

Leveraging Investments in Broadband for National Development

THE CASE OF VANUATU



UN-OHRLLS

supporting

Least Developed Countries

Landlocked Developing Countries

Small Island Developing States

United Nations Office of the High Representative for Least Developed Countries,
Landlocked Developing Countries and Small Island Developing States

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Note

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Acronyms and Abbreviations

<i>ADB</i>	Asian Development Bank
<i>ADSL</i>	Asymmetric Digital Subscriber Line
<i>ANZ</i>	Australia and New Zealand Banking Group
<i>APT</i>	Asia Pacific Telecommunity
<i>ATH</i>	Amalgamated Telecom Holdings
<i>CDN</i>	Content Delivery Network
<i>CLICC</i>	Computer Laboratory and Internet Community Centre
<i>DHN</i>	Digital Humanitarian Network
<i>DIY</i>	Do It Yourself
<i>DSL</i>	Digital Subscriber Line
<i>EDGE</i>	Enhanced Data rates for GSM Evolution
<i>EPI</i>	Extended Programme for Immunization
<i>FCC</i>	Fidelity Communications Corporation
<i>FSM</i>	Federated States of Micronesia
<i>FWA</i>	Fixed Wireless Access
<i>GB</i>	Gigabyte
<i>GBN</i>	Government Broadband Network
<i>GDP</i>	Gross Domestic Product
<i>GHz</i>	Gigahertz
<i>GPRS</i>	General Packet Radio Service
<i>GSM</i>	Global System for Mobile communications
<i>HOT</i>	Humanitarian OpenStreetMap Team
<i>HSPA</i>	High Speed Packet Access
<i>HTS</i>	High Throughput Satellite
<i>IAP</i>	Internet Access Provider
<i>ICL</i>	Interchange Limited
<i>ICN1</i>	Interchange Cable Network
<i>ICS</i>	Internet Café Support
<i>ICT</i>	Information and Communication Technology
<i>IP</i>	Internet Protocol
<i>IRU</i>	Indefeasible Right of Use
<i>ISP</i>	Internet Service Provider
<i>ITU</i>	International Telecommunication Union
<i>IXP</i>	Internet Exchange Point
<i>JTEC</i>	Japan Telecommunications and Engineering Consultancy Service
<i>LDC</i>	Least Developed Country
<i>LTE</i>	Long Term Evolution
<i>MB</i>	Megabyte
<i>Mbit/s</i>	Megabits Per Second
<i>MCS</i>	Melanesian Cable Solution
<i>MDG</i>	Millennium Development Goals
<i>MHz</i>	Megahertz
<i>NBV</i>	National Bank of Vanuatu
<i>NDMO</i>	National Disaster Management Office
<i>OECD</i>	Organisation for Economic Co-operation and Development
<i>OGCIO</i>	Office of the Government Chief Information Officer
<i>PAA</i>	Priority Action Agenda
<i>PFIP</i>	Pacific Financial Inclusion Project

<i>PNG</i>	Papua New Guinea
<i>PPP</i>	Public-Private Partnership
<i>PPP</i>	Purchasing Power Parity
<i>RMI</i>	Republic of the Marshall Islands
<i>RSE</i>	Recognised Seasonal Employer
<i>SCCN</i>	Southern Cross Cable Network
<i>SIDS</i>	Small Island Developing States
<i>SMS</i>	Short Message Service
<i>TCC</i>	Tonga Communications Corporation
<i>TFS</i>	Tablet For Students
<i>TRR</i>	Telecommunications and Radiocommunications Regulator
<i>TSKL</i>	Telecommunications Services Kiribati Limited
<i>TVL</i>	Telecom Vanuatu Limited
<i>UAP</i>	Universal Access Programme
<i>UAV</i>	Unmanned Aerial Vehicle
<i>UNCDF</i>	United Nations Capital Development Fund
<i>UNDP</i>	United Nations Development Programme
<i>UNELCO Engie</i>	Union Electrique du Vanuatu Limited
<i>UN-OHRLLS</i>	UN Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Islands Developing States
<i>USP</i>	The University of South Pacific
<i>VAT</i>	Value Added Tax
<i>VIX</i>	Vanuatu Internet exchange Point
<i>VMGD</i>	Vanuatu Meteorological and Geohazards Department
<i>VNMS</i>	Vanuatu National Meteorological Service
<i>VNPF</i>	Vanuatu National Provident Fund
<i>VNSO</i>	Vanuatu National Statistics Office
<i>VoIP</i>	Voice over Internet Protocol
<i>VSAT</i>	Very Small Aperture Terminal
<i>VUI</i>	Vanuatu Utilities and Infrastructure Limited
<i>WiMAX</i>	Worldwide Interoperability for Microwave Access

Executive summary

Prior to liberalization of the telecommunications sector in 2007, Information and Communications Technology (ICT) services were largely inaccessible to the highly dispersed population of Vanuatu. This reform initiated profound market change with rapid deployment of modern mobile infrastructure by a new market entrant. **With** the introduction of an independent regulatory authority and relevant sector governing policies, Government aimed to achieve maximum effectiveness of ICT in order to attain the National Vision of a just, educated, healthy and wealthy Vanuatu.

Government policy, through license conditions and the Universal Access Programme (UAP), has driven an increase in mobile service population coverage to 80% in 2008, and then to 98% by the end of 2017. In implementing the UAP, the regulator set minimum broadband speeds at 2Mbit/s download and 1Mbit/s upload, to be achievable 98% of the time. This standard was consistent with speeds theoretically achievable by 3G networks and hence required operators to implement or upgrade networks to 3G at a minimum.¹ Operators were given a choice of active (“playing”) or passive (“paying” a levy on revenue) participation. The three major service providers opted to play.

During the liberalization process, Government policy identified the importance of access to broadband Internet in achieving its objectives, given the evidence that this service may promote greater economic impacts than other telecommunications services. The first Vanuatu e-Government plan, developed in 2008, led to the creation of the Government Broadband Network (GBN), which links government offices in the main provincial centers and provides Internet access to these offices. Government facilitated a step change in broadband connectivity through its commitment in 2013 to a local Public-Private Partnership (PPP) for an international submarine cable.

The Information and Communications sector has experienced steady growth over the past ten years, representing 6.2% of GDP in 2015 compared to approximately 4% in 2006. By the end of 2016, the regulator reported that the telecommunications sector generated gross revenue of around VUV4.48 billion (USD41.86 million), a 13% increase over the previous year.² The significant increase in gross market revenue appears to be predominantly driven by mobile voice and data services. The continuing decline in mobile data prices and increasing geographical coverage of 3G and 4G networks, have led to significant growth in Internet usage.

The extent of household usage of telecommunications services was revealed in the mini-census of November 2016, conducted by the Vanuatu National Statistics Office, which found that over 80% of households in most regions used mobile services but less than 20% of households used the Internet. Internet usage dropped to below 7% in three of the six provinces. Other metrics indicate that in Vanuatu in 2016, less than one person in four used the Internet. These levels of penetration are considerably higher than those observed prior to the installation of the submarine cable while other cable-connected countries in the region are achieving even higher levels of mobile broadband uptake.

The main barriers to further broadband uptake and usage appear to be:

¹ Telecommunications and Radiocommunications Regulator (2017), *Annual Report 2016*, available at <https://www.trr.vu/index.php/en/public-register/reports/annual-reports/2016>

² Telecommunications and Radiocommunications Regulator (2017), *Annual Report 2016*, available at <https://www.trr.vu/index.php/en/public-register/reports/annual-reports/2016>

- **Lack of affordability:** despite substantial improvements in affordability the prices of smartphone handsets and services remain beyond the reach of many. With a population of just over 272,000, Vanuatu is a very small market with limited opportunities to benefit from economies of scale.³ Furthermore, the Government imposes a 12.5% import tax on handsets which contributes to the affordability issue.
- **Difficulties in accessing infrastructure:** while in theory broadband coverage is 100% through the Kacific broadband satellite, most households and businesses simply cannot afford the service while 3G+ services are not ubiquitously available throughout the islands. The lack of a reliable power supply in many areas adds another challenge to improving accessibility.
- **Low digital literacy:** while low levels of digital literacy are evident currently ICTs in education are a focus of Government policy. As such, given the large youth demographic in Vanuatu, greater access to ICT through educational facilities could remedy this issue within a decade.

A review of the use of broadband by sector indicates that applications are only slowly emerging:

- A number of education and health pilot projects have had a high positive impact on communities although as donor funding finishes there are questions as to the ongoing sustainability of the pilots. A monitoring and evaluation system is currently under development.
- Broadband has been a key enabler for the efficient operation of Vanuatu's Government but only one public service application is currently available – namely, applications for scholarships from the Ministry of Education website. The focus to date has been establishing the necessary ICT infrastructure for networking, information management and web presence for public applications.
- Key applications for environmental and disaster management are emerging, including real-time volcano monitoring using broadband technology, and early warning systems.
- In the private sector, an increased number of businesses are using email and maintaining websites, particularly in the hospitality industry.
- Mobile money services are still based on narrowband wireless services, and even these have had disappointing uptake. In past years, the quality of rural broadband connectivity and low demand for banking services has hindered the introduction of more advanced mobile banking services.

There is a notable absence of applications in agriculture which is obviously a key sector for the livelihood of the majority of ni-Vanuatu.

The financing models used in broadband investment in Vanuatu are:

- **Government finance** – the GBN was debt financed by Government;
- **PPP** – a Government entity entered into a PPP with local private sector investors for the submarine cable;
- **Donor funding** – UAP pilot projects were funded by the Australian Government;
- **Private investment** – UAP network extensions were deployed by market “players” at their own expense, while others contributed to the fund.

³ Vanuatu National Statistics Office (2017), *2016 Post-TC Pam mini census report*, 21 July 2017. Available at <https://vnso.gov.vu/index.php/component/advisting/?view=download&fileId=4542>. Accessed October 2017.

In the Pacific region, the use of donor funding is common for the support of broadband initiatives from large-scale cable infrastructure (as in Tonga), to smaller projects on a country-by-country basis (for example, educational and health initiatives). In the context of the Pacific region, the Vanuatu UAP scheme is innovative with its reliance on private sector participation, while the PPP for the cable investment is both ambitious and challenging, given the Government's shareholder role.

Indeed, currently the regulator is attempting to resolve legal and pricing disputes involving the submarine cable. Underlying these issues is Government involvement in the PPP arrangement which has resulted in conflicting public objectives. On the one hand, the Government seeks to promote broadband uptake and improve affordability, to achieve the country's ICT goals. On the other hand, as a majority shareholder in cable, the Government seeks to maintain high prices in order to maximize return on investment.

Access to broadband has certainly improved in recent years following a number of key investments in infrastructure and services. The challenge for Vanuatu now is to explore and identify opportunities for leverage from these existing investments. Achieving all of the priorities of the National ICT policy is still "work in progress" – in particular it remains important to:

- Develop platforms for multi-stakeholder and multi-sector coordination, including demand aggregation, and coordination between deployments of telecommunications and power infrastructure;
- Improve access to ICTs in education, including blueprints for educational institutions to install computer labs with minimal external assistance;
- Build trust and mitigate threats in ICT development, including resolving current tensions involving the PPP arrangements for the submarine cable;
- Extend e-government applications, so that the GBN supports customer to government transactions;
- Foster capacity building and development of local content through digital confidence building, training and engagement with local communities.

1 Introduction

Small Island Developing States (SIDS) typically encounter many challenges in the development of broadband infrastructure and services to encompass all communities regardless of geographic and socio-economic circumstances. In Vanuatu, communities relying predominantly on subsistence agriculture are spread over some 65 islands in an area of the Pacific particularly prone to regular natural disasters. Many communities do not have ready access to basic infrastructure (including roads and electricity), transport and health services. The isolated location of communities, coupled with a lack of resources, contributes to the difficulties in providing universal high-quality education, and only primary schooling is offered free of charge. In this setting, the availability and accessibility of reliable broadband communications can potentially support profound developmental change.

This case study examines:

- The context of broadband penetration in Vanuatu, including the roles of Government and the private sector in broadband infrastructure and service provision;
- The impact of investments in broadband, including examples that demonstrate the leverage of broadband expansion for enhancing national development;
- The barriers to increased equitable broadband deployment and adoption;
- The most appropriate financing models for various rollout options.

The report structure encompasses:

- A short overview of the country context (Chapter 2);
- A description of the policy and regulatory environment (Chapter 3);
- A review of the supply of broadband services (Chapter 4);
- An examination of demand for broadband services (Chapter 5);
- An analysis of the sector use and impact of broadband in Vanuatu (Chapter 6);
- A summary of outcomes in Vanuatu and learnings for other developing countries (Chapter 7).

Study approach

Primary research for the study was undertaken in Port Vila, Vanuatu, from 28 September to 3 October, 2017. During this time, information was gathered via a series of interviews with key stakeholders (Annex C), including operators, service providers, Government and regulatory organizations. Additional information was obtained during a conference in Port Vila from 26 to 27 October, 2017, convened by the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (OHRLLS).

In general, data for the study was locally sourced, particularly from the Government statistics office and the telecommunications regulator. Secondary data or estimates were only used where local data was unavailable.

Primary research was undertaken for the affordability analysis (service pricing and handset pricing), to ensure that the results reflected current prices available in Vanuatu. A consistent regional time series of original price data for the affordability analysis was sourced from Network Strategies Limited. This approach was selected in preference to the use of secondary data on affordability from the International Telecommunication Union (ITU),⁴ which was over two years old. These results are not directly comparable. For example, in this case study the affordability of 1GB of mobile broadband services per month for Vanuatu and other Pacific countries is based on October 2017 prices, while the ITU reports on affordability of 1GB of computer-based broadband services for 2015.

In view of a lack of information on the use of Internet by the business sector, primary research was also undertaken on business use of email and websites, using a sample from the local 2017 telephone directory.

2 Country context

The Republic of Vanuatu comprises an archipelago of 83 islands in the South Pacific, about 65 of which are inhabited. The chain of islands are located about 800km west of Fiji and 1770km east of Australia and spans 1100km (**Error! Reference source not found.**). The islands and the inhabitants are particularly susceptible to natural disasters, including cyclones, earthquakes and volcanic eruptions. There are nine active volcanoes, including Manaro on the island of Ambae. At the time of writing this report, 11,000 people had been evacuated from Ambae to neighboring islands as a precautionary measure in the wake of Manaro's heightened volcanic activity. In 2015, a category 5 cyclone completely destroyed almost a third of dwellings across the entire country and worsened economic conditions for many individuals and communities.

The total population of Vanuatu was estimated at 272,459 in 2016, with an annual growth rate of 2.3%.⁵ Vanuatu has a young population with 38% of the population under the age of 15 (**Error! Reference source not found.**). Population density is 22 people per square kilometer and is mostly rural, with only 25% of the population living in urban areas. There are six provinces (**Error! Reference source not found.**) but only two major urban population centers: Port Vila on Efate (with 50,944 inhabitants) and Luganville on Espiritu Santo (15,865 inhabitants).

Vanuatu has three official languages: Bislama (pidgin English), French and English, although a multitude of different dialects are spoken across the islands.

⁴ ITU (2016), *Measuring the Information Society Report*, 2016. Page 130.

⁵ Vanuatu National Statistics Office (2017), *2016 Post-TC Pam mini census report*, 21 July 2017. Available at <https://vnso.gov.vu/index.php/component/advertising/?view=download&fileId=4542>. Accessed October 2017.

Figure 2.1: Map of Vanuatu⁶

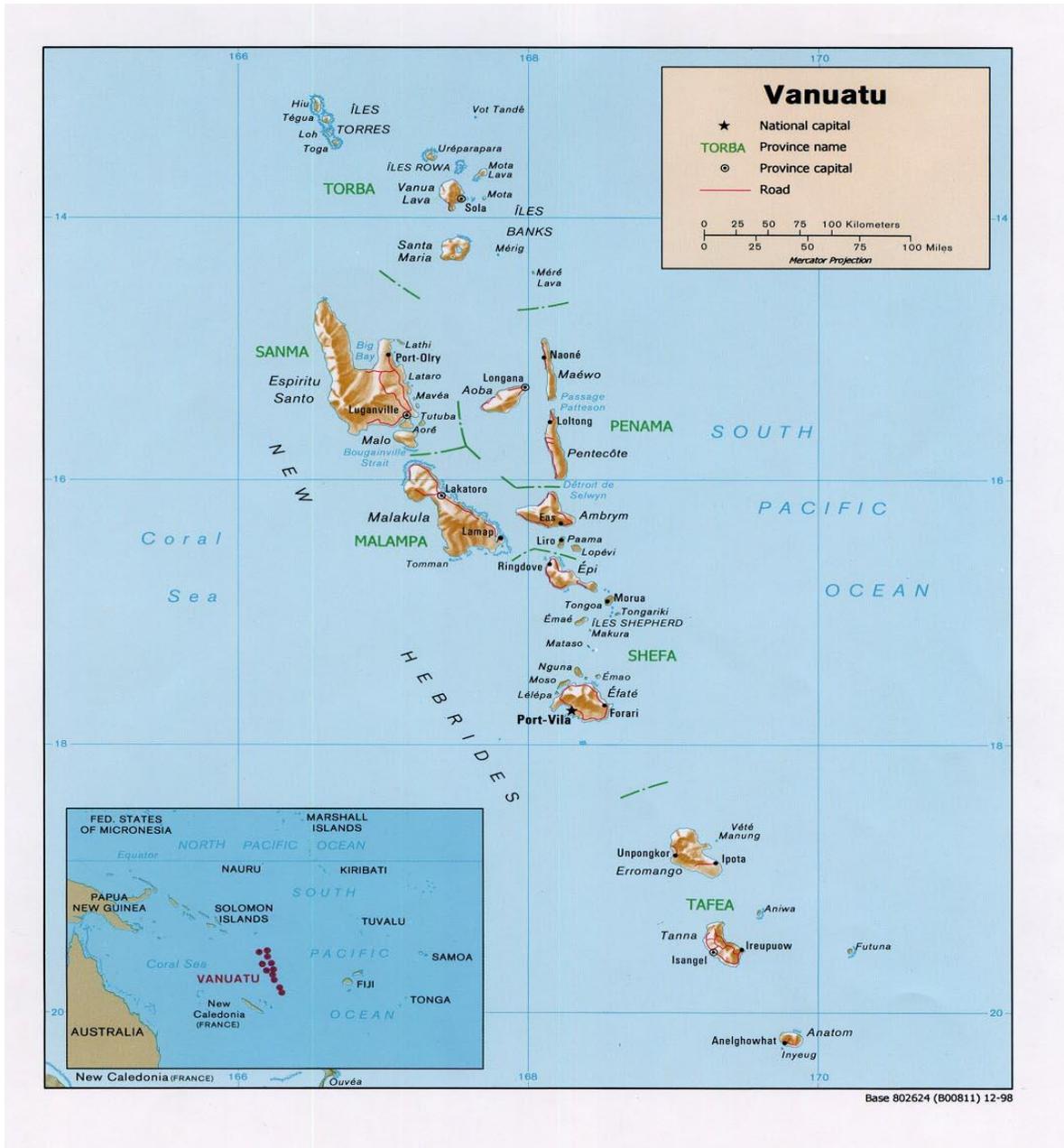


Figure 2.2: Vanuatu population pyramid 1016⁷

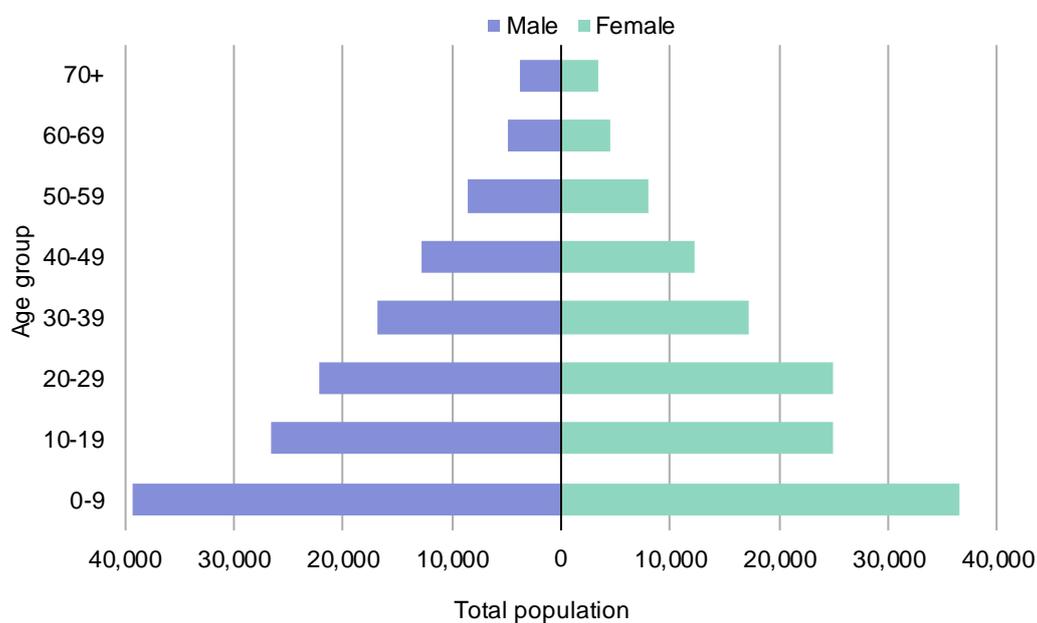


Table 2.1: Vanuatu population by province, 2016⁸

Province	Capital	Population
Torba	Sola	10,161
Sanma	Luganville	54,184
Penama	Saratamata	32,534
Malampa	Lakatoro	40,928
Shefa	Port Vila	97,602
Tafea	Isangel	37,050

Vanuatu's GDP growth was 1.6% from 2014 to 2015,⁹ and then was estimated at 4.8% in 2016,¹⁰ reflecting public construction and rebuilding after Cyclone Pam. Agriculture is a major contributor to

⁷ Source: Vanuatu National Statistics Office

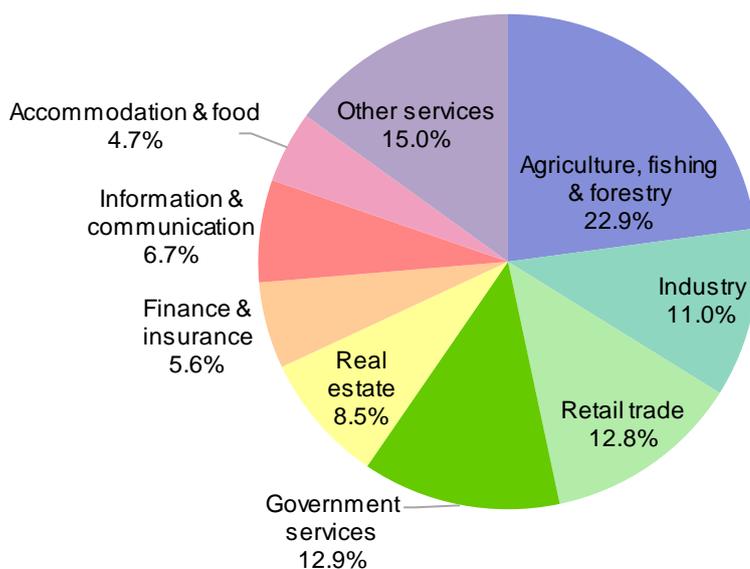
⁸ Source: Vanuatu National Statistics Office

⁹ Vanuatu National Statistics Office (2015), *Statistics Release: Gross Domestic Product 2015*. Available at <https://vnso.gov.vu/index.php/component/advisting/?view=download&fileId=4582>. Accessed October 2017.

