open source downloads such as Open Office, and Open Suse, a free Linux based operating system.[177]

Social Impacts

Digital Literacy

With SIM cards and entry level Android smartphones costing 1,500 MMK and 50,000 MMK respectively, owning an Internet connected mobile phone is starting to be financially realistic for much of the population. While official data on digital literacy in Myanmar is limited, the increase in mobile penetration over the past 15 years suggests many users are interacting with online services for the first time over an Internet connected mobile phone. A 2014 study by OnDevice Research conducted prior to the commercial launches of Telenor and Ooredoo found that 49% of Myanmar's Internet users accessed the web via a mobile device.[178]

In Myanmar many social interactions are moving to digital venues, such as social media. Many users accessing the Internet for the first time perceive Facebook as 'the Internet'. Myanmar currently has approximately 3.28 million Facebook users, a number that will only increase with additional mobile penetration and Internet access.[179] Messaging and chat applications such as MySquar, Viber, Line, WeChat, and Facebook Messenger are very popular in Myanmar.[180] These applications allow users to send messages over the Internet which is often cheaper than sending an SMS text message between two phones. They offer additional features such as gaming, video calling, online stickers, and media sharing. Viber now incorporates features such as 'public chats' which are conversations anyone can see. Hush, a new mobile application in Myanmar, allows users to post messages and questions that are publicly visible but identify the author only by location.

Digital interactions provide a space for personal expression. But there are significant emerging risks accompanying ICT usage, which new users of Myanmar's growing ICT sector need to be aware of, including responsible social media interaction and managing data privacy online. The ICT Master Plan called for the "*establishment of the National Committee for Information Culture Movement*" to promote e-awareness in Myanmar society. However, to date there has been little action from the Government on promoting e-awareness.   Furthermore, Myanmar's education system, which is based on rote learning, rather than critical thinking and analysis, does not generally build the skills

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[177] See examples in Cambodia via KhmerOS at http://www.khmeros.info/.
[178] OnDevice Research, "Myanmar: The Final Frontier of the Mobile Internet" (July 2014).
[179] DVB, "Govt, facebook to purge hate speech accounts" (14 Sept 2015).
[180] Myanmar Times, "MySQUAR Aims for Listing in London" (May 2015).

needed to debate the ethics of the complex societal issues which arise from ICTs, and identify appropriate rights-based solutions.

Table 32: A Myanmar Civil Society Initiative on Responsible Use of Social Media

Panzagar (Flower Speech) is a grassroots campaign[181] founded by Nay Phone Latt, Executive Director of Myanmar ICT for Development Foundation (MIDO). Panzagar aims to promote responsible use of social media, and raise awareness of the implications resulting from online behavior. Panzagar has partnered with local graphic designers and Facebook to create a set of 'digital stickers' users can stick in comments or messages online. (See Chapter 4.2 on Hate Speech for further details)

Use of ICT for Exploitation and Degrading Treatment: Cyber Bullying, Online Harassment, Non-Consensual Pornography (Revenge Porn)

While not defined in international law, cyber-bullying refers to bullying that takes place over any electronic technology, including mobile phones, laptops, tablets, and desktop computers as well as online services such as emails, social media, instant messaging, or over a phone call. Cyber-bullying is deliberate and can include threats, insults, or rumours targeted solely at the victim and others to a larger audience online. Cyber-bullying can occur in numerous forms, and the impacts can be severe.[182] An emerging trend in cyber-bullying is called 'doxxing' which refers to the public sharing of an individual's personal identifying information online. In August 2015, Yangon police authorities publicly highlighted that anyone using ICTs to disturb, threaten or defame others in a sexual manner could face penalties of three to five years' jail and/or a fine.[183]

In 2011, a Myanmar woman studying in Singapore committed suicide after her ex-boyfriend posted public comments on her Facebook page accusing her of sexual promiscuity.[184] More recently, other women have reported threats of blackmail online. Blackmailers have threatened to distribute public profile pictures, along with posting degrading rumours online, and demanded mobile top up cards as payment to prevent the posting of personal information.[185] Women have reported receiving lewd photographs from individuals using fake Facebook accounts, who then demand that the women send them nude photographs.