¹⁰ Ministry of Finance and Economic Management (2017), *Half year economic and fiscal update*, 31 July 2017. Available at <https://doft.gov.vu/images/2017/Half-Year-Fiscal-Report-2017-english.pdf>. Accessed October 2017.

the economy, comprising approximately 23% of total GDP in 2015. In fact the majority of households rely on subsistence agriculture. The service industry in total contributes more to GDP than agriculture and industry combined (**Error! Reference source not found.**)¹¹ The economy also relies heavily on tourism which made a direct contribution of about 17% to GDP in 2016, and a total contribution (including indirect effects) of 44.5% of GDP.¹²

Figure 2.3: GDP by sector, 2015¹³



Vanuatu is classified as a lower middle income country by the World Bank, with GDP per capita of USD3,170 in 2016. The UN categorizes Vanuatu as a least developed country (LDC) due to severe structural impediments to sustainable development, and currently appears to be on target to meet thresholds for graduation from the category as scheduled in 2020.¹⁴ Nevertheless some developmental indicators suggest that ni-Vanuatu households will remain economically vulnerable for the foreseeable future (**Error! Reference source not found.**).

¹¹ A complete set of national accounts was only available for 2015 at the time of writing this report.

¹² World Travel and Tourism Council (2017), *Travel and Tourism Economic Impact 2017 Vanuatu*, March 2017. Available at <https://www.wttc.org/-/media/files/reports/economic-impact-research/countries-2017/vanuatu2017.pdf>. Accessed October 2017.

¹³ Source: Vanuatu National Statistics Office

¹⁴ United Nations (2017), *Least Developing Country Category: Vanuatu Profile*, available at <https://www.un.org/development/desa/dpad/publication/least-developed-country-category-vanuatu/>. Accessed October 2017.

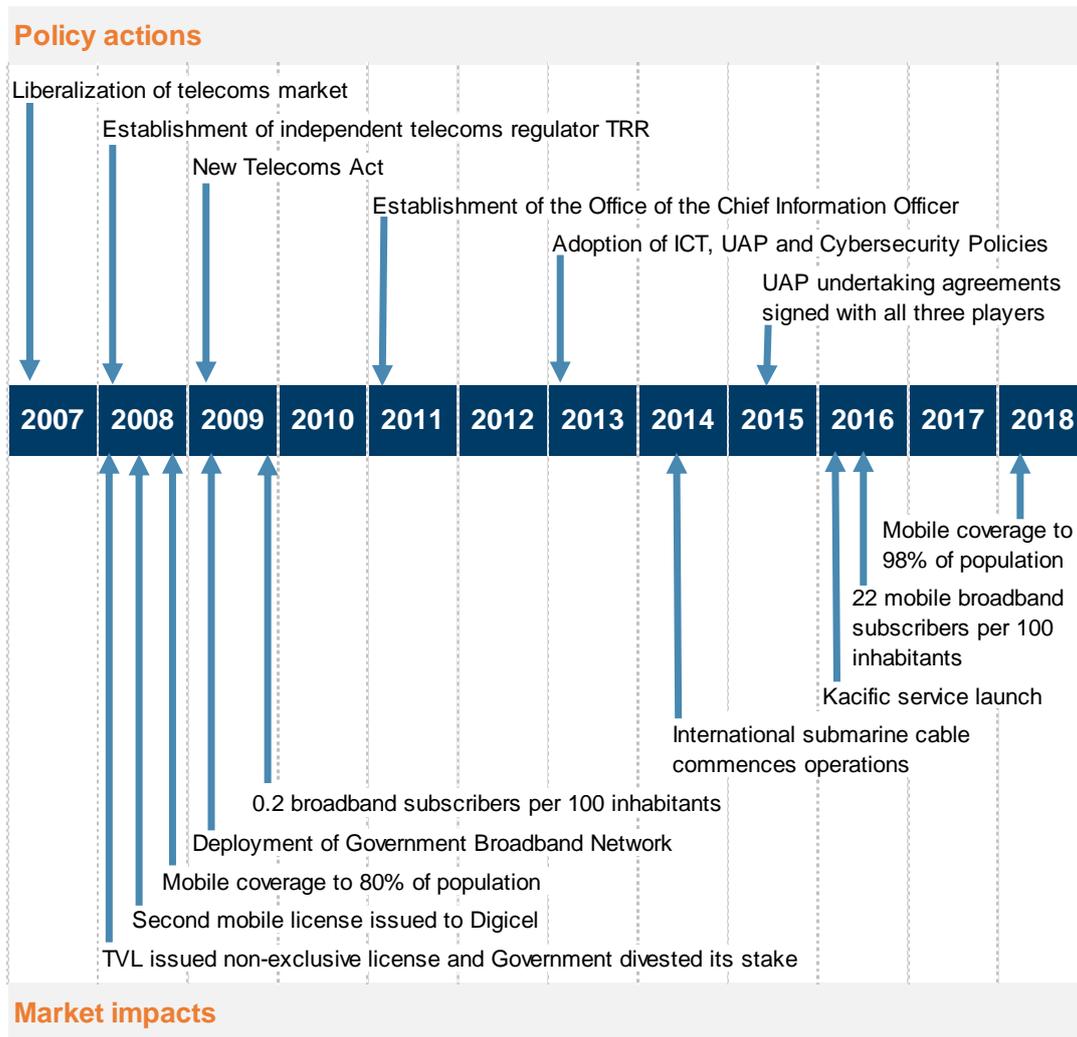
Table 2.2: Selected demographic and developmental indicators, 2016¹⁵

	<i>Vanuatu</i>	<i>Urban</i>	<i>Rural</i>
Population (number)	272,459	67,749	204,710
Households (number)	55,527	14,048	41,479
Adults with bank account (%)	36.4	56.4	29.5
No birth certificate (%)	13.6	2.6	17.3
Children (5-13) not attending school (%)	11.2	5.7	12.6
Households with solar power only (%)	65.4	11.4	83.7
Households with no access to improved sanitation (%)	65.2	50.1	70.4
Households with no access to improved water (%)	15.7	3.2	19.9
Households in vegetable crop production (%)	88.1	61.6	97.1
Household dwellings completely damaged in Cyclone Pam 2015 (%)	31.3	22.6	34.2

3 Policy and regulatory environment

The liberalization of Vanuatu's telecommunications sector which began in 2007, set in motion a reformed market structure with rapid new infrastructure investment. Key to the success of the reform was the introduction of an independent regulator and relevant governing policies (**Error! Reference source not found.**). Ten years later, mobile services are available to 98% of the population of Vanuatu, while broadband connectivity has been facilitated through an international submarine cable link initiated and owned by a local Public-Private Partnership (PPP).

Figure 3.1: Vanuatu's telecommunications sector reform timeline¹⁶



3.1 Telecommunications regulation in Vanuatu

With the aim of ending the existing monopoly and creating competition in the telecommunications sector, the *2007 Telecommunications Policy Statement* established four guiding principles:

- open and competitive markets
- modern, independent and proportionate regulation
- non-discrimination and technology neutrality
- optimal use of scarce resources.

Subsequently, the *Telecommunications and Radiocommunications Regulation Act No. 30* established a new regulatory framework and created the Telecommunications and Radiocommunications Regulator (TRR), an independent statutory body with powers and functions to regulate telecommunications and

¹⁶ Source: TRR, Network Strategies

radiocommunications services to promote national, social and economic development. From March 2008, a non-exclusive license was issued to incumbent Telecom Vanuatu Limited (TVL), thereby opening the market to competition. The Government divested its 33% stake in TVL in favor of the remaining owners (Cable and Wireless and France Telecom). A new market entrant, Digicel Vanuatu, was also issued a non-exclusive license to provide mobile telecoms services in 2008, and from 2009, other service providers entered the market (

).

Table 3.1: Operating telecommunications licenses¹⁷

<i>Company</i>	<i>License issued</i>	<i>Services</i>	<i>Current Ownership</i>
Telecom Vanuatu	2008	mobile and fixed voice, Internet	ATH of Fiji
Digicel	2008	mobile and fixed voice, Internet	Digicel Group Ltd
Telsat Broadband	2009	Internet	Local privately owned
Wantok Network	2009	Internet	Terralight Holdings Limited of Canada
Interchange	2009	Internet	Government & private investors
Incite	2010	Internet	Affiliate of overseas company
Spim	2011	Internet	Local privately owned
Global Telecom Pacific	2015	Internet	Local privately owned

In June 2009 Digicel surpassed 40% market share in the retail mobile services market and was declared dominant in that market by the TRR. By 2011, Digicel had a share of 57% in this market.¹⁸

The Office of the Government Chief Information Officer (OGCIO) was created in 2011 with responsibilities for the e-government strategic plan leadership, overall inter-agency and cross-level coordination, policy and strategy development, and advice on I-Government expenditure and planning. The OGCIO and the TRR report to the Prime Minister, who is also the Minister responsible for ICT / Telecommunications. Although the OGCIO and TRR collaborate and work closely, each Office operates independently.

3.2 Telecommunications policy in Vanuatu

In support of the Government Priority Action Agenda (PAA) 2006 – 2015, with its vision of a just, educated, healthy and wealthy Vanuatu, and the Millennium Development Goals (MDGs), the Vanuatu Government announced three new policies in 2013:¹⁹

¹⁷ Source: TRR

¹⁸ Telecommunications and Radiocommunications Regulator (2012), *Designation Order – Dominance Review Digicel (Vanuatu) Limited*, 16 July 2012. Available at https://www.trr.vu/attachments/article/169/Order_4_-_Designation_Order.pdf. Accessed October 2017.

¹⁹ Republic of Vanuatu (2006), *Priorities and Action Agenda for Vanuatu 2006 – 2015*, June 2006.

- the National Information and Communication Technology Policy
- the Universal Access Policy (UAP)
- the Cybersecurity Policy.

As at October 2017, the cybersecurity policy is under revision, while a successor UAP policy is under development.

National Information and Communication Technology Policy

The objective of the policy is to ‘maximise the contribution, efficiency and effectiveness of ICTs in achieving the National Vision, thereby empowering and benefiting every citizen and resident of Vanuatu.’²⁰ Eight policy priorities have been identified:

- access to ICTs in education
- access to ICT infrastructure and devices
- e-Government
- integration of ICTs into sectoral policies
- building trust and mitigating risks and threats in ICT development
- locally relevant content
- capacity building
- developing a platform for multi-stakeholder and multi-sector coordination and collaboration.

Furthermore, the policy identifies the importance of access to broadband Internet in achieving these priorities, given the evidence that this service may promote greater economic impacts than other telecommunications services. There is particular emphasis in the policy on improving access to ICTs in education.²¹

Universal Access Policy

In 2013, the Prime Minister of Vanuatu presented a Universal Access Policy with the goal of ensuring access by 98% of the population to voice, narrowband data services and broadband Internet services by 1 January 2018.²² A key objective was improving the accessibility of telecommunications services to unserved or underserved areas. The UAP specified that services must be available at educational institutions (including early childhood education centers, as well as primary, secondary and tertiary institutions), health facilities and public offices. The policy provides for geographically uniform pricing at levels consistent with those of an effectively competitive market, although discounted prices may be made available to educational and health facilities.

The Telecommunications Regulator was tasked with implementing the policy through collaboration with and commitments from the private sector, and with monitoring progress. Service providers were offered the option of actively contributing through network deployment, or passively contributing via annual levies on revenue to a UAP Fund. Three “players” provided plans for deploying new infrastructure – TVL, Digicel Vanuatu and Telsat – while five licensees were initially identified as “payers.” By 2015, Undertaking Agreements were signed with all three players, while payers

²⁰ Republic of Vanuatu (2013), *National Information and Communication Technology Policy*, December 2013. Page 14.

²¹ *Ibid*, page 29.

²² Republic of Vanuatu (2013), *Universal Access Policy*, December 2013.

contributed 4% of annual revenue to the UAP Fund. As at 2017, the number of payers had reduced to four as a result of the TRR revoking an inactive license at the end of 2014.

In relation to broadband Internet services, the policy initially specified a download speed of 21Mbit/s and upload of at least 12Mbit/s. However, following substantial Government, industry and public consultation in 2014, minimum broadband speeds for the UAP initiative were set at 2Mbit/s download and 1Mbit/s upload, to be achievable 98% of the time.²³ This standard was consistent with speeds theoretically achievable by 3G mobile networks and hence required operators to implement or upgrade networks to 3G at a minimum.

As at June 2017, the regulator expected that the UAP target of access to broadband data services by 98% of the population would be achieved by the target date of 1 January 2018, although it acknowledged some risk posed by ongoing delays in infrastructure deployment caused by land ownership and local labor disputes, and challenges with civil works and logistics in very remote areas with difficult terrain.²⁴ Nevertheless, it is clear that substantial progress has already been achieved with many new operational sites, as well as upgrading of existing sites to support 3G. Furthermore, in 2017, full broadband satellite coverage of Vanuatu was achieved by virtue of a wholesale agreement between TelSat and Kacific. The regulator noted that, ‘it is now a matter for responsible Government Departments and the Business Community to contribute with connecting required communities.’²⁵

The UAP project also encompassed three projects for extending ICT access to schools and communities through funding from the Australian Governance for Growth programme ().

Table 3.2: UAP projects for extending ICT access to schools and communities²⁵

<i>Project</i>	<i>Funding</i>
Computer Lab and Internet Community Centre (CLICC)	VUV50 million (USD471,189)
Tablets for Students (TFS)	VUV10 million (USD94,238)
Internet Café Support (ICS)	VUV10 million (USD94,238)

The CLICC project has been implemented in 19 schools, the TFS project in seven schools, and three Internet cafes have benefitted from the ICS project. Further details of the implementation and impact of the above projects are provided in Sections 6.3 and 6.4.

²³ Telecommunications and Radiocommunications Regulator (2014), *Determination on the broadband speed provisions as set out in the Government’s Universal Access Policy 2013*, 12 November 2014. Available at https://www.trr.vu/attachments/article/436/trr_determination_broadband_speed_2014.pdf. Accessed October 2017.

²⁴ Telecommunications and Radiocommunications Regulator (2017), *Universal Access Policy (UAP) Stakeholders Update Report No. 7, Update on UAP implementation*, June 2017. Available at https://www.trr.vu/attachments/article/653/uap_stakeholders_update_report_no_7.pdf. Accessed October 2017.

²⁵ *Ibid*, page 6.

²⁶ Source: TRR.

4 Supply side

There are three main components to implementing broadband connectivity: the first mile or international connectivity (Section 4.1), the middle mile or backbone network (Section 4.2), and the final mile or access network (Section 4.3). The availability, capabilities and quality of infrastructure at each mile ultimately determines the quality of the broadband services. In addition, there are other factors that are hidden or invisible (Section 4.4), which also affect service quality and accessibility, such as power and spectrum availability and regulatory or ownership issues.

4.1 First mile (international connectivity)

Due to its remote location and relatively small population distributed across more than 60 islands, Vanuatu has historically relied on satellite systems for international connectivity. Domestically, some islands can be connected via microwave to the nearest island, however many of them are just too distant for microwave connectivity in which case satellite links are used.²⁷ The high cost of capacity and the limited bandwidth provided over satellites ultimately led to construction of an international submarine cable in March 2014, which lands on the island of Efate. Even with the arrival of the cable, Vanuatu still relies on satellite to provide domestic and international connectivity to many islands.

4.1.1 Satellite connectivity

Telsat signed an agreement with Kacific Broadband Satellite to provide High Throughput Satellite (HTS) services, obtaining “Earlybird” pricing at USD270 per Mbit/s. The service enables Telsat to provide Internet broadband access to 100% of Vanuatu’s land mass.²⁸ Note that Telsat is a user of the Kacific service but is not a reseller.

In July 2016, Kacific launched the first operational service – a high-speed broadband Internet connection into the rural Lambubu area on Malekula Island in Vanuatu. The service, which is based at Lambubu Primary School, provides a broadband Internet connection at speeds of up to 17Mbit/s.²⁹

The Kacific service operates in the Ka-band using HTS, a new technology which is optimized for data applications. Using techniques such as multiple spot beams and frequency reuse, these satellites achieve significantly greater capacity than that of other systems which work in other frequency bands. A disadvantage of the Ka-band is that the frequency is more susceptible to signal degradation due to rain fade, a problem in tropical climates.³⁰

²⁷ Microwave links use radio waves to transmit information between two fixed locations (point-to-point link). They are used, for example, to carry mobile calls from cell sites to the core network. They can also provide high-speed Internet access without cable connections. The use of microwave equipment requires a clear path between two locations (line of sight) and is subject to distance limitations. TRR’s spectrum plan allocates the 1.5GHz band and from 5GHz to 22GHz for microwave fixed services.

²⁸ Telecommunications and Radiocommunications Regulator (2017), *Universal Access Policy (UAP) stakeholders update report no. 7*, June 2017. Available at https://www.trr.vu/attachments/article/653/uap_stakeholders_update_report_no_7.pdf. Accessed October 2017.

²⁹ Kacific (2016), *Kacific’s first operational service – connecting rural Vanuatu to the world*, July 2016. Available at <http://kacific.com/kacifics-first-operational-service-connecting-rural-vanuatu-to-the-world/>. Accessed October 2017.

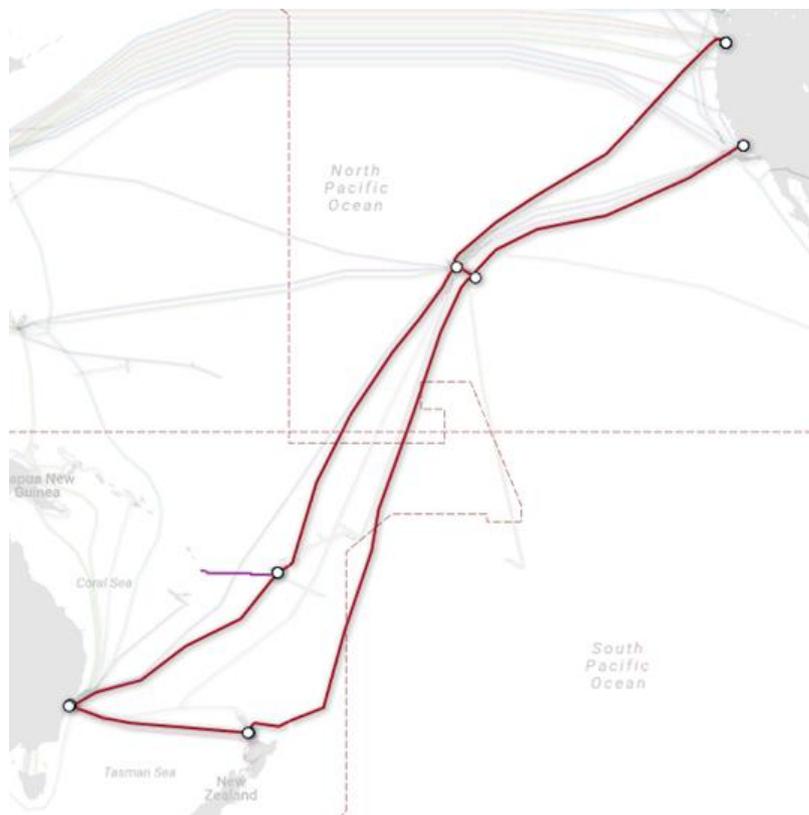
³⁰ Higher frequency bands typically give access to wider bandwidths hence higher speeds, but are also more susceptible to signal degradation due to ‘rain fade’ (the absorption of radio signals by atmospheric rain).

The Kacific system requires installation of small inexpensive terminals of 1 to 1.2 meter diameter (Very Small Aperture Terminal – VSAT), an advantage in comparison with other satellite systems which require high initial investment for satellite earth stations.

4.1.2 Submarine cable

The construction of the Interchange Cable Network (ICN1) was completed in January 2014, and started providing capacity to the market two months later in March 2014. The ICN1 cable is owned by Interchange Ltd (ICL) and the project required an investment of USD32 million. With a configured initial capacity of 20Gbit/s, the 1,259km cable connects Port Vila to Suva (Fiji), linking Vanuatu directly to the high capacity Southern Cross Cable Network (SCCN), which has landing stations in Australia (Sydney), New Zealand and the United States (**Error! Reference source not found.**).

Figure 4.1: ICN1 and Southern Cross Cable Network³¹



The launching of the submarine cable immediately led to a significant increase in available bandwidth to the Internet Service Providers (ISPs), at much lower pricing than previously available.³² This brought

³¹ Source: TeleGeography

³² Internet Service Provider (ISP) refers to an organization that provides users (subscribers) with Internet access. An ISP is also sometimes referred to as an IAP (Internet Access Provider).

significant growth in the number of subscribers and increased competition in retail Internet markets with the entry of new market players. As a result, since January 2014, international bandwidth has increased by over 650%.³³ Total international Internet capacity has increased to over 1Gbit/s in June 2017.

Melanesian Cable Solution (MCS)

In 2014, immediately after the completion of ICN1, ICL announced a plan to expand its undersea infrastructure with a new 3000km cable linking Vanuatu with the Solomon Islands and Papua New Guinea (PNG). The system is planned to connect Port Vila to Port Moresby in PNG, with branches to the islands of Espiritu Santo and Tanna in Vanuatu, and Honiara in the Solomon Islands (**Error! Reference source not found.**). With an initial operating capacity of 40Gbit/s the cable will have a design capacity of 1.2Tbit/s.³⁴ In 2015, ICL announced that the project, now called Melanesian Cable Solution (MCS), was on track with deployment set to be completed by June 2016.³⁵ However, as at October 2017, there has been no further progress with the MCS initiative although negotiations with stakeholders are ongoing.³⁶

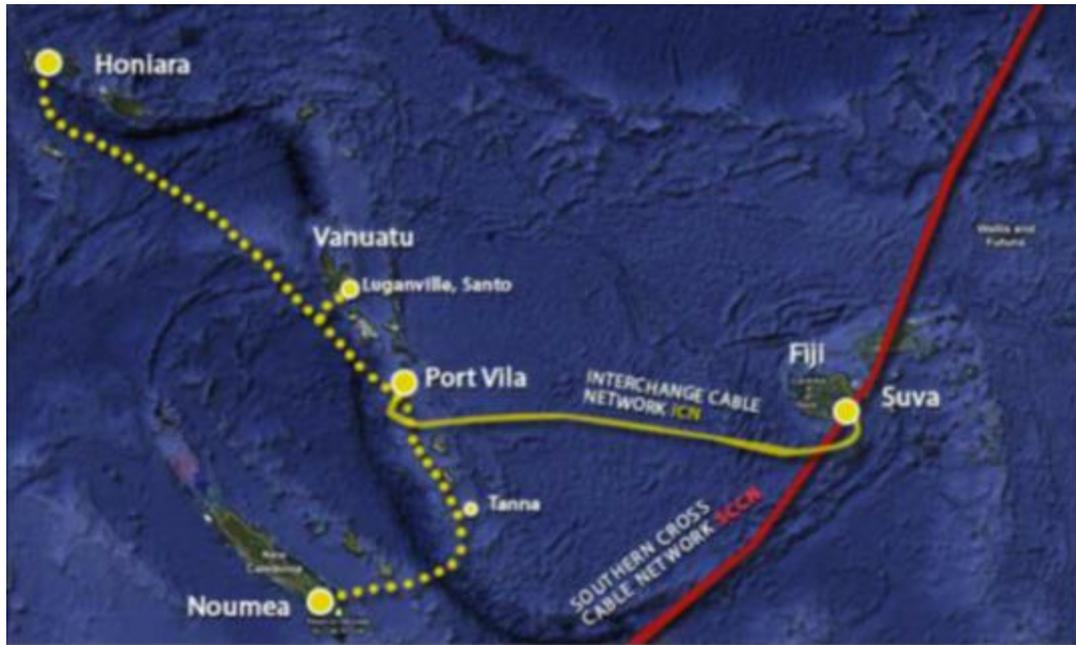
³³ Telecommunications and Radiocommunications Regulator (2017), *TRR Telecommunications Sector Report 2017*. Available at https://www.trr.vu/attachments/article/655/vanuatu_sector_report_2017_final.pdf. Accessed October 2017.

³⁴ Nokia (2014), *Alcatel-Lucent and Interchange to deliver ultra-broadband connectivity linking Vanuatu, the Solomon Islands and Papua New Guinea*, 22 January 2014. Available at <https://networks.nokia.com/press/2014/alcatel-lucent-and-interchange-deliver-ultra-broadband-connectivity-linking-vanuatu>. Accessed October 2017.

³⁵ TeleGeography (2015), *Cable Compendium: a guide to the week's submarine and terrestrial developments*, 9 Jan 2015. Available at <https://www.telegeography.com/products/commsupdate/articles/2015/01/09/cable-compedium-a-guide-to-the-weeks-submarine-and-terrestrial-developments/>. Accessed October 2017.

³⁶ The MCS project may have been affected by the Solomon Islands' Government decision to develop a submarine cable link towards Australia.

Figure: 4.2: Vanuatu-Solomon Islands – PNG proposed cable³⁷



4.2 Middle mile

4.2.1 National backbone

The telecommunications operators in Vanuatu each have their own domestic backbone network, comprised mainly of microwave and satellite links. Both TVL and Digicel have extensive networks. TVL has typically established its backbone network on high sites, with sites at lower elevations located close to more populated areas for providing mobile services. Digicel entered the mobile market in 2008 and has deployed the majority of its sites at lower elevations near populated areas. Digicel and TVL also have fiber backbones in Port Vila. Telsat operates a terrestrial microwave network which provides wireless broadband services, mainly around Port Vila. Its network is complemented with VSAT technology to provide coverage in other provinces.

The Government Broadband Network (GBN) was launched in 2012 and connects the six provincial capitals. The GBN has its own backbone network – a fiber backbone in provincial capitals (Port Vila and Luganville), and microwave and satellite links in other areas. The network infrastructure also includes two data centers, and disaster recovery capability. The GBN is Vanuatu's third largest network behind those of TVL and Digicel. The three networks are available to be used by any of the operators in case of outages.

VoIP and video-conferencing services are provided over the GBN and it is used by around half of the 7,000 government employees. The GBN is a private network but the Government is planning in the near future to outsource management functions while retaining ownership. Although the nature of the

³⁷ Source: Internet Society.

commercial arrangements is still to be finalized, it appears likely that spare capacity may be leased so that the network will generate revenue for the Government.

Having three low capacity backbone networks in a small market the size of Vanuatu results in a higher overall cost than if there had been coordination to build a single national backbone network. Synergy and collaboration between operators and Government to develop sharing strategies are central for having a more cost effective network infrastructure. Reductions in capital expenditure and operating expenses can be achieved by leasing existing capacity and coordinating future deployments.

A number of consulted stakeholders complained about the quality of telecommunications services. With competition introduced by market liberalization, access networks (Section 4.3) evolved with the deployment of modern technologies capable of delivering better services. The fact that quality of service remains an issue for many end-users, suggests that backbone infrastructure has not evolved at the same pace, preventing improved service delivery. To establish the extent to which an inadequate backbone infrastructure is responsible for the existing quality of service issues in Vanuatu, requires more detailed analysis which is currently not possible due to a lack of available information.

4.2.2 Vanuatu Internet Exchange

The Vanuatu Internet Exchange Point (VIX) emerged as a solution in the absence of a common point to connect and exchange traffic between networks in Vanuatu.³⁸ The lack of connectivity between ISPs often resulted in the routing of traffic over expensive international links, simply to reach destinations within Vanuatu. To address this issue Government, TRR and the local network operators worked cooperatively to build VIX, a local Internet exchange point located in Vanuatu which connects all local network operators and content providers.

VIX commenced operations in 2013 and now connects all ISPs and government institutions. VIX is operating from the government datacenter which is located in Port Vila and has connections for ISPs over fiber and wireless. The government is offering collocation space for free and covers the operational costs of the VIX (electricity, acclimatization, etc.).

A few months after the launch, a Google cache server was installed at VIX, which allowed YouTube content to be served locally. The effects on the traffic were immediately noticeable – the volume of traffic started to grow substantially, exceeding expectations.³⁹ Content Delivery Networks (CDNs) are also connected to VIX and in 2016 Akamai servers were installed at VIX.^{40 41}

4.3 Last mile - access network

Market liberalization introduced competition and innovation into Vanuatu's telecommunications market. Profound market change was initiated with the entry of a second mobile operator with rapid deployment of modern infrastructure. Access technologies evolved from fixed broadband through ADSL

³⁸ An Internet Exchange Point (IXP) is a physical infrastructure for interconnection and exchange of traffic, where Internet players interconnect directly with each other. Such exchange points enable the local peering of domestic traffic resulting in benefits such as: reduced number of network hops to exchange traffic, optimized use of international Internet connectivity, and improved network resilience.

³⁹ Internet Governance Forum (2017), *Contributing to the success and continued development of Internet exchange points*, January 2017.

⁴⁰ A Content Delivery Network (CDN) refers to a geographically distributed group of servers which work together to provide fast delivery of Internet content. In order to improve speed and connectivity, a CDN will place servers at the IXP points between different networks.

⁴¹ Akamai is a leading CDN and cloud services provider, with headquarters in the United States. It operates a network of servers around the world.

to fixed wireless broadband.⁴² Today there is a range of fixed Internet technologies available in Vanuatu which includes ADSL over copper, fiber optic cable, WiMAX, Wi-Fi and fixed 4G. However, the majority of new technologies are only available in the main urban centers, namely Port Vila and Luganville. Indeed, the fixed Internet infrastructure of most ISPs is located in Port Vila.

Historically, users in rural and remote areas may only have had very limited, if any, access to the Internet, either via slow and expensive mobile technologies, or through the purchase of expensive dedicated personal satellite services. Nowadays, with a more extensive mobile network and new satellite technologies that facilitate connectivity at a lower cost (Telsat's broadband offer through Kacific), Internet availability in rural and remote areas has improved significantly.

4.3.1 Mobile

Mobile services play a key role in communications throughout Vanuatu. Mobile is the preferred mode of telephony in both rural and urban areas and in many cases is the only means of telecommunication.⁴³ In 2014, mobile population coverage provided by the two mobile operators (TVL and Digicel), was estimated at around 92%.⁴⁴ TVL's mobile network provides coverage to 75% of the country's population while in 2015, Digicel reported 89 cell sites, 92% population coverage with 2G technology and 51% coverage with 3G technology.^{45 46} Digicel's current mobile network, reaches most islands in Vanuatu (Annex B), with 60% of the network on 3G and 40% on 2G.

In March 2017 TVL was acquired from Mauritius Telecom by Amalgamated Telecom Holdings (ATH) of Fiji for USD28 million⁴⁷. ATH has been increasing its presence across the region with a previous purchase of the former incumbent TSKL in Kiribati and, more recently, with the acquisition of BlueSky which has operations in Samoa, American Samoa and the Cook Islands.⁴⁸ ATH has stated that it intends to invest in upgrading infrastructure in Vanuatu, including the deployment of 4G+ services⁴⁹. TVL does not have Fixed Wireless Access technology and it will also be closing its WiMAX network.

Mobile technology available in Vanuatu has evolved from GSM 2G, 2.5G, and 3G, to some areas with 3G+ broadband. 3G technology is able to provide data rates more than 30 times higher than 2G.⁵⁰ However, the deployment of the newer technologies is concentrated in the two more densely populated areas of Port Vila and Luganville. In December 2011, Digicel launched its 3G network, and

⁴² Telecommunications and Radiocommunications Regulator (2014), *Universal Access Policy (UAP) stakeholders update report no. 1*, 31 July 2014. Available at https://www.trr.vu/attachments/article/495/uap_public_stakeholder_report_31_07_14.pdf. Accessed October 2017.

⁴³ Pacific Institute of Public Policy (2008), *Social and economic impact of introducing telecommunications throughout Vanuatu*, November 2008.

⁴⁴ Telecommunications and Radiocommunications Regulator (2014), *Universal Access Policy (UAP) stakeholders update report no. 1*, 31 July 2014. Available at https://www.trr.vu/attachments/article/495/uap_public_stakeholder_report_31_07_14.pdf. Accessed October 2017.

⁴⁵ Telecom Vanuatu Limited (2017), *Coverage*. Available at <http://www.tvl.vu/en/mobile/coverage/>. Accessed October 2017.

⁴⁶ Internet Society (2017), *Ensuring Sustainable Connectivity in Small Island Developing States*. Available at https://cdn.prod.internetsociety.org/wp-content/uploads/2017/08/ISOC_Small_Island_Developing_States-201706015.pdf. Accessed October 2017.

⁴⁷ Amalgamated Telecom Holdings (2017), *Annual Report 2017*. Available at <http://www.ath.com.fj/images/athannualreport2017.pdf>. Accessed October 2017.

⁴⁸ Samoa Observer (2017), *Blue Sky Sold*, 6 August 2017, available at http://www.samoobserver.ws/en/06_08_2017/local/22950/Bluesky-Samoa-sold.htm/. Accessed October 2017.

⁴⁹ Amalgamated Telecom Holdings (2017), *Annual Report 2017*. Available at <http://www.ath.com.fj/images/athannualreport2017.pdf>. Accessed October 2017.

⁵⁰ 3G supports theoretical maximum data rates up to 14.4Mbit/s for HSPA, and above 21Mbit/s for HSPA+. Maximum data rates for 2G technologies are lower than 0.5Mbit/s. Note that these reference values are theoretical maximum, actual speeds achieved by customers will be lower.

TVL followed a year later in January 2013.⁵¹ In January 2016, Digicel launched Vanuatu's first 4G LTE mobile services, providing coverage to subscribers in the capital of Port Vila.⁵² TVL's LTE network is scheduled for launch at the end of 2017 – the service will be available in Santo, Ambae, Malekula and Efate, covering around 40% of the population.

In 2014, TRR identified 25 rural locations throughout Vanuatu to be the major unserved areas (Annex B).⁵³ These areas represent about 5% of the population and form the basis of the target for the Universal Access Policy rollout (UAP).⁵⁴

In fulfilment of UAP obligations, a total of 28 sites were planned to be deployed by Digicel, TVL and TelSat.⁵⁵ In addition to this, Digicel and TVL agreed to upgrade existing sites to provide 3G+ services and cater for future LTE upgrades. Both Digicel and TVL reported that provision of mobile infrastructure to unserved areas was extremely challenging and expensive. On average, the cost of deployment for a single site was between USD350,000 and USD400,000. This cost includes equipment, links, transport by barge, solar panels, helicopter links, and civil works.

TRR confirmed that current coverage reaches around 98.2% of the population. While these figures are to be reviewed on the basis of recent population information to account for relocation, TRR is confident that the UAP 98% coverage target will be reached and likely to be exceeded. It is clear that 3G mobile coverage has improved considerably as a result of the UAP deployment (**Error! Reference source not found.** and Annex B).

⁵¹ Internet Society (2017), *Ensuring Sustainable Connectivity in Small Island Developing States*. Available at https://cdn.prod.internetsociety.org/wp-content/uploads/2017/08/ISOC_Small_Island_Developing_States-201706015.pdf. Accessed October 2017.

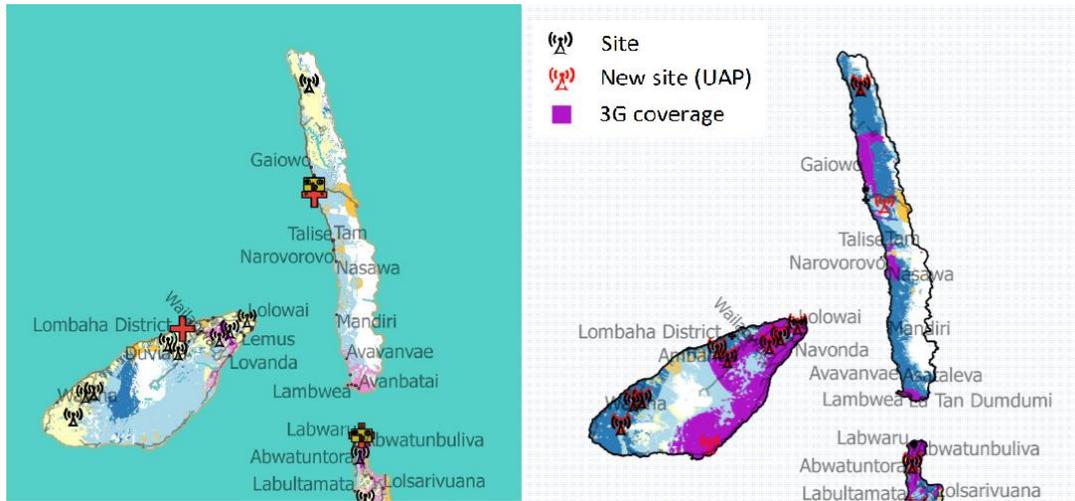
⁵² Digicel (2016), *World-Class LTE Internet has now arrived in Vanuatu*. Available at <https://www.digicelgroup.com/vu/en/mobile/explore/other-stuff/news-community/2016/january/20/world-class-lte-internet-has-now-arrived-in-vanuatu.html>. Accessed October 2017.

⁵³ Telecommunications and Radiocommunications Regulator (2014), *Universal Access Policy (UAP) stakeholders update report no. 1*, 31 July 2014. Available at https://www.trr.vu/attachments/article/495/uap_public_stakeholder_report_31_07_14.pdf. Accessed October 2017.

⁵⁴ *Ibid.*

⁵⁵ Telecommunications and Radiocommunications Regulator (2015), *Universal Access Policy (UAP) stakeholders update report no. 4*, December 2015. Available at https://www.trr.vu/attachments/article/554/4th_trr_uap_update_public_report_final.pdf. Accessed October 2017.

Figure 4.3: 3G coverage previous to UAP (left) and actual (right) – Ambae and Maewo⁵⁶



4.3.2 Fixed Internet

With the arrival of the submarine cable in 2014, the number of fixed Internet subscribers experienced a significant increase, which was more pronounced for fixed wireless subscribers. The advantage of fixed wireless access over other fixed access technologies, such as copper or fiber, is likely to be the main reason for the substantial difference in growth between wireless and wired technologies – wireless access technologies typically require less capital investment and are quicker to deploy than fixed wireline access.

The ISP WanTok offers broadband and voice over its 4G LTE network. The company was originally owned by the ICN1 cable’s owner, ICL. As such, the strategy behind the launch of the 4G service was to leverage the additional capacity available from the submarine cable.