Non-Consensual Pornography (also referred to as 'Revenge Porn') is an emerging risk for Internet users around the world. This form of harassment can occur across ICTs (social media, chat applications, email, etc.) and involves the public distribution of photographs or video that was shared privately between two people. When private intimate content is shared publically, it can often go viral, spreading beyond the original platform it was

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[181] For more information on Panzagar see https://www.facebook.com/panzagar and Travelling Panzagar
[182] *ibid*
[183] Myanmar Times, "Cyber sex offenders get time" (10 August 2015).
[184] Asia One, "Ex-boyfriend called her a 'loose woman'", (April 2011).
[185] See 7 Day News Print Daily (20 May 2015).

posted to, leaving the victim with limited options for remedy. [186] Major social media platforms have taken steps to address revenge porn. In March 2015 Twitter, Reddit, and Facebook updated their community standards to prohibit the posting of revenge porn.[187] While these moderation mechanisms exist, users in Myanmar may be unaware of how to access them.

Child Safety Online

Children can be particularly vulnerable to digital dangers when using ICTs. This can include cyber-bullying or harassment online, accessing inappropriate content, or sexual exploitation. Children that are targeted online can experience various degrees of trauma that can affect their performance in school, social relationships, and mental health.

Limited information is available regarding the risk of child sexual abuse images in Myanmar, but high levels of poverty combined with improved Internet access poses new risks. There is little evidence that this has been a priority for child protection agencies or NGOs in Myanmar to date, given low Internet penetration levels. This is an area where awareness raising, appropriate standards and stronger penalties will be required. Under Section 66 of Myanmar's *Child Law*, the production or resale of child sexual abuse images can result in maximum fine of 10,000 MMK (approximately US$8) and a two-year prison sentence.[188]

Education

ICTs interact with the education sector in at least three ways:

■ *ICT Education* focused on students learning how to program or use software applications and/or training future ICT technicians/experts. See below for the status of ICT Education in Myanmar
■ *ICT in education* focused on teachers incorporating ICT into teaching in the classroom, e.g., multimedia classrooms, Powerpoint to support lectures, use of computers for testing or tracking student records, etc). The potential benefits of expanding ICT in primary and secondary education in Myanmar must be carefully assessed against international evidence as well as the high capital and recurrent costs this would impose and the resources this would draw away from other higher impact investments in the education sector.[189]

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[186] An increasing number of governments around the world are adopting legislation that criminalises revenge porn. To accelerate these efforts, the Cyber Civil Rights Initiative (CCRI) has organised a campaign called End Revenge Porn and published a guide for legislators to assist with the development of legislation that criminalises non-consensual pornography.

[187] For example, Twitter's community standards now prohibits the sharing of private intimate photos or video. See Twitter, "The Twitter Rules" (last accessed August 2015). See also Facebook, ""Community Standards", "Sexual Violence and Exploitation" section, (last accessed August 2015).

[188] Section 4, section 84 (a) of the Myanmar *Child Law*.

[189] See for example, World Bank, "Worst practice in ICT use in education" (2010). As part of Myanmar's Comprehensive Education Sector Review (CESR), a survey of secondary schools nationwide (supported by ADB and Australia) confirms that "hardware-driven" approaches would be hugely costly: e.g., roughly 2/3 of responding rural basic education middle schools had no electricity and no computers, and virtually none had

■ *ICT for education* which may include the above, but starts more firmly from the philosophy that ICT is a tool to support education, typically requiring ICT to be strategically combined into broader approaches).

The Status of ICT Education

Accessing ICT-focussed higher education, and technical and vocational education and training (TVET), can be challenging for prospective students. There are 25 Computer Universities in Myanmar. To enter the Technical University system in Myanmar, students must achieve a certain level of 10th Grade matriculation exam marks out of a total of 600. According to 2013-2014 University entrance results, the most competitive subject is Medicine. Access is discriminatory, with male students requiring marks of 490 and female students 508 to gain access[190].

The Yangon University of Computer Studies also requires comparatively high marks (473) compared to other subject areas, as does Mandalay University of Computer Studies (450), but does not discriminate between sexes. These two Universities offer Masters and PhD courses and are better equipped than the Computer Universities in other parts of the country (which generally require around 365 marks). By comparison, Yangon Institute of Economics requires marks of 383; other disciplines e.g. Chemistry, Physics, History require less.