The service is only available in Port Vila and other areas in Efate (Annex B). The launch of Wantok’s 4G LTE fixed wireless network in April 2014, contributed to the increase of wireless subscriptions in Vanuatu – the number of fixed wireless subscriptions (which includes WiMAX, Wi-Fi and fixed 4G), grew at around 2.7 fold from Q1 to Q2 2014 (**Error! Reference source not found.**). By 2016, most of the fixed Internet subscription were fixed wireless.

4.3.3 Other broadband access

Telsat Broadband provides broadband access in Port Vila and the surrounding suburbs through its Wi-Fi network (Annex B). Extended coverage is available with Telsat’s dedicated network of 14 towers, which provides access to one third of Efate. In addition to this, Telsat has VSAT satellite options (through Kacific), to provide 100% coverage to the rest of Vanuatu.

⁵⁶ Source: TRR.

There are two other ISPs – Global Pacific Telecom and SPIM. The former offers a fixed Wi-Fi service in Luganville while the latter is a reseller in Port Vila.

4.4 Invisible mile

4.4.1 Submarine cable market structure and pricing

While the submarine cable implementation was led by the private sector, the sources of funding were primarily from the public sector, including the Vanuatu National Provident Fund (VNPF), Vanuatu Post and the Vanuatu Government. These three public entities have a shareholding of approximately 63%, while the remaining 37% of shares are held by two private companies (Interchange Holdings and Fidelity Pacific Life Insurance). Finance was obtained through a commercial bank loan and there is no grant funding from any source. This form of Public-Private Partnership (PPP) has created conflicting interests between the Government and the independent regulator in regard to pricing international connectivity. A 2017 Commission of Inquiry into the VNPF identified the ICL investment as “non performing.”⁵⁷ As such, there has been considerable pressure on ICL to achieve a very high return on investment.

As previously occurred with Tonga, the World Bank offered the Government of Vanuatu a grant to help reduce the cost of international connectivity and increase the availability of Internet in the country.⁵⁸ Tonga was the first Pacific Island country to connect to the cable under the Pacific Regional Connectivity Project, which is being funded through grants of USD 17.2 million from the World Bank, USD 9.7 million from Asian Development Bank (ADB), and a USD6.6 million investment from Tonga Communications Corporation (TCC)⁵⁹.

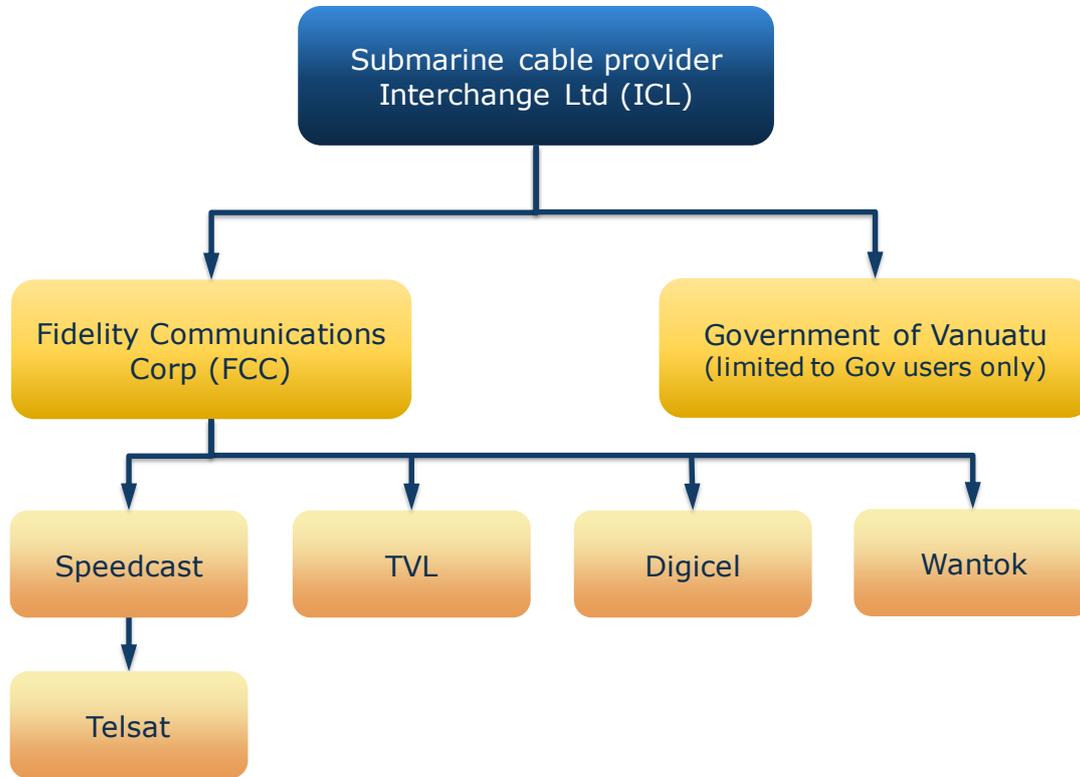
In 2010, ICL offered Indefeasible Rights of Use (IRUs) for a 15-year period in advance. The Government of Vanuatu, Fidelity Communications Corporation (FCC) and Wantok were the only companies that purchased IRUs. Note that while currently Wantok is owned by Terralight Gateway Holdings of Canada, prior to 2015 it was owned by ICL. Digicel, TVL, and Telsat opted to not acquire capacity in advance. Later in 2014, ICL stated that only IRUs will be offered and that leased capacity must be acquired through a reseller. This approach added a ‘middleman’ to the market structure which resulted in higher wholesale prices (**Error! Reference source not found.**).

⁵⁷ The report of the Commission of Inquiry was not publicly available as at October 2017, although the press has obtained a leaked copy.

⁵⁸ The Tonga Cable System, a submarine cable system which connects Tonga with Fiji, was funded through a grant of USD17.2 million from the World Bank.

⁵⁹ <https://www.adb.org/sites/default/files/project-document/.../44172-022-ton-rrp.pdf>

Figure 4.4: Vanuatu wholesale market structure⁶⁰



Speedcast leased capacity from FCC and then, operating as a wholesaler, leased capacity to TVL. Digicel opted to lease capacity directly from FCC. TVL subsequently acquired capacity directly from ICL at a lower price than from Speedcast, and therefore decided to cancel its contract with Speedcast. As a result, in November 2014, Speedcast made a claim to TRR against ICL for anti-competitive, discriminatory and misleading conduct. In its claim, Speedcast also raised other existing issues beyond the specific agreement between ICL and TVL – these included existing price, supply agreements and whether there was effective competition in the wholesale market. Digicel and Telsat also presented complaints about the price and the market structure proposed by ICL.

Consequently, TRR undertook a public consultation and in 2016 issued a determination imposing fines on FCC and ICL, and requesting information regarding the actual cost of providing leased capacity.⁶¹ In its determination, TRR recognized that ICL and FCC had engaged in anti-competitive conduct, that ICL is a dominant service provider in the Wholesale International Internet Service market, and that there are concerns whether there is effective competition in this market. As at November 2017, TRR approved the sale of additional lease capacity by FCC setting a maximum price for it.⁶² The TRR Determination is currently under judicial review at the behest of ICL.

⁶⁰ Source: TRR.

⁶¹ Telecommunications and Radiocommunications Regulator (2016), *Determination and findings relating to the wholesale international internet services market and Speedcast's complaint against Interchange Ltd*, 3 August 2016.

⁶² Telecommunications and Radiocommunications Regulator (2017), *Order n° 2 of 2017*, 2 May 2017 and *Order n° 7 of 2017*, 4 July 2017.

As at November 2017, all retail service providers are connected to the submarine cable. Since the launching of the submarine cable, the average lease price in the market has decreased from USD340 to USD260, per Mbit/s per month, as a result of TRR's intervention. Transit costs to the Southern Cross cable are an additional expense. In October 2017, transit prices from Fiji to Australia were USD60–70.

Price for international capacity on submarine links differs enormously depending on factors such as existing competition, capacity available, infrastructure cost and financing, and capacity acquired. Obviously, the cost of international capacity over less competitive routes is typically more expensive than those with a high level of competition. As an example, the median monthly lease price in 2016 for a 10Gbit/s circuit on the London – New York route (USD0.45 per Mbit/s per month), is around 59% and 89% lower than for Los Angeles – Tokyo (USD1.10 per Mbit/s per month), and Los Angeles – Sydney (USD4 per Mbit/s per month) routes, respectively.⁶³ Naturally, prices would be even higher for routes with no competition and low volume requirements – for example, the average lease price per Mbit/s per month in Vanuatu is 65 times higher than in the Los Angeles – Sydney link.

At a regional level, Vanuatu, together with PNG and Samoa, is one of the Pacific jurisdictions with higher prices for international connectivity over submarine cable at more than USD300 per Mbit/s per month including international backhaul and IP transit (**Error! Reference source not found.**).⁶⁴

Table 4.1: International submarine capacity wholesale price – Mbit/s per month including IP transit cost, August 2017⁶⁵

	< USD 100	USD100 to USD300	>USD300
Guam	✓		
Northern Marianas	✓		
New Caledonia	✓		
French Polynesia	✓		
Fiji	✓		
FS Micronesia		✓	
Tonga		✓	
Marshall Islands		✓	
Samoa			✓
Vanuatu			✓
Papua New Guinea			✓

4.4.2 Power supply

The electricity market in Vanuatu consists of two main operators: Union Electrique du Vanuatu Limited (UNELCO Engie), and Vanuatu Utilities and Infrastructure Limited (VUI). Electricity is generated by diesel and other renewable sources (wind, hydro and solar). By 2013, renewable energy sources generated

⁶³ TeleGeography (2016), *Global Submarine Cable Market Trends: What WAN Managers Need to Know*.

⁶⁴ MS Consulting Tahiti (2017), *Satellite and Submarine International Connectivity in the Pacific*, 2 August 2017.

⁶⁵ Source: MS Consulting Tahiti

around 29.5% of the total energy.⁶⁶ However, Vanuatu has a high dependency on expensive fossil fuel based energy.

While in the urban centers such as Port Vila and Luganville, electricity access is available through local electricity grids. Outside these urban areas there is no or only very limited access to electricity. Only 17% of rural households have access to any form of electricity other than battery powered mobile lamps or radios.⁶⁷ The lack of grid electricity in rural and remote areas represents a real challenge for telecommunications operators.

Rural Electrification Programme

In 2014, Vanuatu launched the Rural Electrification Programme with the objective to increase access to electricity for rural and remote areas, including households, aid posts and community halls located in off-grid areas. The overall goals set by the Government are to provide by 2020:

- Access to electricity for 90% of the population
- 65% power generation from renewable energy.

The programme includes provisions for subsidies of 50% of the cost of solar power systems for families, and assistance for eligible low income families to access the main electricity grid by subsidizing up to 80% of the cost of household connection.

The programme is receiving the support of the World Bank and the Government of New Zealand and will provide access to electricity to an additional 17,500 households.⁶⁸

Due to the dispersion and remoteness of the areas covered by the programme, equipment shipping and installation incur substantial costs. Similar logistical difficulties and high costs were experienced in the installations for the CLICC programme, yet there appears to be no process or mechanism for co-ordination between the Rural Electrification Programme and telecommunication network deployments.

4.4.3 Spectrum holdings

Spectrum is key for supporting better quality and widespread mobile services. Increasing the amount of available spectrum will increase the volume and quality of mobile services that can be provided while simultaneously reducing service costs. TRR is the responsible authority for allocating, assigning and managing the radio spectrum in Vanuatu.

Mobile services are supplied over three bands – 700MHz, 900MHz and 1800MHz (paired) (**Error! Reference source not found.**):

⁶⁶ Utilities Regulatory Authority (2013), *Electricity market*, available at http://ura.gov.vu/index.php?option=com_content&view=article&id=38&Itemid=89&lang=en. Accessed October 2017.

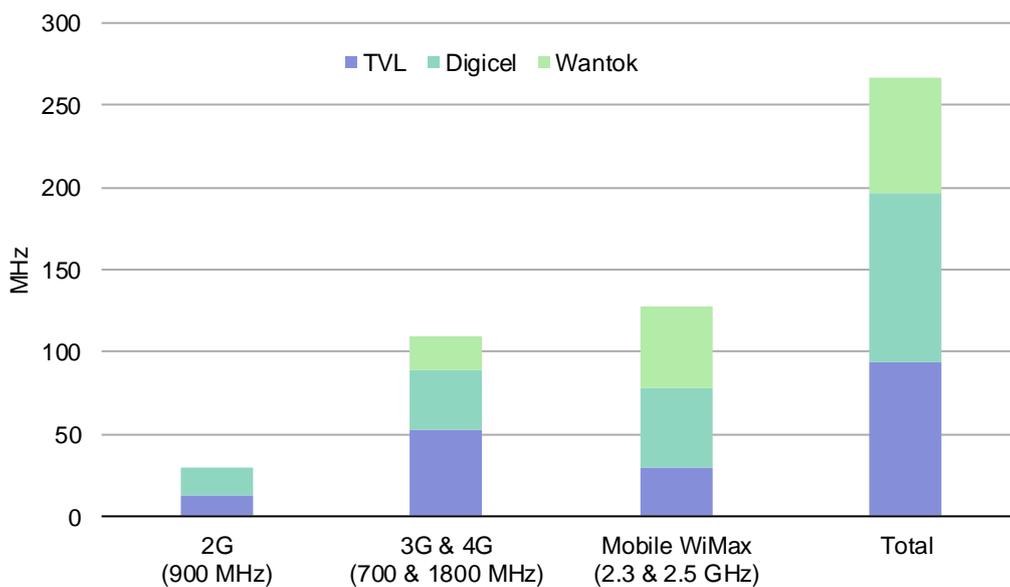
⁶⁷ United Nations (2015), *Rural electrification in Vanuatu*, 11 September 2015.

⁶⁸ The World Bank (2017), *Vanuatu Rural Electrification Programme benefits remote communities*, 22 May 2017. Available at <http://www.worldbank.org/en/news/feature/2017/05/22/vanuatu-rural-electrification-programme-benefits-remote-communities>. Accessed October 2017.

- 2G services are provided over the 900MHz band – Digicel holds almost 50% more spectrum than TVL
- 3G and 4G services are provided over 700MHz and 1800MHz bands. TVL is the operator with the most spectrum, with almost the same amount held by Digicel and Wantok combined.

WiMAX services are provided over the 2.3GHz and 2.5GHz bands (unpaired). Wantok and Digicel have the most spectrum (Figure 2).

Figure 2: Spectrum holdings, 2017⁶⁹



In consultation with TVL, it was mentioned that the current allocation of 900MHz is insufficient to provide good quality 2G services. However, for the delivery of 3G and 4G services, TVL has a competitive advantage in comparison to Digicel – while both have the same amount of spectrum in the 1800MHz band, TVL has additional spectrum in the 700MHz band. This low frequency spectrum reduces the cost of deploying mobile coverage as fewer base stations are required to cover the same geographic area.

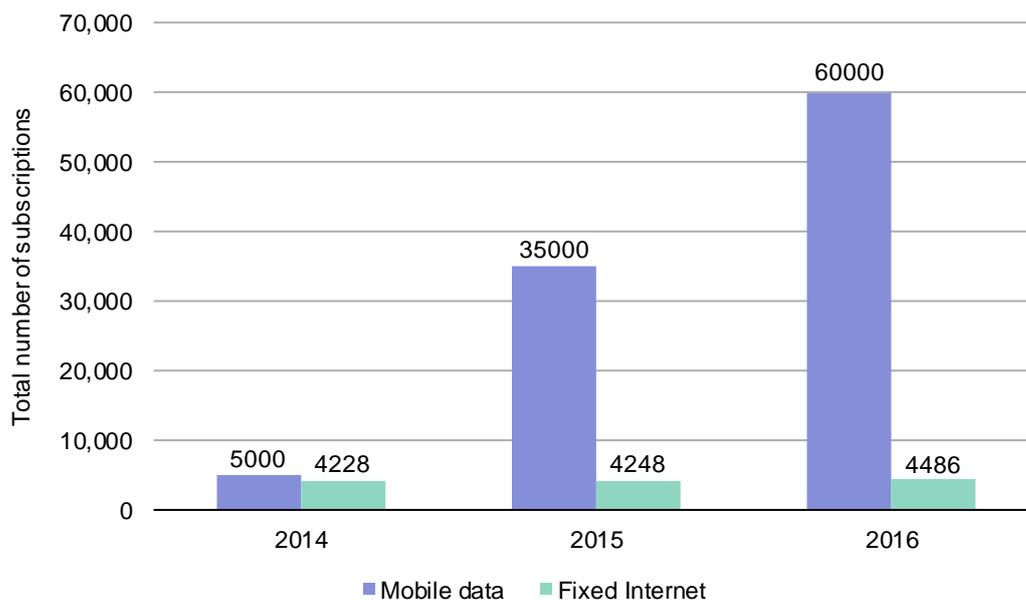
5 Demand side

This Chapter considers the changing pattern of broadband uptake, affordability and usage in Vanuatu, based on a variety of metrics. Internet usage is difficult to measure and so a range of both supply- and demand-side metrics have been used.

5.1 Fixed and mobile broadband penetration

The number of fixed broadband subscriptions has increased modestly in Vanuatu since 2011, with the number of mobile broadband subscriptions increasing by a factor of 10 (Figure 3). TRR estimated broadband penetration in 2013 as approximately 14.4% of the population, with the majority of subscribers located in urban areas. VSAT satellite technology was used to deliver services in most remote areas of the country.⁷⁰ With the arrival of the submarine cable in 2014, the market experienced a rapid increase in the number of Internet subscribers.

Figure 3: Fixed and mobile broadband subscriptions in Vanuatu from 2014 to 2016⁷¹

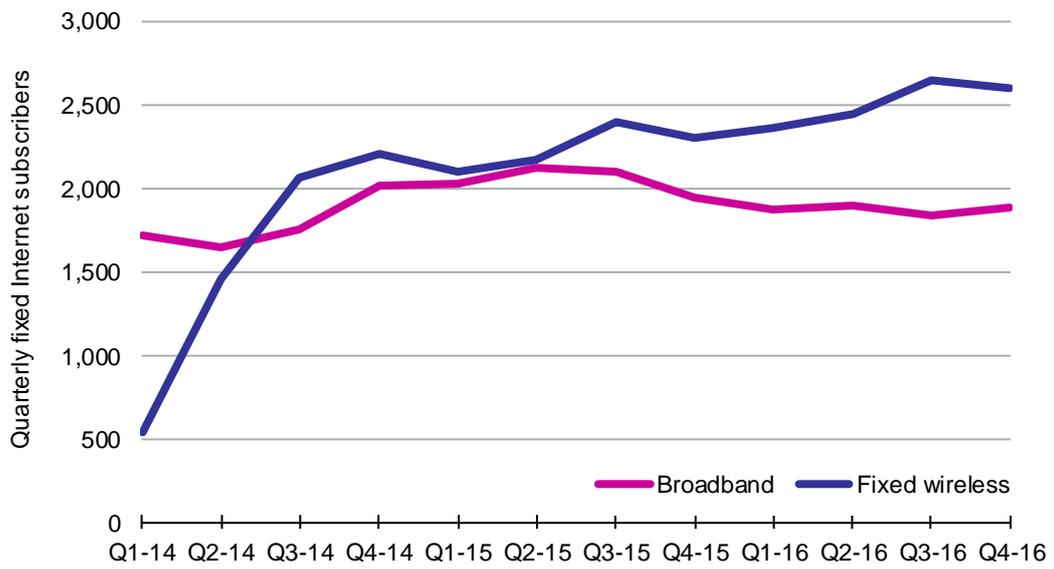


The number of fixed broadband subscribers (which includes DSL and its variants, and fiber optic cabling), increased gradually from 2014 to 2015 but a decline is evident in 2016. During the same period of time, fixed wireless subscriptions (WiMAX, Wi-Fi and fixed 4G) grew more than fourfold (Figure 4).

⁷⁰ Telecommunications and Radiocommunications Regulator (2014), *Universal Access Policy (UAP) stakeholders update report no. 1*, 31 July 2014. Available at https://www.trr.vu/attachments/article/495/uap_public_stakeholder_report_31_07_14.pdf. Accessed October 2017.