If students do gain access to a Computer University, they can experience further challenges. During a focus group discussion in Mandalay, local stakeholders noted that while there are four Computer Universities in Mandalay Region (two in Mandalay, one in Pyin Oo Lwin, one in Meiktila), the local university system only has enough faculty to adequately staff two. Some professors are forced to split their time between multiple universities, leaving students without support on assignments or projects. Limited human resources, combined with long commutes to universities located outside of the city and a lack of boarding accommodation results in students spending limited time on campus outside of class.

Curriculum in the public Technical University is disconnected from the needs of employers in the sector for several reasons. Stakeholders in Yangon and Mandalay have noted that in technical terms, many aspects of the curriculum are "*ten years behind*". A well-funded Myanmar start-up based in Yangon noted difficulties hiring recent graduates with any experience developing code in newer programming languages such as Ruby on Rails or hiring a qualified iOS developer who had practical experience applying their knowledge outside of the classroom.

In some cases, updated technical training is available through private ICT education offering accredited international courses. But high costs deter the majority of potential

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more than 2 computers. The initial capital costs of computer installation would likely, in turn, be eclipsed by various recurrent costs (e.g., electricity, maintenance, upgrading/replacement, etc.).

students. Private education can cost up to $3,000 per year compared to $150 per year at public universities.

To understand the needs of the ICT labour market, collaboration between relevant Government ministries and private sector ICT companies will be required. This involves assessing desired qualifications and expanding opportunities for students to practically apply their knowledge in real-world settings such as business case competitions, or software development events such as 'hackathons'.

Health Services

Organisations in Myanmar are beginning to utilise ICTs, particularly mobile technology, to provide health services. Mobile health (mHealth) applications can be used for remote data collection or monitoring of patients, facilitating information exchange between health care providers, tracking diseases and epidemics.[191] The potential of mobile includes improved access to information for patients and providers, as well as reduced costs.[192]

Ooredoo Myanmar, through a partnership with Population Services International Myanmar and Koe Koe Tech, has launched the 'May May' (Mummy) Android app for pregnant women. The application allows users to receive weekly health notifications and locate doctors nearby. The app also includes an optional social component, through Facebook connectivity. Telenor Myanmar has also partnered with Marie Stopes International Myanmar to launch future mHealth services.[193] In September 2013, core members of the Ministry of Health's national team were trained on DHIS2[194], a powerful free software program for aggregating and analysing health information.[195]

Myanmar currently lacks legislated standards around data collection, data privacy, and data protection. As mHealth programs expand, data collection and privacy will be a major concern, particularly with at risk communities where social stigma exists. Examples of these communities may include men who have sex with men, female sex workers, or other sensitive patient populations such as those with HIV/AIDs. The disclosure of these patients' health information or a data breach could result in harassment, violence, or discrimination. This could further exacerbate challenges surrounding health outreach to these populations.

While mHealth programs are powerful tools for disseminating health information and connecting patients with healthcare professionals, mHealth applications must be adapted for use by ethnic minorities so they can access health information in their local language. Health care providers have typically relied on local health staff to translate local health

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[191] See United Nations Foundation, Vodafone Foundation "mHealth for Development: The Oppurtunity of Mobile Technology for Healthcare in the Developing World" (2011), pg 9.
[192] See McKinsey & Co, "mHealth: A new vision for healthcare" (2012) and BCG Perspectives "The Socioeconomic Impact of Mobile Health" (29 May 2012).
[193] See Telenor "Telenor and Marie Stopes announce joint mHealth initiative in Myanmar" (28 July 2014).
[194] Department of Health Planning, Ministry of Health, "eHealth in Myanmar" (December 2013)
[195] For an overview of DHIS2, please visit https://www.dhis2.org/overview.

information.[196] By supporting international technical standards (such as Unicode), health care providers and partner organisations can accelerate technical development and content creation.

Disaster risk reduction

In 2008 – when less than 1% of Myanmar had access to a mobile phone – Cyclone Nargis devastated Myanmar, claiming nearly 140,000 lives and displacing 2.4 million people. There was no early warning system in place in 2008 and the Government of Myanmar was harshly criticised for its response to the disaster. The 2011-2015 ICT Masterplan called for the use of ICTs for pre-emptive disaster response, including the establishment of a national disaster prevention network.[197] It is unclear what progress has been made against the recommendations called for in the 2011-2015 Master Plan.