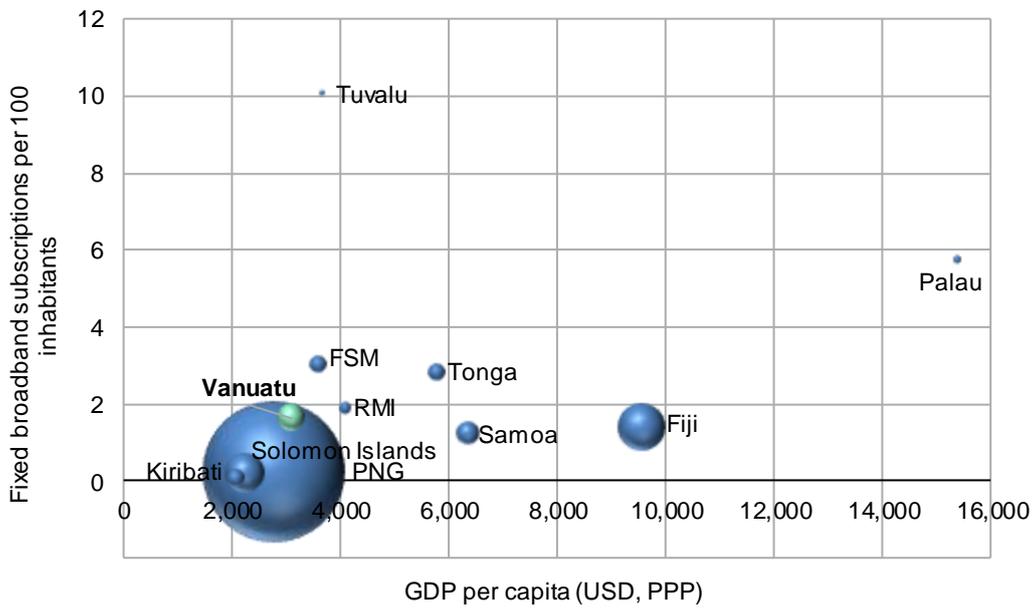
⁷¹ Source: TRR.

Figure 4: Quarterly fixed Internet subscribers⁷²



Vanuatu showed average levels for both fixed and mobile broadband penetration in 2016, compared to other Pacific Islands (Figure 5 and Figure 6, respectively).

Figure 5: Fixed broadband penetration in various Pacific Island countries, 2016⁷³



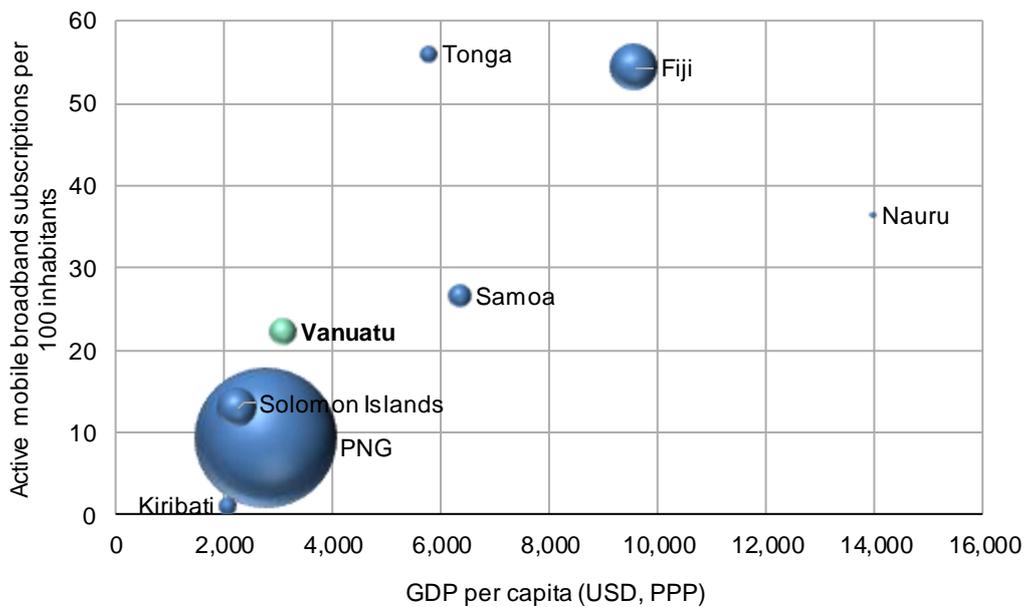
Note: size of bubble represents population

FSM – Federated States of Micronesia

PNG – Papua New Guinea

RMI – Republic of the Marshall Islands

Figure 6: Mobile broadband penetration in various Pacific Island countries, 2016⁷⁴



Note: size of bubble represents population

PNG – Papua New Guinea

5.2 Broadband affordability

A lack of affordability of broadband services was identified by many stakeholders as a major barrier to increased usage. In this Section, we examine affordability using current and historical Network Strategies data on Pacific broadband pricing.⁷⁵ The broadband prices have been directly sourced from the operators' websites to ensure these are the current prices. The affordability assessment uses World Bank GDP per capita for a consistent income proxy between countries. An average measure is used as there is no information on the distribution of income for Vanuatu.

Fixed broadband affordability

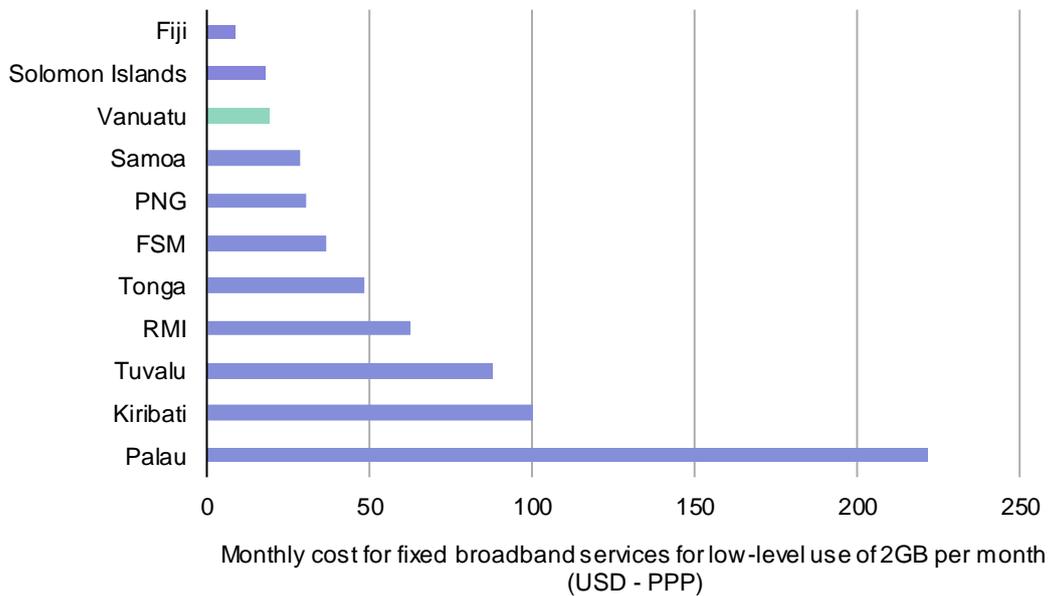
In comparison with other Pacific islands the monthly cost of a low-level of fixed broadband usage (2GB per month) in Vanuatu appears relatively low, at USD19.50 (Figure 7).

73 Source: ITU, World Bank

74 Source: ITU, World Bank

75 Telecommunications data for the Pacific region is difficult to obtain and other sources do not have the complete and up-to-date data-sets held by Network Strategies. The company, which is based in the Pacific region, has collected pricing data in the Pacific for almost ten years, and uses the OECD baskets of usage to assess affordability for different levels of broadband usage per month.

Figure 7: Monthly cost for 2GB of fixed broadband usage in Vanuatu and various other Pacific Islands, October 2017⁷⁶



FSM – Federated States of Micronesia

PNG – Papua New Guinea

RMI – Republic of the Marshall Islands

A general measure of true affordability of broadband services is that they should require less than 5% of average monthly income, which is not yet possible in Vanuatu.⁷⁷⁷⁸ Only two of the Pacific Islands have achieved true affordability for low-level fixed broadband use: Fiji and the Cook Islands, where less than 1.5% of average monthly income is required to pay for the service (Figure 8).

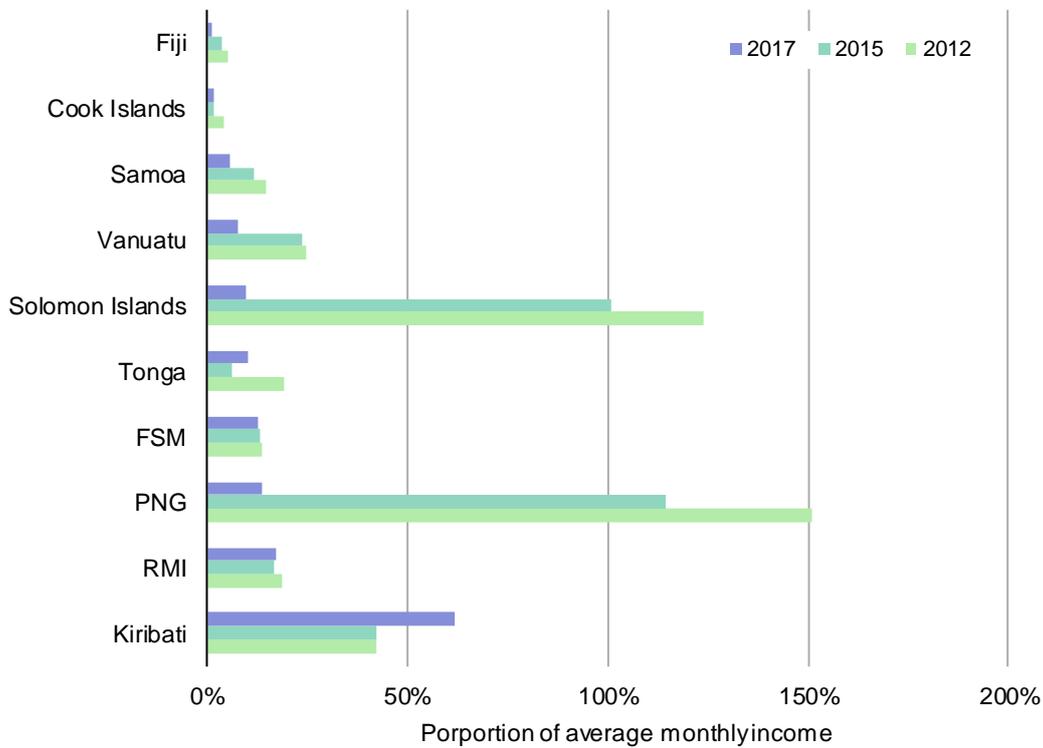
Compared to the other Pacific Islands analyzed, however, a low-level of broadband usage is relatively affordable in Vanuatu, with the monthly cost for 2GB usage requiring 7.6% of average monthly income. This is a significant improvement compared to the 24.6% required in 2012. The relative affordability of this level of fixed broadband services has been steadily improving for almost all the Pacific Island countries analyzed, with the exception of Kiribati and Tonga. In Kiribati, this is due to the discontinuation of the slow-speed fixed wireless service offered by Telecommunications Service Kiribati Limited (TSKL), with the takeover by ATH. A new 4G home-based broadband service is now offered instead. In Tonga, the lower-cost Digicel fixed-wireless service has also been discontinued.

⁷⁶ Source: Network Strategies.

⁷⁷ Broadband Commission for Digital Development (2015), *Broadband targets for 2015*.

⁷⁸ To estimate affordability of broadband services the monthly cost has been divided by an average monthly income value. GDP per capita divided by 12 is used for a monthly income proxy. An indication of the change in broadband affordability over time is provided using previous affordability calculations from October 2015 and November 2012.

Figure 8: Affordability of 2GB fixed broadband services per month in Vanuatu and other Pacific Islands⁷⁹



FSM – Federated States of Micronesia

PNG – Papua New Guinea

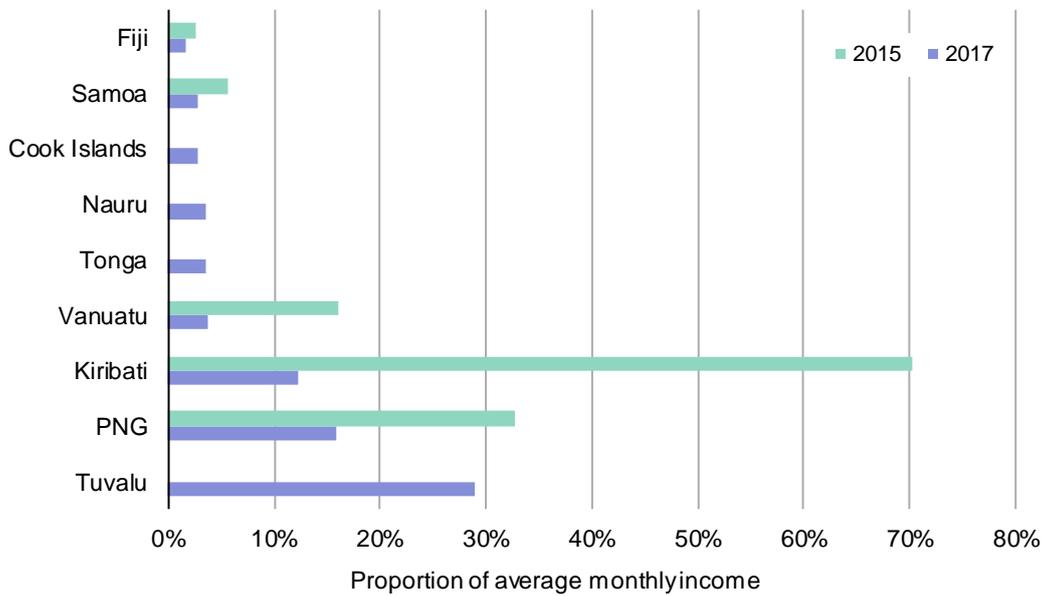
RMI – Republic of the Marshall Islands

Mobile broadband

In Vanuatu, a low-level mobile broadband usage of 1GB per month requires 3.8% of average monthly income, compared to 16% in 2015 (Figure 9). This level of mobile broadband usage now requires less than 4% of average monthly income in six of the nine countries that offer mobile broadband, including Vanuatu. This shows that mobile broadband is the only broadband service that is starting to become truly affordable in the Pacific Islands, albeit only at fairly low-levels of usage.

Mobile broadband is now offered in nine of the Pacific Islands in the benchmark sample, including Vanuatu. In 2015, mobile broadband was only available in five of these countries. Mobile data has become more affordable in all these countries since 2015, and is also becoming more accessible. In 2015, mobile broadband data packs were only available for dongles for laptops, but all these countries now offer equivalent mobile data packs for 3G or 4G capable mobile handsets.

Figure 9: Affordability of 1GB of mobile broadband services per month in Vanuatu and other Pacific Islands⁸⁰



PNG – Papua New Guinea

The cost of smartphone handsets in Vanuatu has been identified as an affordability barrier to entry for mobile broadband, particularly in the outer islands. Only one company in Port Vila offers hire purchase (or rent-to-buy) arrangements for handsets, and this scheme is only available to Government employees.

The prices of various smartphones available in Vanuatu and New Zealand are compared in **Error! Reference source not found.** The prices were obtained from a personal visit to a Digicel shop in Port Vila in October 2017, and include the cheapest available on display. A comparison with the smartphones offered on the Digicel website reveals similar models and prices, although an “affordable” model (Alcatel Pixi) is listed at USD56. This model was not on display at the Digicel shop.

Table 5.1: Smartphone handset prices in Vanuatu compared to New Zealand, October 2017⁸¹

<i>Handset model</i>	<i>Vanuatu price (USD – PPP)</i>	<i>New Zealand price (USD – PPP)</i>
Motorola G5	258.33	241.38
Motorola G4 Plus	224.22	240.00
iPhone 6S	887.11	551.03
Samsung Galaxy S8	955.35	895.86
Samsung Galaxy J5	243.71	241.38
Samsung Galaxy J2 Prime	121.86	171.72

The price differences between countries vary widely, with the price for the iPhone 6S in Vanuatu being over USD300 higher than in New Zealand; however, at the other end of the scale, the Samsung Galaxy J2 Prime is USD50 lower in Vanuatu than New Zealand. This indicates that, with the exception of the iPhone, the absolute handset prices are not particularly inflated in Vanuatu compared to New Zealand. Comparing the handset costs to a monthly income proxy (GDP per capita divided by 12), tells the true affordability story however, with these values presented in **Error! Reference source not found.** In Vanuatu, even the cheapest of the handsets would take nearly half the average monthly income to purchase, compared to just 5% of monthly income in New Zealand. The most expensive handset would require over three and a half times the average monthly income to purchase in Vanuatu.

Table 5.2: Relative affordability of smartphone handsets in Vanuatu and New Zealand, October 2017⁸²

<i>Handset model</i>	<i>Vanuatu % of monthly income required to purchase handset</i>	<i>New Zealand % of monthly income required to purchase handset</i>
Motorola G5	101%	7%
Motorola G4 Plus	87%	7%
iPhone 6S	345%	17%
Samsung Galaxy S8	372%	28%
Samsung Galaxy J5	95%	7%
Samsung Galaxy J2 Prime	47%	5%

It should be noted that the Government charges a 12.5% Value Added Tax (VAT) on the import of telephone handsets into Vanuatu which clearly contributes to the lack of affordability of smartphones. While removal of the tax would improve affordability, with a population of just over 272,000 Vanuatu remains a very small market with limited opportunities to benefit from economies of scale. Smartphone prices may, therefore, remain out-of-reach for some. Nevertheless, with the purchase of TVL by ATH early in 2017, there are signs that the telecommunications market may become more competitive.

ATH is an established and respected Pacific regional telecommunications market player with plans to invest and improve service offerings in Vanuatu. From the ATH 2017 Annual Report:

The primary immediate focus is to improve the telecommunications services and provide innovative, reliable and affordable services to the people of Vanuatu. As with our experience in Kiribati, we feel

⁸¹ Source: Network Strategies

⁸² Source: Network Strategies

confident that our approach of ascribing to the principles of excellence in all facets of operations will imbue TVL with new life and in due course, will deliver just returns on our investment.⁸³

As such, TVL is expected to become far more competitive, after a relatively long period of market dominance by Digicel during which ownership of TVL changed in 2011 from Cable and Wireless / France Telecom to Mauritius Telecom International Ventures / France Telecom – Orange and then in 2013, to Mauritius Telecom International Ventures alone. As ATH owns other telecommunications businesses in Fiji, Kiribati, Samoa, American Samoa and the Cook Islands, it is feasible that the organization may be able to benefit from economies of scale in purchasing.

5.3 Extent of Internet usage

This Section considers evidence on the extent of Internet usage in Vanuatu. Applications of broadband in developmental fields (including governance, health and education) are explored in Chapter 6.

The percentage of inhabitants using the Internet in 2016, as estimated by the ITU, shows that Vanuatu has a mid-range level of Internet usage compared to other Pacific Islands, at 24 inhabitants per 100 using the Internet (**Error! Reference source not found.**). Another method has been previously used to estimate Internet usage levels, based on Facebook account numbers, obtained from Facebook’s advertising manager.⁸⁴ This approach may tend to overestimate usage due to such factors as individuals with multiple accounts, and accounts remaining “active” after an individual’s death. Alternatively some individuals do not have Facebook accounts, hence usage may be underestimated. In its 2016 annual report, Facebook reported that duplicate accounts were estimated to be around 6% of its accounts, around 1% of accounts being false.⁸⁵ More recently, Facebook revised its estimates, with 10% of accounts worldwide being duplicates and 2-3% of accounts being false.⁸⁶ Indeed, comparing Facebook account numbers in various Pacific Islands to ITU’s Internet usage estimates shows a large disparity in many countries. In Vanuatu, however, these values are quite similar, with there being 22.7 Facebook accounts per 100 inhabitants (Figure 11).

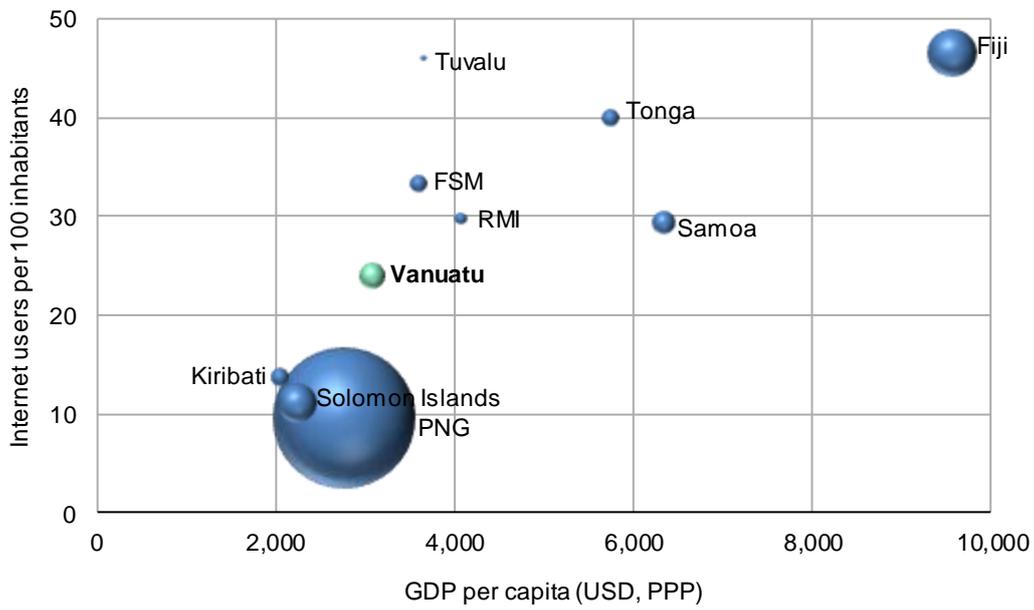
⁸³ Amalgamated Telecom Holdings (2017), *Annual Report*, 2017, page 9.

⁸⁴ Reports on the number of Facebook accounts by country can be freely generated via <https://www.facebook.com/ads/manager>.

⁸⁵ Facebook (2017), *Annual report* 2016, page 4. Available at https://s21.q4cdn.com/399680738/files/doc_financials/annual_reports/FB_AR_2016_FINAL.pdf. Accessed November 2017.

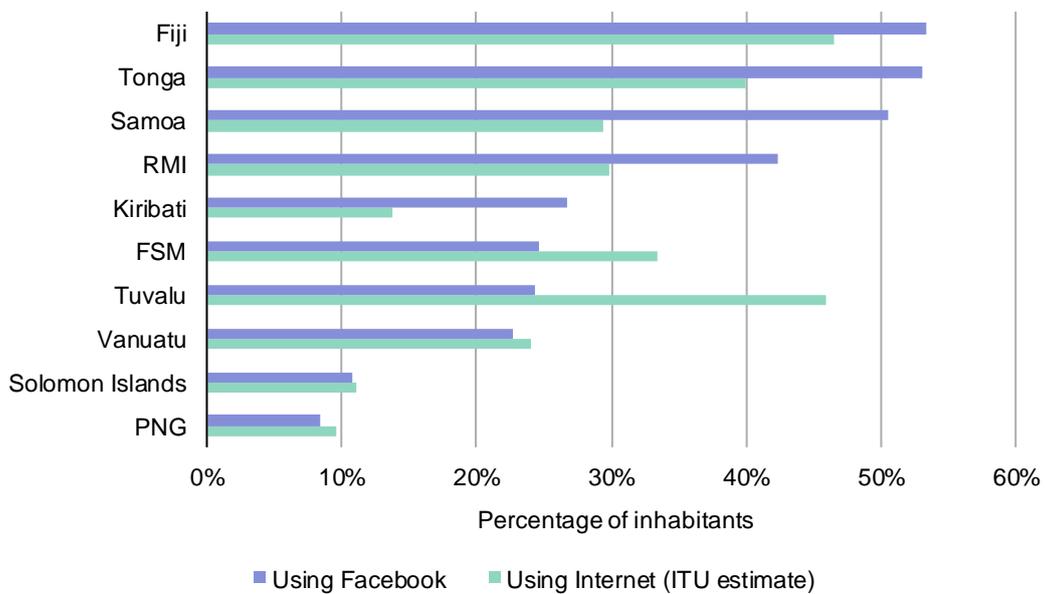
⁸⁶ Facebook (2017), *Form 10-Q Quarterly Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934 For the quarterly period ended September 30, 2017*, page 51. Available at <http://d18rn0p25nwr6d.cloudfront.net/CIK-0001326801/06205619-7ced-42ed-b8c8-4621b5a121e9.pdf>. Accessed November 2017.

Figure 10: Estimated percentage of inhabitants using the Internet, 2016⁸⁷



FSM – Federated States of Micronesia
 PNG – Papua New Guinea
 RMI – Republic of the Marshall Islands

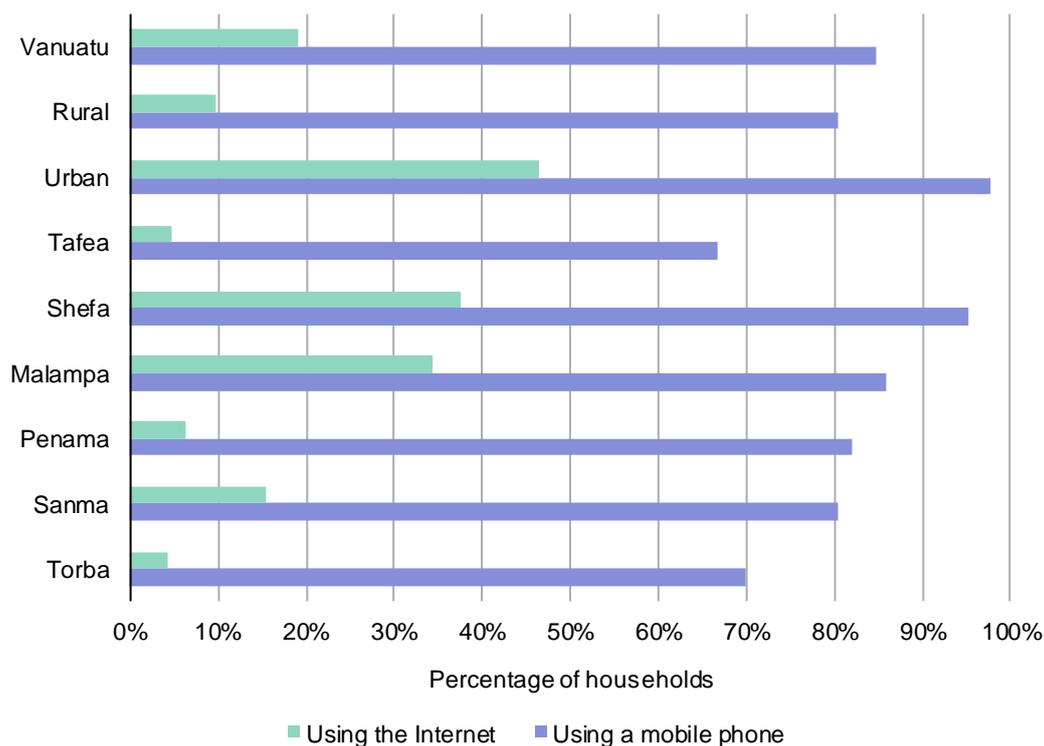
Figure 11: Estimated percentage of inhabitants using the Internet compared to Facebook users, 2016⁸⁸



FSM – Federated States of Micronesia
 PNG – Papua New Guinea
 RMI – Republic of the Marshall Islands

Household use of telecommunications services, including mobile and Internet, was recorded in the 2016 mini-census (Figure 12), for all households in Vanuatu, and also disaggregated by all rural areas, all urban areas and by province. Mobile phones are used in most households, with over 80% of households in most regions using mobile phones. Internet usage is far lower, however, with less than 20% of households over all of Vanuatu using the Internet. Even in urban areas less than half of households use the Internet, and this figure drops to below 7% in three of the six provinces.

Figure 12: Household use of communications services in Vanuatu, 2016⁸⁹



5.4 Internet attractiveness

In addition to affordability, another key barrier to broadband uptake is a perceived lack of relevance or need. This could be the result of an inability to evaluate the utility of broadband Internet content and / or applications, or simply that available content is insufficiently attractive or culturally relevant. To this end, availability of local content is extremely important, particularly in communities where a number of different languages are spoken.

In Vanuatu, local Internet content creation is extremely limited. In fact many Government Ministries have only recently invested in websites. There is informal local content via social media, with some

87 Source: ITU
 88 Source: ITU, Facebook
 89 Source: Vanuatu national Statistics Office

positive impacts reported. However, there is also anecdotal evidence that some of this content has caused social malaise and friction.

Of the top ten websites in Vanuatu, three are local sites. While the top three sites are Google, YouTube and Facebook, it is interesting to note that the fourth most popular is the University of the South Pacific in Fiji (**Error! Reference source not found.**). This suggests that the Internet is serving an important educational role, enabling distance-based learning.

Some of the mobile packages offered by TVL and Digicel include “Free Basics” Internet access.⁹⁰ The “Free Basics” initiative provides access to a basket of websites and services without charging for the used data. These include social media, news, health and education services such as Wikipedia, Thesaurus, AccuWeather, Bing, Facts for life, a basic version of Facebook and Facebook messenger. These mobile websites were optimized to be less data hungry to allow for access even in areas where there is only GPRS/EDGE (2.5G) coverage.

Table 5.3: Top websites in Vanuatu, October 2017⁹¹

<i>Rank*</i>	<i>Site</i>	<i>Daily time on site per visitor (minutes:seconds)</i>	<i>Daily pageviews per visitor</i>	<i>Number of external websites linking to this site</i>
1	Google.com	7:60	8.80	3,560,046
2	Youtube.com	8:30	5.02	2,699,220
3	Facebook.com	9:50	4.00	7,601,185
4	Usp.ac.fj	19:10	12.00	780
5	Yahoo.com	4:04	3.80	648,102
6	Google.vu	1:13	1.90	277
7	Gov.vu	5:15	2.90	38
8	Telsatbb.vu	42:40	1.50	44
9	Dailypost.vu	7:19	3.10	269
10	Wikipedia.org	4:11	3.29	1,722,890

* Websites are ranked based on a combination of average daily visitors and pageviews over the past month.

⁹⁰ Facebook (2017), *Free basics by Facebook*, available at <https://info.internet.org/en/story/free-basics-from-internet-org/>. Accessed October 2017.
⁹¹ Source: Alexa, <https://www.alexa.com/topsites/countries/VU>, accessed October 2017.

6 Sectoral use and impacts

This Section discusses the impact of broadband on the social and economic development in Vanuatu. It highlights the role of broadband in rolling out the e-Government project, digital initiatives and recent projects in health care and education.

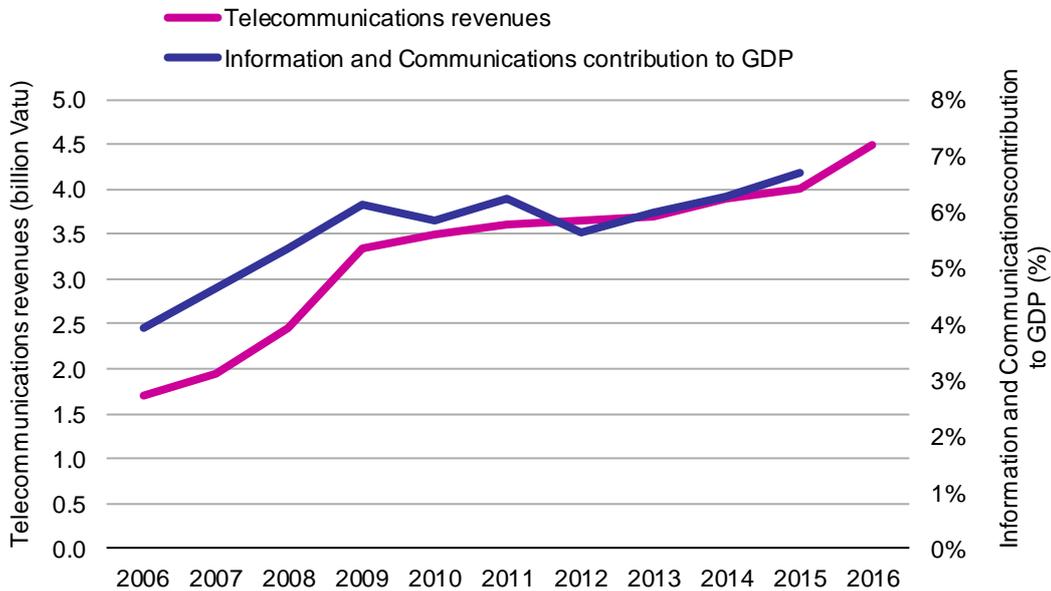
6.1 The ICT sector

The ICT sector in Vanuatu has seen steady growth over the past ten years. According to the latest data published by the Vanuatu National Statistics Office, Information and Communication represented 6.2% of GDP in 2015. However, it can be inferred from the published statistics of the TRR that this is largely the revenues of the telecommunications sector (Figure 13). By the end of 2016, the sector generated gross revenue of around VUV4.48 billion (USD41.86 million).

According to TRR analysis, the significant increase of 13% in gross market revenue in the last year appears to be predominantly driven by mobile voice and data services. The continuing decline in mobile data prices and increasing geographical coverage of 3G and 4G networks have led to significant growth in Internet usage.

Digicel advises that it employs 900 people, both directly and indirectly (that is, including distributors) in Vanuatu. However, there is a paucity of recent data about the total number of people employed in the ICT sector. The same applies to other ICT services such as software development, desktop support and enterprise networking. Nevertheless the lack of digital literacy and the insignificant contribution of these enterprises to GDP suggests that these sectors are still weak. The 2017-2018 telephone directory of Vanuatu lists only two companies specializing in website development. Within government sectors, there is a tendency for individual Ministries to use dedicated staff to provide these services.

Figure 13: Growth of ICT sector in Vanuatu⁹²



6.2 e-Government

The first Vanuatu e-Government plan was developed in 2008.⁹³ One of its main objectives was to create a Government Broadband Network (GBN).⁹⁴ The project, which was funded by a low interest loan from China, cost approximately USD28 million. The GBN is a private fiber optic and fixed wireless network linking the government offices in the main provincial centers of Vanuatu. The network also provides Internet access to government offices.

A key responsibility of the OGCIO is to lead e-Government initiatives, referred to as iGov. The iGov initiative aims at using e-government solutions and ICTs to bring better service delivery methods for all ministries, agencies, businesses and residents. Other general objectives of the OGCIO include encouraging the spread of ICT in society and encouraging the right to information in Vanuatu. Currently, four services are provided over the e-Government network including VoIP telephony for internal and external communications, video conferencing, website development and hosting for government agencies, and databases. Examples of databases running on OGCIO servers include the new Court Management System which was commissioned in November 2015, and the Civil Registry information management system. The latter system had a huge impact on the efficiency and coverage of the civil registry office and has already been extended to enable birth registration using mobile units.⁹⁵

⁹² Source: TRR and VNSO

⁹³ FutureGov Asia (2012), *Vanuatu: Integrating Government in the Pacific Islands*, 10 July 2012. Available at <http://www.unpan.org/PublicAdministrationNews/tabid/115/mctl/ArticleView/ModuleID/1467/articleId/32294/default.aspx>.

⁹⁴ Cullen, R. and G. Hassall (2016), *e-Government in the Pacific Island states: ICT policy and implementation in small island developing countries. Vanuatu country report*, 2016.

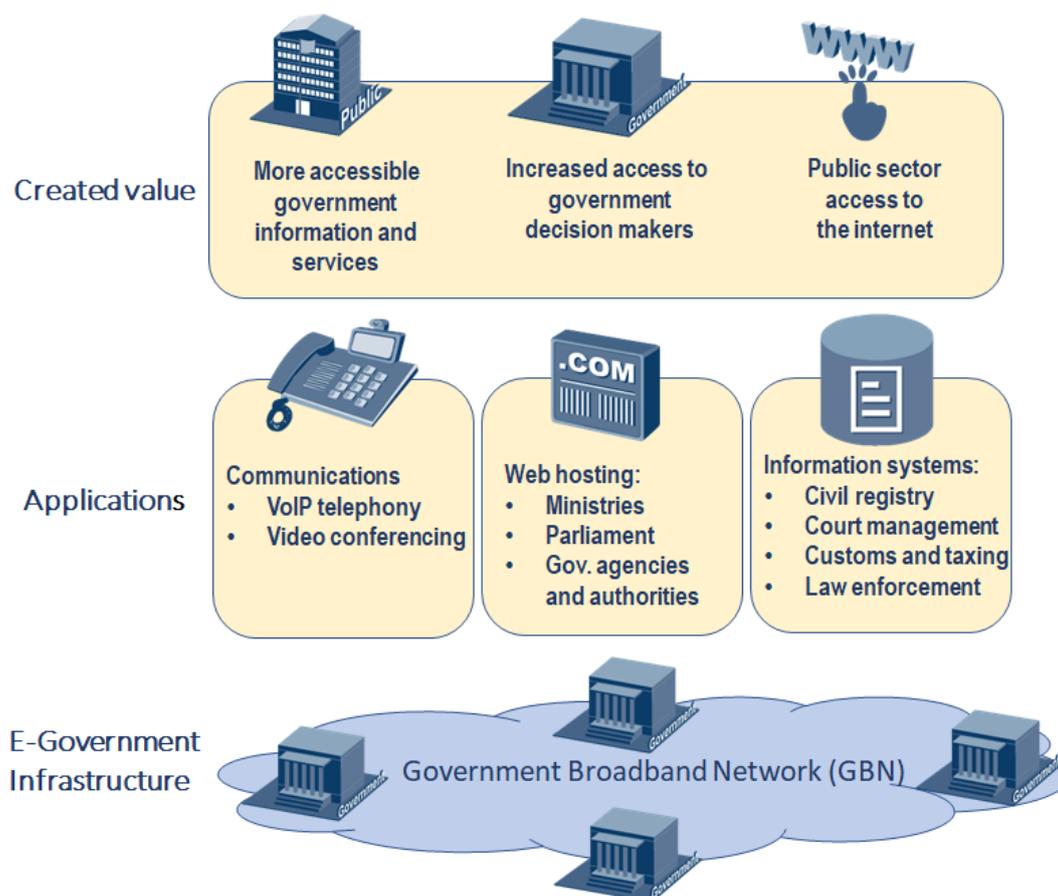
⁹⁵ UNICEF (2017), *Pacific Island Countries: what we do*, available at <https://www.unicef.org/pacificislands/overview.html>. Accessed October 2017.

The GBN has been crucial in enabling networking and information management services for the government (Figure 14). However, a lack of human capacity and low levels of ICT literacy seem to be major barriers towards utilizing the full potential of the existing GBN and ICT infrastructure in general. To overcome these barriers building local ICT capacity is one of the key priorities set in the National Information and Communication Technology Policy.⁹⁶ For cost reasons, there is a trend across government to shift to open source software.⁹⁷ As a result, the OGCIO has been building a small base of programmers who are developing open source programming expertise. Government agencies are encouraged to develop capabilities to manage their own website development. The database used by the civil registry was developed locally. These capacity building activities can be considered as a positive side effect of the GBN. However, no data exists about the number of staff trained in the process or the cost reductions achieved in government communications. From the available data, it appears that the most important gains from the GBN are related to the core aspects of governance, namely the management of the bureaucracy, economy, taxation and revenues as well as improving resilience to natural disasters.

⁹⁶ Republic of Vanuatu (2013), *National Information and Communication Technology Policy*, December 2013.

⁹⁷ Cullen, R. and G. Hassall (2016), *e-Government in the Pacific Island states: ICT policy and implementation in small island developing countries. Vanuatu country report*, 2016.

Figure 14: Applications enabled by the Government Broadband Network⁹⁸



To date, there is only one GBN e-Government example where members of the public may submit an online application. Launched in September 2017, this online process is available on the Ministry of Education’s scholarships website.⁹⁹ The OGCIO has identified a number of other possible e-Government applications which, once available and accessible, would generate substantial cost savings for consumers.

A notable example is the process of obtaining documentation to travel abroad for seasonal work – for example, the Recognised Seasonal Employer (RSE) Scheme which enables ni-Vanuatu to undertake seasonal work in New Zealand in orchards, market gardens and vineyards. The RSE scheme has been operational for a decade, enabling work opportunities for 3,500 ni-Vanuatu at any one time. The scheme is currently being expanded to include an additional 1,000 workers. In order to avail themselves of these opportunities prospective RSE workers must travel to Port Vila to obtain birth certificates and remain in Port Vila for approximately six months to obtain all the required documentation and a visa. This process involves expensive travel costs, a loss of productive time in the villages and additional costs for relatives and their households providing temporary accommodation in Port Vila. Clearly an efficient online process would lead to substantial cost savings.

⁹⁸ Cullen, R. and G. Hassall (2016), *e-Government in the Pacific Island states: ICT policy and implementation in small island developing countries. Vanuatu country report*, 2016.

⁹⁹ Republic of Vanuatu (2017), *Government Scholarship Website and Online Application Process*, 4 September 2017. Available at <https://www.gov.vu/en/public-information/309-government-scholarship-website-and-online-application-process>. Accessed October 2017.

6.3 Health

In general, the Ministry of Health in Vanuatu is not as yet a significant user of ICT. However, enhancing the delivery of health services with ICT is one of the priorities included in the National ICT Policy and Universal Access Policy.