As Myanmar's telecommunications infrastructure continues to improve, more people will have reliable mobile phone service, presenting a major opportunity to leverage ICTs for disaster reduction and relief, seen most recently in the July 2015 floods[198]. National early warning systems can be designed to function over SMS messaging, voice calls, and mass messaging of weather alerts or evacuation notices through cellular broadcasting. Cellular broadcasting is used for mass-messaging alerts to users in a network area.

Technology companies are also offering services to assist in disaster relief. Both Facebook and Google offer services that can be used to locate people impacted by a natural disaster. Facebook's tool, 'Safety Check', uses location data to identify a user in a natural disaster area. Users can then verify they are safe through the Facebook app, or identify others in the impact area they have verified are safe. Google's tool, 'People Finder' focuses on crowdsourcing information on missing people, which is then shared with responders in the area. While not having developed a specific tool, Viber recently offered free Viber Out (calling from Viber to any phone number in the world) calling in and out of Nepal following the devastating earthquake in Kathmandu. However, any such services need to work with emergency specialists to ensure that privacy protections are built into systems – for example there can be unintended consequences for child safety if information about unaccompanied children is posted online and accessible to all, including traffickers.

Environmental Impacts

Disposal of electronic waste/recycling

Throughout Myanmar, it is common practice to burn trash. The incidence of public or private sector rubbish collection and recycling varies across Myanmar, with some

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[196] Asia Pacifc Observatory on Health Systems and Policies, "The Republic of the Union of Myanmar : Health Systems Review", pg 59.

[197] See, MCIT, KOICA, ETRI, "The Followup Project of the Myanmar ICT Master Plan" (2011), pg 122.

[198] 'Officials use social media to fight flood rumours', Myanmar Times, 31 July 2015 and 'Social media drives flood donations, Myanmar Times, 7 August 2015

neighbourhoods being serviced by informal recycling services collecting bottles, scrap metal and paper.

Underdeveloped waste management systems in Myanmar – especially outside of urban areas[199] – are unequipped to deal with electronic waste. Electronic waste (e-waste) can be defined as "*all types of electrical and electronic equipment (EEE) and its parts that have been discarded by the owner as waste without the intention of re-use*".[200] There are some markets, such as Yangon's 28th Street, trading in electronic waste then used to refurbish devices or sold for raw materials. In some cases, supplying these markets can be dangerous for so called 'garbage hunters' or 'pickers' who are involved in the salvage process. In the informal sector, the extraction of valuable materials or components from discarded ICTs is done without proper training or protection, exposing individuals to serious health risks. Mobile phones, tablets, laptops, desktop computers, and other consumer electronics contain a variety of toxic substances ranging from heavy metals (lead, mercury, arsenic, nickel, cadmium) and plastics such as PVC that emit dioxin when burned.[201] Human exposure to these substances can result in damage to the brain, kidneys, and liver, severe allergic reactions, and cancer.

Handset use is increasing. The MCIT hopes to achieve 80% mobile penetration by 2016. With a population of 51.4 million, this would imply over 40 million mobile phone users in Myanmar. This increase in handsets and other ICT equipment will require the development of formal waste management processes for e-waste, including enhanced regulations and training for individuals participating in the informal sector. Estimates by the United Nations' STEP Initiative note that Myanmar generated 29 metric kilotonnes of e-waste in 2014, which excludes any waste that has been exported to Myanmar from other countries.[202]

E-waste can also involve foreign countries shipping their own electronic waste abroad. This trend has been documented in developed countries, where e-waste is often exported to developing countries under the guise of 'recycling' due to weaker environmental regulation, cheap labour, and lack of export controls over sending e-waste abroad.[203] Exported waste can contaminate land and groundwater. Official current data on e-waste exported to Myanmar is not readily available. A 2007 report by the United Nations Environment Programme noted that 90% of the then 20-50 million tonnes generated every year is sent to Bangladesh, China, India, Myanmar, and Pakistan.[204]

Environmental Impact from Towers

Mobile network operators require consistent power to operate their networks, as base transceiver stations (BTS) located at tower sites must be powered on 24 hours a day, 365

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[199] Yangon City Development Committee announced the privatisation of trash collection services in 2015, see Myanmar Times "Trash Talk" (15 December 2014).
[200] See STEP Initiative, "What is E-Waste?" (last accessed August 2015).
[201] See Basel Action Network, "Exporting Harm : The High Tech Trashing of Asia" (2002), pg 9.
[202] See Overview of E-Waste Information for Myanmar at www.step-initiative.org/Overview_Myanmar.html
[203] Ibid pg 8. See also, The Guardian "Toxic e-waste dumped in poor nations, says United Nations" (2013).
[204] See, United Nations Environment Programme, "Geo 4: Global Environment Outlook" (2007), pg 225.