In July 2016, the first telemedicine facility was launched in the remote community of Naviso village, on East Maewo. The project is part of the Vanuatu Inter-Island Telemedicine and Learning Network pilot project and is the result of governmental and non-governmental collaboration, including the local community.^{100 101} The facility connects the nurses in the primary care unit with doctors at a hospital in Luganville. In the six months since its inception, more than 1,250 engagements with doctors were reported and 32 patients were assisted, including six life-threatening cases. The service uses Internet based free video communications software, such as Skype, to access specialist advice in real time. The facility, which provides Internet connectivity using the Kacific broadband satellite, is the only connection to the outside world. Consequently, its use extends beyond telemedicine to provide general Internet connectivity. The local community took an active role in building the infrastructure to extend connectivity, assisted by Peace Corps volunteers. The funding for the Internet use finishes at the end of 2017, at which point the Ministry of Health may assume responsibility for the ongoing charges. The project is currently under evaluation to confirm whether this model will be suitable for other areas in Vanuatu. The service provider, Kacific, reviewed incomes of families in rural and remote areas of Vanuatu. It concluded that this model can be both affordable and sustainable if communities or groups of families are willing to share the cost of the system. The estimated cost can be as low as 1.5% of the income of the group.¹⁰²

Another pilot project, reported by UNICEF Pacific, aims at improving Vanuatu's immunization programme. With support from UNICEF, the Ministry of Health has piloted the use of the open source software Akvo Flow to carry out supervision and data collection.¹⁰³ With the help of the software, tablets and smartphones are pre-loaded with supervisory checklists and other materials to assist with supervision and data collection related to child vaccination at health centers around the country. The collected data can be made immediately accessible online, over the mobile network, to data officers at the Extended Programme for Immunization (EPI). According to a UNICEF report from July 2017, the system has already been pilot tested in 60 health facilities throughout Vanuatu.

6.4 Education and digital literacy

A 2013 study found that Vanuatu scored poorly on key education ICT measures, in comparison to various other developing countries.¹⁰⁴ For example, only 6% of Vanuatu schools had access to the Internet with only 1% of schools with access to broadband. The same study indicated that 5% of

¹⁰⁰ ITU (2017), *Vanuatu inter-island telemedicine and learning (vital) network project*, available at <https://www.itu.int/net4/wsis/stocktaking/projects/Project/Details?projectId=1486967327>. Accessed October 2017.

¹⁰¹ Maewo Telecommunications (2017), *Grassroots initiative for remote villages to access Internet*, available at <http://mtc.invanuatu.com/>. Accessed October 2017.

¹⁰² Kacific (2016), *Kacific in Vanuatu: connectivity changes lives*, 7 October 2016. Available at <http://kacific.com/kacific-in-vanuatu-connectivity-changes-lives-by-christian-patouraux/>. Accessed October 2017.

¹⁰³ Akvo.org (2017), *Capture, understand, share*, available at <http://akvo.org>. Accessed October 2017.

¹⁰⁴ Republic of Vanuatu (2013), *The first survey of ICT usage in the Vanuatu schools*, May 2013.

students had access to ICT and 4% of students were computer literate. However, in the small number of schools where computer lab facilities were available to students 71% were computer literate.

Consequently the national ICT policy highlights the importance of ICT in education and thus a significant component of the UAP aims to increase access to ICT facilities and the Internet in schools, and improve digital literacy in communities. The Ministry of Education advises that some schools have privately funded computer and Internet facilities, but information is not available on the precise number or the locations. Some data is collected through the Ministry's online ICT system, VEMIS¹⁰⁵, which is accessible to educational authorities and school principals. Principals are required to upload monthly reports (for example, financial reports and registration details) and the information is retrieved by the Ministry. Currently the Ministry is training school principals to use smartphones for this purpose, however the principals are responsible for purchasing their own mobile data services. On-time reporting by principals now has a 80% success rate, which is substantially higher than previous years.

The UAP initiatives include the CLICC, TFS and ICS programmes. Interest in these programmes far exceeded expectations with TRR receiving 322 applications in total. Following a rigorous selection process based on an assessment against set criteria, an initial 15 schools were selected for CLICC, seven schools for TFS and three enterprises for ICS. One of the key criteria was related to logistical issues for installation, including availability of power. Other factors included capacity for local support and the potential impact on teachers, students and members of the community. After completion of the selection process TRR then undertook a procurement process for the required goods and services.

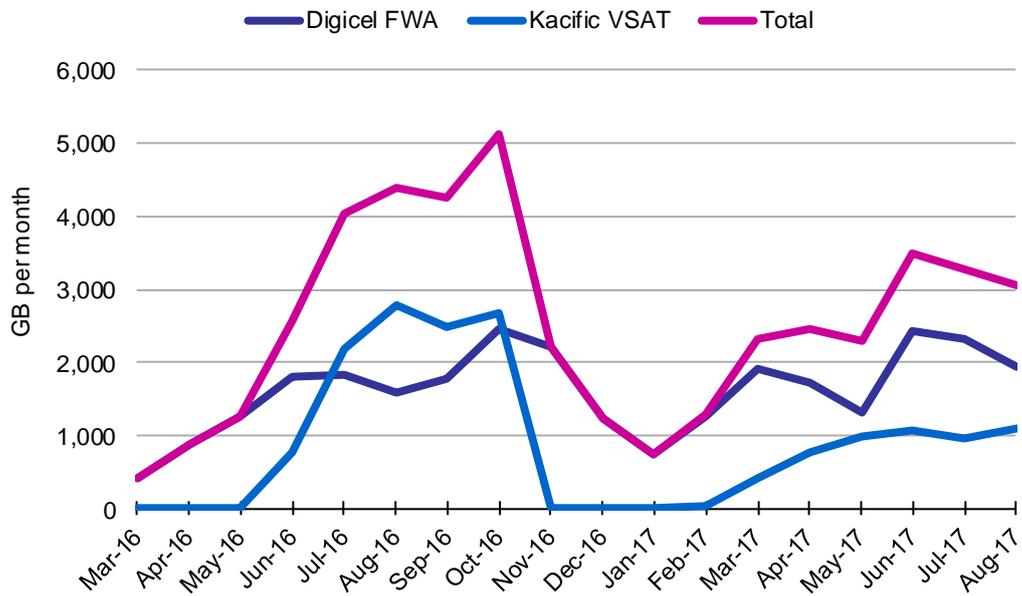
TRR reports that a total of 19 schools have now been provided with computer labs for general educational purposes as part of the CLICC programme. Internet access was provided by fixed wireless access (Digicel) and VSAT (Telsat).¹⁰⁶ The labs are also open to the community during and after school hours to promote ICT literacy, enhance the development of local content and potentially to provide a hub for the delivery of e-Government services. Computer labs have been quickly integrated by the teachers. The demand for the use of these centers by students and community is evident by the rapid increase in the used data volume from about 400GB to 5,000GB from March to October 2016 (**Error! Reference source not found.**). The decline in usage over the November to February period was the result of a lengthy satellite outage.

The rollout of the TFS programme in schools is still in its beginnings, with only 50 tablets delivered, and its impact is still being evaluated. TRR also reports opening of three Internet cafés, which partly contribute to training the community in ICT.

¹⁰⁵ Open VEMIS (2017), *Open VEMIS the Vanuatu education planning toolbox*, <http://www.openvemis.gov.vu/Default.aspx>. Accessed October 2017.

¹⁰⁶ Telecommunications and Radiocommunications Regulator (2017), *Annual Report 2016*, available at <https://www.trr.vu/index.php/en/public-register/reports/annual-reports/2016>. Accessed October 2017.

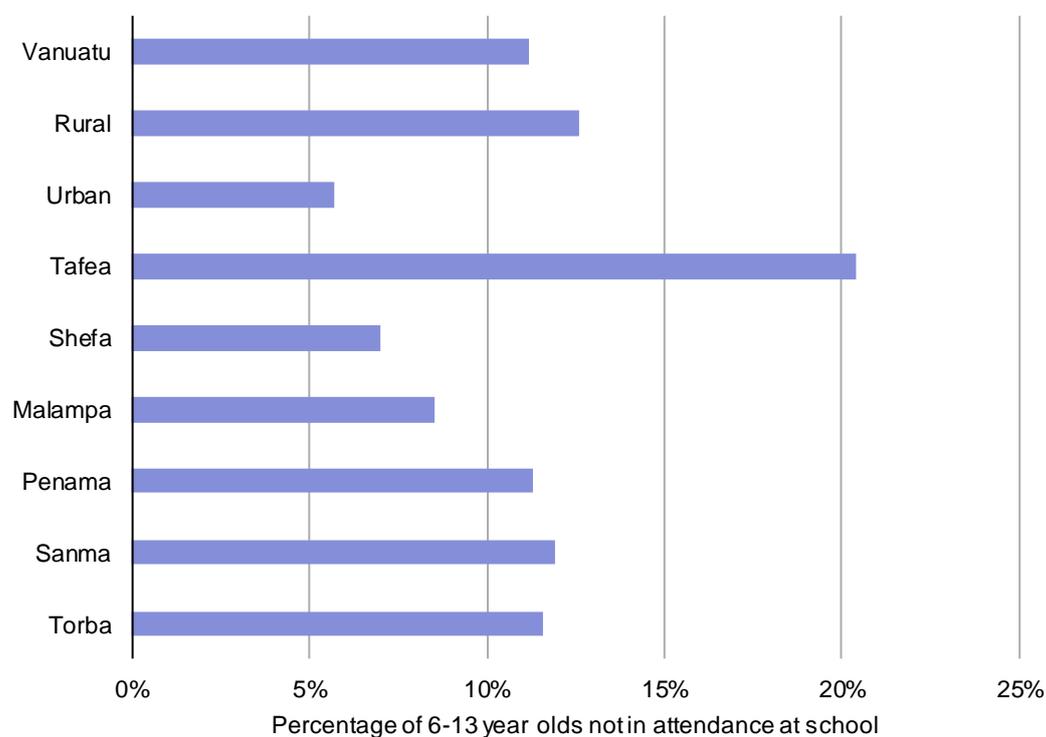
Figure 15: CLICC data usage - GB per month¹⁰⁷



The last Thursday of April each year is commemorated as “Women and Girls in ICT” day. The opportunity is seized by the government of Vanuatu to train women and girls on basic IT skills such as creating email and Facebook accounts or developing their own business websites. These activities make use of the existing CLICC centers as well. Another campaign takes place on the celebration of the National ICT Day, where a selected group of girls are enrolled in a week-long boot camp for basic IT training.

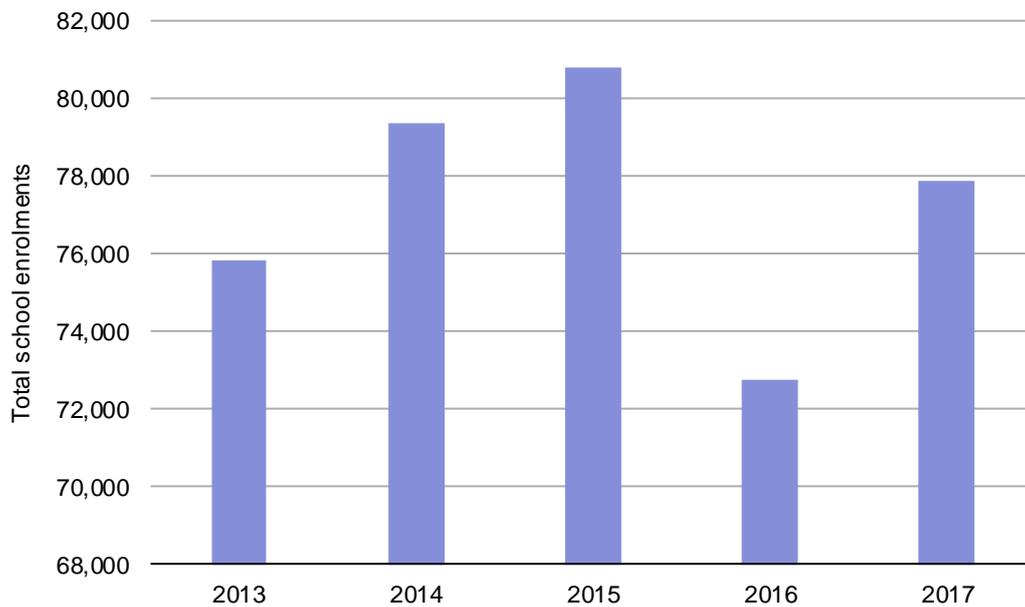
TRR is currently implementing a monitoring and evaluation system which will provide key information on the impact of the UAP initiatives. Anecdotal feedback to date is that the availability of the computer facilities at schools has been encouraging school attendance. Note that school attendance is not compulsory in Vanuatu. The 2016 mini-census reported the number of 6–13 year olds not in attendance at school by region (Figure 16). In Vanuatu, just over 11% of children did not attend school in 2016, with the levels of non-attendance in rural areas approximately double that in urban areas. Tafea province had by far the lowest level of school attendance, with over 20% of 6–13 year olds not attending school in 2016. The most common reason for non-attendance is the need for children to assist family with subsistence agriculture.

Figure 16: School attendance levels for 6-13 year olds in Vanuatu, 2016¹⁰⁸



The total number of school enrolments in Vanuatu for all school levels increased steadily from 2013 to 2015, then suffered a large drop in 2016, possibly as a result of the aftermath of Cyclone Pam, and started to recover in 2017 (**Error! Reference source not found.**).

Figure 17: School enrolment levels in Vanuatu from 2013 to 2017¹⁰⁹

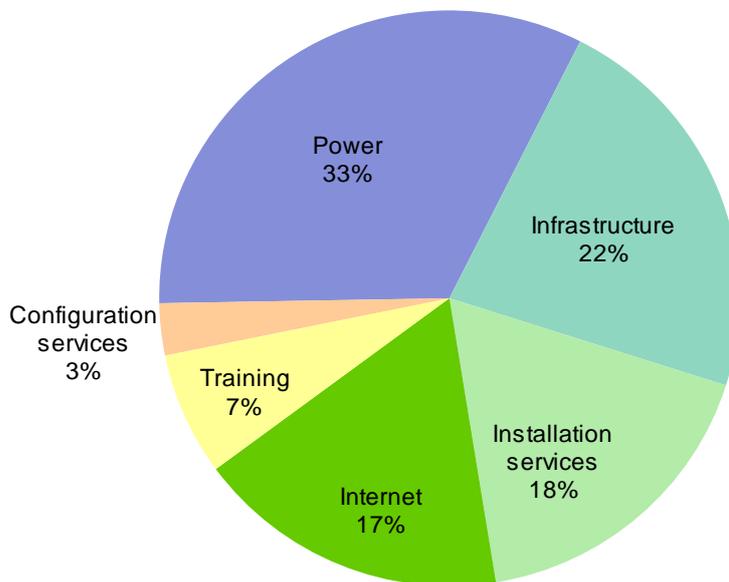


Another positive impact on student learning is evident in that the schools with computer labs are able to access textbooks much more easily than previously. In addition, the tablets have pre-installed mobile applications which automatically update when textbooks are updated. The Ministry of Education has historically experienced logistical difficulties in shipping teaching resources to remote schools. This often lengthy process has presented barriers to learning and achievement in the past.

If the CLICC project is to be extended then further funding would be required for power, infrastructure, installation, training and the cost of Internet. An average cost for one CLICC was USD30,000, with power and infrastructure representing over 50% of the cost (Figure 18). The installation of VSAT infrastructure, however, was a considerably cheaper option at approximately USD2,000 per site. The VSAT CLICC sites were installed free of charge by TelSat as part of its contribution to the UAP.

¹⁰⁹ Source: Ministry of Education and Training, Vanuatu National Statistics Office

Figure 18: CLICC cost breakdown, 2017¹¹⁰



The ongoing bandwidth cost is between USD800 and USD1,600 per month. This ongoing cost was included in the CLICC funding but at the end of 2017, the centers must either be fully self-sustaining or obtain funding from the Ministry of Education. However the Ministry informs that no allowance has been made for this in the budget until 2019. This will create an immediate challenge for the centers as they may have to become fully self-sustaining by year end.

A number of management difficulties arose in CLICC project implementation and maintenance. The operators reported that there were instances of theft of generator fuel, solar panels, and batteries. In addition, technical problems which could not be solved by local people meant that the sites required maintenance visits on average about once a month. This involves chartering a plane at a cost of USD2000 – USD3000 per visit and in many instances the problems were trivial. Consequently, in addition to ongoing affordability, another barrier to sustainability was identified as a lack of local ICT expertise and inability to troubleshoot and rectify minor hardware and software issues.

The University of South Pacific (USP) has a campus in Port Vila which hosts 900-1200 students per semester. The Port Vila campus hosts only a single faculty: the School of Law which serves both in-Vanuatu and other students from the Pacific region.¹¹¹ Students of other disciplines are studying via distance and flexible learning. USP operates its own wide area network, USPNet, which is currently based on 5MHz IP satellite technology. The system connects campuses and centers throughout its 12 member countries. USPNet, which was originally launched in 1973 to support distance learning via analog video and audio conferencing, provides today a range of other services, including video

¹¹⁰ Source: TRR.

¹¹¹ The University of the South Pacific (2017), *Emalus Campus*, <https://www.usp.ac.fj/index.php?id=7596>. Accessed October 2017.

broadcasting, interactive audio tutorials, e-mail service, e-learning using Moodle and Internet access to students. Internet connectivity is provided over fiber in the main campus in Suva, Fiji.

6.5 Environment and disaster management

Vanuatu is particularly vulnerable to natural disasters such as cyclones and earthquakes. As a result, there has been strong interest in utilizing ICT to mitigate and forecast hazards. Recently, the Japan Telecommunications and Engineering Consultancy Service (JTEC) has established the Asia Pacific Telecommunity (APT)-J3 Volcano Monitoring network. The network transmits live video from two cameras, monitoring the activity of Mt Yusur, to the Vanuatu Meteorological and Geohazards Department (VMGD) in Port Vila. This network also provides Internet access to other sites, including a school, health facilities and meteorological offices.

The VMGD runs its own website which provides comprehensive information and forecasts of weather, tsunamis, volcanos and earthquakes. The department was among the first users of the government's GBN, which facilitates connection to regional centers. This connectivity is essential for the coordination of emergency warnings and monitoring of emergency situations. The website provides daily weather forecasts, long term marine and aviation forecasts, tsunami and volcano alerts. Through this website, the department also engages in promoting local awareness of climate issues and provides educational resources and brochures for download.

In addition to VMGD, the government has a dedicated National Disaster Management Office (NDMO). The purpose of the office is to coordinate and prepare for emergencies and national disasters. One of its objectives is to work closely with the regulator and private telecommunications companies to improve network resilience. The office maintains an independent website, providing news and educational material to promote awareness of natural disasters. With support of the regulator, the office reached an agreement with mobile operators to broadcast SMS message alerts to the population before and during national disasters, as in the case of Cyclone Pam in 2015.

As the cyclone was forming in 2015, the direction and the speed of the cyclone was observed by the Vanuatu National Meteorological Service (VNMS). The data was processed and disseminated to all stakeholders, including the public. Since radio and TV broadcasting have limited coverage, the mobile networks were ideal to broadcast short text messages to alert the population. The SMS updates were sent at three hour intervals, and then hourly as the cyclone came nearer. This allowed the population to take the necessary preventive measures. The flow of meteorological and remote sensing data into Vanuatu's ICT network was critical for early warning and saving lives despite the severe destruction caused by the cyclone.

The post-cyclone relief efforts involved considerable use of drones for damage assessment. The government of Vanuatu, with assistance of the World Bank, used pilots from the Humanitarian Unmanned Aerial Vehicle (UAV) Network to provide detailed damage assessment images.¹¹² The purpose of the aerial surveys was to identify which buildings were fully destroyed, repairable or largely undamaged. The operating teams provided the imagery to the Government of Vanuatu and the World Bank at the end of each day. The collected data was uploaded to the cloud via Dropbox and Mapbox. Volunteer members of the Digital Humanitarian Network (DHN) and the Humanitarian OpenStreetMap Team (HOT) analyzed the images remotely. The combined capabilities of drones, data communications

¹¹² Capacity4dev.eu (2016), *Case Study – Using Drones for Disaster Damage Assessments in Vanuatu*, July 2016.

and crowdsourcing allowed a cost-effective framework for informing the humanitarian response and recovery planning. The project was the first of its kind under the World Bank UAVs for resilience programme. The World Bank and the government of Vanuatu are still drawing on the insights gained from this project to improve the use of UAVs.

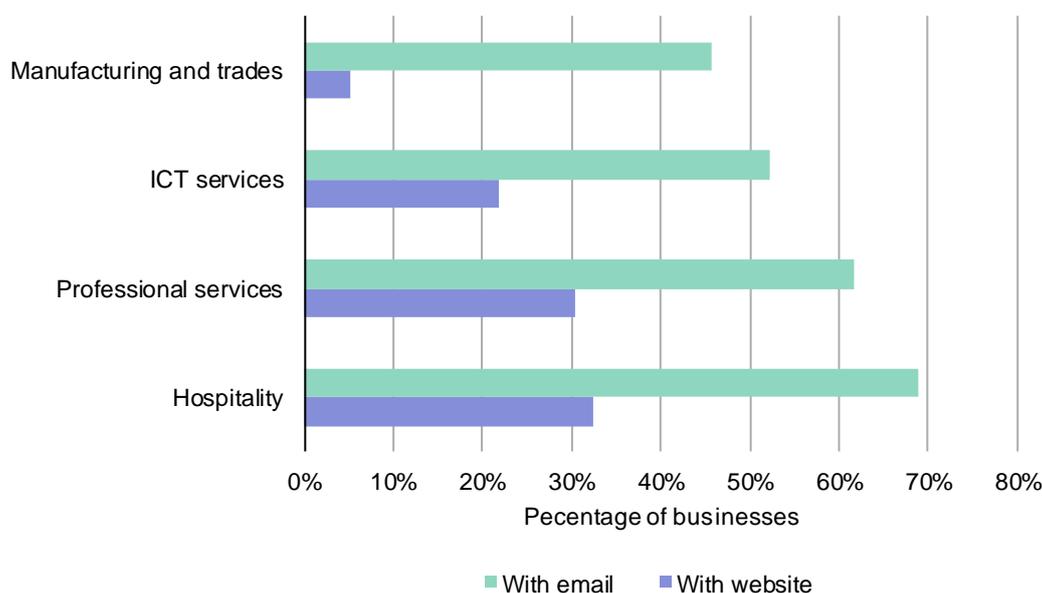
6.6 Business

Tourism revenues provide a key contribution to the economy of Vanuatu. The GBN is an important resource for the Department of Tourism, which is part of the Ministry of Tourism, Trade, Commerce and ni-Vanuatu Business. The provincial tourism offices rely on the GBN for communication purposes, and the Department of Tourism website encompasses important resources for visitors including provincial accommodation options. This service is also vital for those in the hospitality sector with limited or no web presence of their own.

In the private sector, an increased number of businesses are using email and maintaining websites, particularly in the hospitality sector. A comparison of email and websites across sectors reveals that hospitality (including hotels and all forms of accommodation) is the most digitally connected sector, closely followed by professional services (including accountants, engineers, construction companies, lawyers, clinics and doctors, and auditors). Surprisingly, small scale providers of ICT services lag behind these two sectors in both availability of email and websites (Figure 19).¹¹³

¹¹³ The exhibited results are based on primary research with a sample size of 953 businesses listed in the Yellow Pages of Vanuatu.

Figure 19: Business use of email and websites, 2017¹¹⁴



6.7 Finance services

Vanuatu is a participant in the Pacific Financial Inclusion Project (PFIP), which aims at funding innovation in financial services and supporting regulatory initiatives to enable more people gain access to financial services.¹¹⁵ The programme is partly funded by the United Nations Capital Development Fund (UNCDF) and the United Nations Development Programme (UNDP). The programme has provided funds to support the Vanuatu National Bank to improve communications with branches in rural areas and enable mobile banking.

According to reports from PFIP, Digicel has already introduced a pilot mobile money project, isiMani, in partnership with the National Bank of Vanuatu (NBV) in 2011.¹¹⁶ Although the product is still listed in the website of NBV, interviews with officials in Vanuatu suggest that this product has not been successful. In 2013, the Australia and New Zealand Banking Group (ANZ) launched a narrowband mobile banking service, goMoney. Mobile money services are very important for financial inclusion of the population, especially in rural areas. The service allows customers to send money to family, pay bills and view their account balances using mobile phones. It also enables customers to complete their cash deposits and withdrawals, and purchase goods from accredited merchants across the country without the need to travel distances or carry cash. However the service has met with limited success for a number of reasons. Major problems include the prevalence of a cash economy with approximately 70% of the rural populace lacking bank accounts. The bank does not anticipate launching a broadband mobile banking service until it is clear that there is both sufficient demand and that the quality and extent of rural mobile broadband connectivity is adequate.

¹¹⁴ Source: Network Strategies

¹¹⁵ Pacific Financial Inclusion Programme (2017), *Innovation for financial inclusion*, available at <http://www.pfip.org/>. Accessed October 2017.

¹¹⁶ Pacific Financial Inclusion Programme (2011), *Digicel and Vanuatu*, 2011. Available at <http://www.pfip.org/our-work/work-streams/financial-innovation/digicel-fiji/>. Accessed October 2017.

7 Broadband in Vanuatu: key outcomes and lessons

The Government of Vanuatu has demonstrated considerable commitment to investment in ICT and broadband (Section 7.1). In this concluding Section we review the impact of broadband (Section 7.2) and the barriers to further uptake and usage (Section 7.3). Finally we consider the financing models that have been used for broadband investments in Vanuatu (Section 7.4).

7.1 Broadband commitment

The Government, donors and private sector investors have demonstrated substantial ongoing commitment to developing and extending the footprint of broadband connectivity and ICT services in Vanuatu since market liberalization over a decade ago. In the Pacific region Vanuatu was one of the first countries to reform its monopolistic telecommunications sector and to relinquish its part ownership of the incumbent telecommunications operator. The Government also empowered an independent regulatory authority to oversee the development of a competitive market, and introduced policies to ensure that ICT would play a pivotal role in attaining the national vision of a just, educated, healthy and wealthy country.

The particular importance of access to broadband Internet was recognized by Government in the early days of liberalization, and over the years Government has remained steadfast in its commitment to improving accessibility and affordability. This was reflected in Government investment in its own broadband infrastructure (the GBN) in 2009, its support for deployment of Vanuatu's own international submarine cable in 2014 and in UAP initiatives which encompassed broadband pilot projects and the upgrading and extension of mobile infrastructure to achieve 98% population coverage by the end of 2017.

7.2 The impact

Broadband has been a key enabler for the efficient operation of Vanuatu's Government. However, the focus to date was on establishing the necessary ICT infrastructure for networking, information management and web presence for public services. Online public services are starting to emerge slowly.

In the private sector, an increased number of businesses are using email and maintaining websites, particularly in the hospitality sector. Mobile money services, although available, are still based on narrowband wireless services. In past years the quality of rural broadband connectivity and low demand for banking services has hindered the introduction of more advanced mobile banking services.

There are no broadband applications as yet in the agriculture sector, and applications in education and health are limited to a small number of pilot projects. A monitoring and evaluation system is currently

under development but there is clear anecdotal evidence that these pilot projects had a high positive impact on the local communities.

7.3 The barriers

Census data from November 2016 indicated that over 80% of households in most regions use mobile services while less than 20% of households in Vanuatu use the Internet. In three of the six provinces less than 7% of households use the Internet.¹¹⁷ Other sources of information indicate that in 2016 there were less than 25 active mobile broadband subscriptions and about two fixed broadband subscriptions per hundred population. These levels of penetration are considerably higher than those observed prior to the submarine cable but other cable-connected countries in the region (Tonga, Samoa and Fiji), are achieving higher levels of mobile broadband uptake.

Clearly a number of barriers remain in Vanuatu. The key ones appear to be:

Lack of affordability

Although by regional standards the absolute level of broadband pricing is reasonable, the low average level of income in Vanuatu renders most services unaffordable. The price of smartphones – which includes a 12.5% import tax – presents another hurdle and in part explains the continuing proliferation of feature phones (2G handsets). Even if the tax is to be removed, with a population of just over 272,000 Vanuatu is a very small market with limited opportunities to benefit from economies of scale, and therefore smartphone prices may remain out-of-reach for some. Nevertheless, with the purchase of TVL by ATH early in 2017 there are signs that the telecommunications market may become more competitive, after a relatively long period of market dominance by Digicel. This is a positive development as regards likely improvements in affordability.

Accessibility of infrastructure

Despite recent mobile infrastructure upgrades, 3G+ services are not ubiquitously available throughout the islands. Some areas only have 2G coverage and the quality of the service is reported by many as poor. Broadband satellite services are available to the whole country but these are not affordable for the majority of households and businesses. The lack of a reliable power supply in many areas adds another challenge to improving accessibility.

Low level of digital literacy

There is evidence of low levels of digital literacy although, given the large youth demographic in Vanuatu, greater access to ICT through educational facilities could remedy this issue within a decade.

¹¹⁷ Vanuatu National Statistics Office (2017), *2016 Post-TC Pam mini census report*, 21 July 2017. Available at <https://vnso.gov.vu/index.php/component/advertising/?view=download&fileId=4542>. Accessed October 2017.

7.4 Implications for financing models

In the Pacific region, the use of donor funding is common for the support of broadband initiatives from large-scale cable infrastructure (as in Tonga) to smaller projects on a country-by-country basis (for example, educational and health initiatives).

Four main financing models have been used in the provision of broadband infrastructure and services in Vanuatu.

<i>Government finance</i>	The GBN was originally financed through a low-interest loan to the Government from China. The infrastructure is to be upgraded to an all-IP network shortly with the aid of funds from the Cyclone Pam relief funding. Total investment was USD28 million.
<i>Public-private partnership</i>	The submarine cable was financed at a cost of USD32 million through a PPP involving private local investors with the National Provident Fund as majority shareholder. There is Government pressure to achieve a commercial return on investment and there are debt repayments to be made to a commercial lender. Meanwhile complaints from wholesale customers have led to the imposition of price regulation by the TRR. This financing model has clearly created considerable tension between the Government shareholder in the cable and the independent regulator who has a legitimate right to intervene in pricing disputes in the market.
<i>Donor funding</i>	The UAP pilot projects were funded through assistance from the Australian Government (approximately USD0.7 million). The funding of these projects is due to end shortly. In the absence of ongoing funding for providing the necessary bandwidth for computer labs and telemedicine projects there is a danger that these services may be discontinued. It is possible that the funding may be accommodated within budgets of relevant Ministries, but it is not assured. Without Government or donor assistance it falls to the local communities to maintain the projects and ensure service continuity. This involves developing sustainable local business models and engaging all stakeholders.
<i>Private investment</i>	TVL, Digicel and Telsat have all undertaken investments in infrastructure to meet UAP obligations, while other service providers have contributed 4% of service revenue to the UAP fund. Provision of service to the underserved and unserved areas of the country has represented a significant investment for operators and obtaining a commercial return on this investment may be difficult. The total amount of private investment to achieve the UAP obligations is unknown but certainly represented a multi-million dollar investment for TVL and Digicel.

In general, investment in high-speed broadband networks is a costly exercise. Typically governments around the world have shied away from direct involvement in large scale deployments, with a few

notable exceptions (for example, Australia, New Zealand, Singapore, and Malaysia). Given the scale of the investments, it is important to identify the most cost-effective technology for specific locations and to avoid inefficient duplication of infrastructure. In the context of the Pacific region the Vanuatu UAP scheme is innovative with its reliance on private sector participation for the extension of mobile broadband services, while the PPP for the cable investment is both ambitious and challenging, given the Government's shareholder role.

In Vanuatu, the investments in broadband infrastructure and services have already been made which have undoubtedly improved the accessibility of ICT to the population. The challenge for the country now is to explore and identify opportunities for leverage from these existing investments. To that end there are a number of possibilities which are consistent with the priorities of the National ICT policy:

Developing a platform for multi-stakeholder and multi-sector coordination and collaboration

- Extension of the GBN infrastructure where feasible to provide additional Internet access points that would serve a wider clientele than direct Government staff
- Co-ordination and aggregation of demand for broadband services across geographic areas with limited access to broadband
- Co-ordination of infrastructure deployment under the Rural Electrification Programme with further telecommunications deployment.

Access to ICTs in education

For the approximately 300 unsuccessful applicants for UAP funding, presentation of a Do It Yourself (DIY) option with details of low cost technology option (in most circumstances likely to be broadband satellite) and the key requirements for implementation and sustainability (with an emphasis on community commitment and inspiring success stories. Note that some seed funding from Government or donors may be necessary. Experience from the CLICC pilots indicates that the most cost-effective technology is likely to be broadband satellite, with an upfront capital investment of around USD2000.

Building trust and mitigating risks and threats in ICT development

Recognizing the fraught nature of the current PPP arrangements for the submarine cable, consideration by stakeholders of options for possible restructure in conjunction with an examination of future wholesale pricing scenarios.

E-government

Move forward with e-government applications, tackling first those which would bring greatest savings in transaction costs to households.

Capacity building and development of local content

Digital inclusion requires digital confidence building and local community engagement. The availability of local expertise with computer hardware and software training and experience is particularly important for sustainability of Internet facilities in remote areas.

In consultations with stakeholders it became apparent that there are many dedicated individuals, groups, communities, volunteers and businesses with the energy and enthusiasm necessary to take these next steps on the road to full digital inclusion for all inhabited islands of Vanuatu.

Annex A: Coverage maps

Figure 20: WanTok's LTE network coverage¹¹⁸



118 Source: WanTok Network Limited

Figure 21: Telsat's Wi-Fi network coverage¹¹⁹

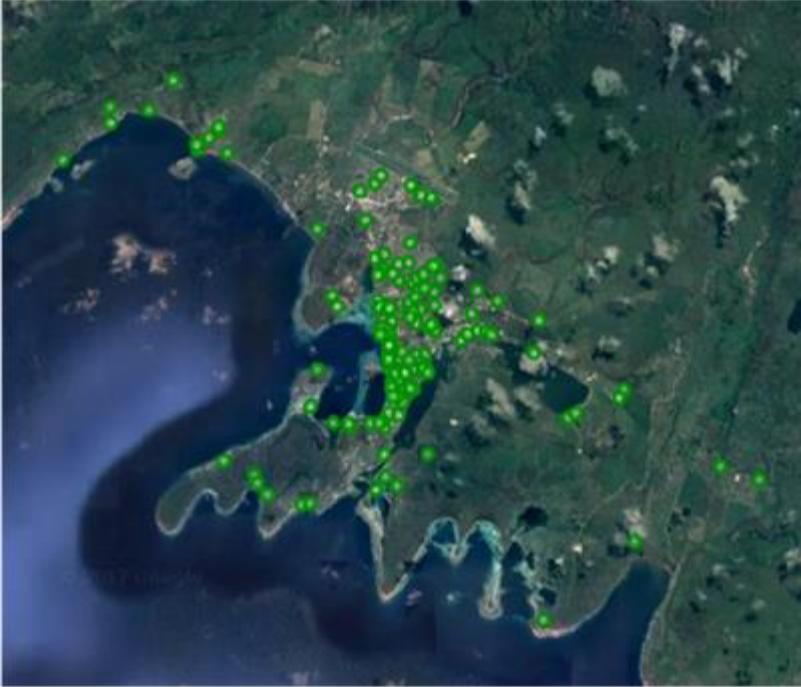


Figure 22: Digicel mobile coverage¹²⁰



Figure 23: Unserved areas¹²¹

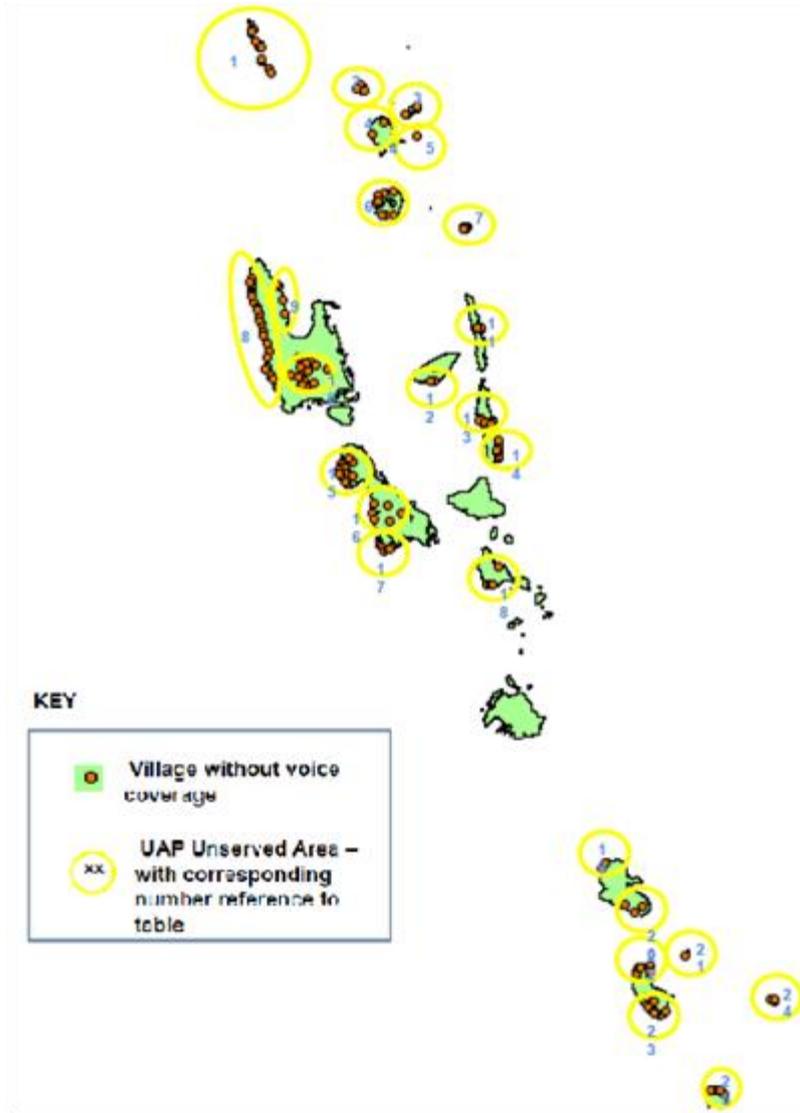
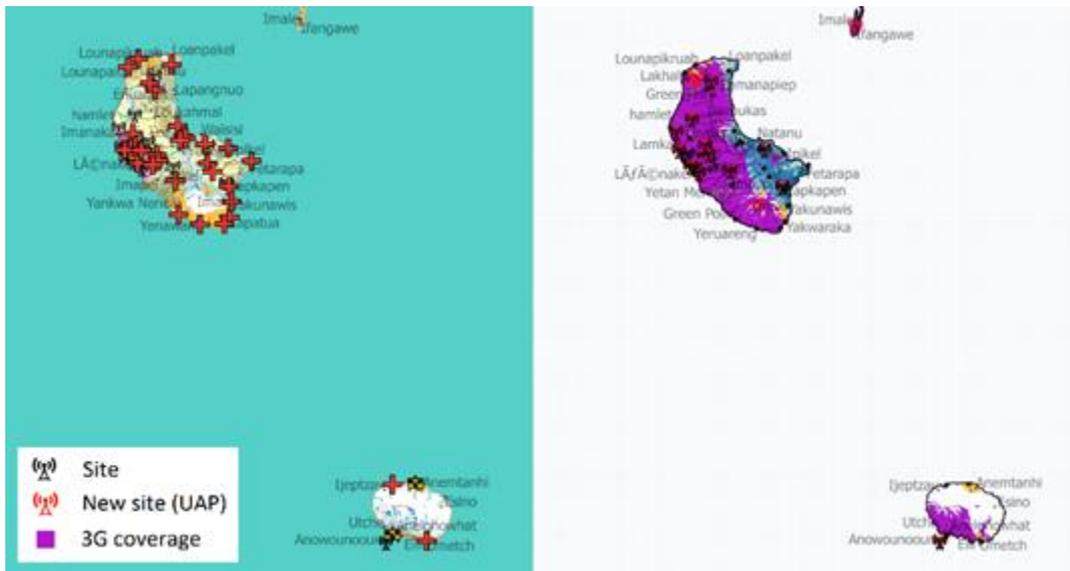


Figure 24: 3G coverage previous to UAP (left) and actual (right) – Vanua Lava, Gaua and Mota Lava¹²²



Figure 25: 3G coverage previous to UAP (left) and actual (right) – Tanna, Aneitvum and Aniwa¹²³



122 Source: TRR

123 Source: TRR

Annex B: Institutions consulted

Digicel Vanuatu Limited
Interchange Cable Limited
Ministry of Education
National Bank of Vanuatu
Office of the Chief Information Officer
Pacific Group Limited
Prime Minister's Office
Telecommunications and Radiocommunications Regulator (TRR)
Telecom Vanuatu Limited
TelSat
UNICEF Field Office
UN Vanuatu
Utilities Regulatory Authority
Vanuatu Daily Post
Vanuatu National Statistics Office
Vanuatu Tourism Office
Wantok Limited
Women and Girls in ICT

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