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days per year. Each tower's power consumption can vary depending on the number of network operators with BTS located at the site. In India, Bharti Enterprises (owner of Bharti Airtel) notes that "*an average mobile tower consumes 96 kilowatts of power daily*" and that in areas where electricity is unreliable "*diesel consumption can average 24 litres per day*". [205] For reference, the World Bank notes that Myanmar's per capita power consumption is 160 kilowatts per year.[206]

Reliable energy access continues to be a major problem across Myanmar. The World Bank estimates that 70% of Myanmar's population lacks access to on-grid electricity,[207] while residents of Myanmar's larger cities where grid power is available continue to experience intermittent power outages due to high demand for electricity.[208] To address the issue of unreliable power, the majority of mobile towers in Myanmar are currently powered by a diesel generator, or by a combination of diesel generator and hybrid electric battery. While both foreign operators allude to sustainable energy usage on their respective websites, specific data regarding current renewable energy usage from Telenor and Ooredoo is not publically available.[209] MPT does not provide information online regarding energy policy, but media reports indicate that in 2014 MPT contracted Vihaan Networks Limited to install 31 solar powered base stations at tower locations located along the Yangon-Mandalay highway.[210]

Outside of renewable energy usage, there are additional opportunities to utilise mobile tower power for community-based micro grids. A Yangon based renewable energy expert notes that excess power produced by the diesel generator (potentially 2-3 kilowatts per day) could be utilised for community power while the diesel generator is running, providing community members with the opportunity to power lights or charge mobile devices through connected micro grids. This model has been adapted in India, where a micro grid connected to 40 towers has provided electricity to 30,000 households.[211] Currently there is no grid feed-in tariff that allows tower operators to sell excess energy capacity to the local community or to energy operators.

The GSM Association (GSMA) estimates power requirements for Myanmar's mobile networks will exceed 455 GWh by 2017, compared with 200 GWh in 2015.[212] Additionally, the GSMA estimates that the annual diesel requirement will reach 116 million litres by 2017, resulting in 310,676 tonnes of annual CO_2 emissions. [213] In addition to CO_2

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[205] In India, Bharti Enterprises notes that "an average mobile tower consumes 96 Kilowatts of power daily" See Bharti, "How Mobile Towers are Reducing Carbon Footprint" (last accessed August 2015).

[206] World Bank, "Project Information Document (Concept Stage): National Electrification Project" (Dec 2014).

[207] *Ibid*, pg 2.

[208] The Irrawaddy "Rangoon Power Supplier Blames Rise in Blackouts on High Demand" (May 2015).

[209] Ooredoo Myanmar notes "*As a socially responsible company we are committed to mitigating the environmental impact of our business activities. Using innovative technologies in rural areas we deploy alternative energies to power our tower sites, using solar energy as an alternative to fuel consumption.*" Ooredoo, "Respecting the Environment" (last accessed 25 Aug. 2015). Telenor Myanmar notes it will complete an environmental impact assessment in compliance with Myanmar's *Environmental Act*, and that "*Telenor is committed to minimising CO2 emissions in Myanmar, such as through the use of solar power, and the ambition will thus be to minimise energy consumption.*" Telenor "Environment" (last accessed Aug. 2015).

[210] Vihaan Networks Ltd, "Seemless GSM Connectivity for Yangon – Mandalay New Highway" (Feb 2014).

[211] The Economist "Could your mobile phone bring you light, too?" (May 2015).

[212] GSMA, "Seizing the Opportunity: Green Telecoms in Myanmar" (2014).

[213] *Ibid.*

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emissions, diesel generators cause localised particulate and noise emissions, noted as a significant issue by community members during MCRB's field research. While fuel theft does not yet seem to be a major problem in Myanmar, as awareness of the availability of fuel at tower sites grows, this could become a challenge in Myanmar as it has in other countries.

In addition to concerns about air and noise pollution, community members also noted concerns about the health risks from mobile towers. In March 2015, the Posts and Telecommunications Department (PTD) held a public forum sharing results from field-testing radiation levels of mobile towers across Myanmar. Findings showed that EMF radiation levels of Myanmar mobile networks were far lower than limits regarded as harmful by the World Health Organisation.[214] PTD also presented a Burmese language information leaflet for community members to be distributed during the tower construction process.[215] It is not, however, clear who is ultimately responsible for distributing the leaflet, PTD, operators or tower companies and their sub-contractors. Some operators have delegated this responsibility to their community engagement teams. Plans around translating the brochure to ethnic languages are currently unclear.

Geographic Information Systems (GIS)

Geographic Information Systems (GIS) refers to specific applications of ICT for geographic and spatial analysis. In GIS, data for a specific area can be layered allowing a user to analyse the spatial relationships. GIS has numerous applications (environmental, human geography, health, urban planning), but depends on the availability of reliable data. This is a particular challenge for Myanmar.

The Myanmar Information Management Unit (MIMU) www.themimu.info is a focal point for GIS activities in Myanmar. It is working to support the development of a National Spatial Data Infrastructure (NSDI). MIMU maintains various data sets on Myanmar (aggregated from INGOs and civil society groups), including data at the township and village level. Additionally, MIMU provides training resources in Myanmar language on open-source GIS software such as QGIS, which can be downloaded for free. Access to such data can provide powerful tools to help civil society organisations understand impacts that have happened and to project forthcoming changes. For example, EcoDev is currently combining satellite images from NASA's LandSat satellite with GIS to map changes in Myanmar's forests over the past decade. This information can be used to hold the Government and private sector to account.

In June 2015 a project called 'OneMap Myanmar' began its inception phase to develop a GIS system compiling, enhancing and making available and accessible union-wide data on land use, land cover and land tenure. It also aims to incorporate valuable data generated locally, including data from civil society organisations. This data can then

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[214] See: WHO, "Electromagnetic Fields" (last accessed August 2015).
[215] Posts and Telecommunications Department, "Media Release: Myanmar Government: No Evident of Health Risk from Myanmar Mobile Network" (March 2015)

inform the Myanmar Government's land governance policy decisions.[216] The project is slated to run over eight years, implemented by Centre for Development and Environment (CDE) of Bern University in partnership with Myanmar's high-level Central Committee for Land Resource Management, but with a focal point in the Ministry of Environment Conservation Forestry (MoECAF).

Table 33: Licenses Issued as of August 2015

No.	Issued	Expires	Company Name	License Type
1	5-2-14	4-2-29	Ooredoo Myanmar	*Nationwide Telecommunications*
2	5-2-14	4-2-29	Telenor Myanmar	*Nationwide Telecommunications*
3	30-1-15	29-1-30	Shwe Than Lwin Media	*Network Facilities Service (Individual)*
4	30-1-15	29-1-30	Eager Communications Group	*Network Facilities Service (Class) Application Service*
5	30-1-15	29-1-30	Global Technology	*Network Facilities Service (Class)*
6	3-2-15	2-2-30	Myanmar Fibre Optic Communications Network	*Network Facilities Service (Class)*
7	3-2-15	2-2-30	Pan Asia Majestic Eagle	*Network Facilities Service (Class)*
8	3-2-15	2-2-30	Digicel Myanmar Tower Co	*Network Facilities Service (Class)*
9	3-2-215	2-2-30	Irrawaddy Green Towers	*Network Facilities Service (Class)*
10	3-2-15	2-2-30	Apollo Towers Myanmar	*Network Facilities Service (Class)*
11	25-2-15	24-2-30	KDDI Summit Global Myanmar	*Network Facilities Service (Class)*
12	27-2-15	26-2-30	Elite Telecom Public Co	*Network Facilities Service (Individual)*
13	27-2-15	26-2-30	Yatanarpon Teleport Public Co	*Network Facilities Service (Individual)*
14	23-3-15	22-3-30	Frontiir Company	*Network Facilities Service (Individual), Application Service*
15	23-3-15	22-3-30	Myanmar Economic Corporation	*Network Facilities Service (Individual)*
16	24-3-15	23-3-30	Myanma Posts and Telecommunications	*Nationwide Telecommunications*
17	25-3-15	24-3-30	Digital Communication	*Network Facilities Service (Class)*
18	26-3-15	25-3-30	Myanma Railways	*Network Facilities Service (Class)*
19	3-4-15	2-4-30	Myanmar World Distribution Trading	*Network Service*
20	23-4-15	22-4-30	Myanmar Technology Gateway	*Application Service*
21	23-4-15	22-4-30	Myanmar Network	*Network Facilities Service (Individual)*

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[216] University of Bern Centre for Development and Environment, "OneMap Myanmar: New CDE Project Launched" (8 July 2015).

22	27-4-15	26-4-30	Myanmar Padauk Engineering & Construction	*Network Facilities Service (Class)*
23	30-4-15	29-4-30	VOIP Myanmar Group	*Application Service*
24	30-4-15	29-4-30	Myanmar Telecommunication & Technology Services	*Application Service*
25	30-4-15	29-4-30	Horizon Telecom International	*Network Facilities Service (Class)*
26	12-5-15	11-5-30	Myanmar Cyber	*Application Service*
27	9-6-15	8-6-30	Kinetic Myanmar Technology	*Network Service*
28	9-6-15	8-6-30	Active Business Consolidation Services	*Network Facilities Service (Class)*
29	12-6-15	11-6-30	Union Internet	*Network Facilities Service (Individual)*
30	12-6-15	11-6-30	Eco-Friendly Tower Co	*Network Facilities Service (Class)*
31	12-6-15	11-6-30	Yadanarbon Fibre Services Co	*Network Facilities Service (Class)*
32	12-6-15	11-6-30	Be the First Company	*Network Facilities Service (Class)*
33	17-6-15	16-6-30	Myanmar Payment Union	*Application Service*
34	26-6-15	25-6-30	ShwePyiTaGon	*Network Facilities Service (Individual)*
35	25-6-15	24-6-15	KyawZeyar	*Network Service*
36	25-6-15	24-6-15	Thoo Lei	*Network Facilities Service (Class)* *Application Service*
37	6-7-15	5-7-30	FPT Myanmar (from Vietnam)	*Network Facilities Service (Individual)*
38	7-7-15	6-7-30	Chiyoda and Public Works	*Application Service*
39	8-7-15	7-7-30	Trust Net Solutions	*Network Service* *Network Facilities Service (Class)*
40	9-7-15	8-7-30	Myanmar Golden 11 Investment International	*Network Facilities Service (Class)*
41	14-7-15	13-7-30	Fortune International	*Network Facilities Service (Individual)*
42	14-7-15	13-7-30	Asia Mega Link	*Network Facilities Service (Class)*
43	21-7-15	20-7-30	Golden TMH Telecom	*Network Facilities Service (Individual)*
44	21-7-15	20-7-30	Horizon Telecom International (HTI)	*Network Service*
45	4-8-15	3-8-30	Myanmar Telecommunication Network Public Co	*Network Facilities Service (Individual)*
46	4-8-15	3-8-30	G N E	*Application Service Licence*
47	4-8-15	3-8-30	KBZ Gateway	*Network Facilities Service (Individual) Licence*
48	11-8-15	10-8-30	Thanlyin Estate Development	*Application Service Licence*

Table 34: Principle Companies Operating in the ICT Value Chain

Fibre optic cable	Mobile network operators
Eager Communications Group Ltd Myanmar Fibre Optic Cable Network Company Ltd. (MFOCN)	Myanma Posts and Telecommunications and KDDI Summit Global Myanmar Company Limited (MPT/KSM) Telenor Myanmar Ltd. Ooredoo Myanmar Ltd.
Tower companies	Internet service providers
Apollo Towers Myanmar Tower Company (MTC) Irrawaddy Green Towers Eco-Friendly Towers (EFT) Myanmar Infrastructure Group (MIG) Pan Asia Majestic Eagle Ltd.	Myanma Posts and Telecommunications Yatanarpon Teleport Red Link Sky Net Telenor Myanmar Ltd. Ooredoo Myanmar Ltd. Elite Fortune Frontiir
Network equipment providers	Web based service providers
Nokia Siemens Networks (NSN) Ericsson Huawei ZTE Wipro	Facebook Google Viber MySquar Bee Chat WeChat Line