WHY ARE INTERNET PRICES HIGH IN PAPUA NEW GUINEA?

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<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADSL</td>
<td>Asynchronous digital subscriber line, a copper wire based digital-transmission access technology with a higher download data rate than its upload data rate</td>
</tr>
<tr>
<td>APAC</td>
<td>Asia-Pacific region</td>
</tr>
<tr>
<td>Gbps</td>
<td>Gigabits per second. A measure of data transfer speed. One gigabit equals 1 billion bits</td>
</tr>
<tr>
<td>GNI</td>
<td>Gross National Income</td>
</tr>
<tr>
<td>ICCC</td>
<td>Independent Consumer and Competition Commission of PNG</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
</tr>
<tr>
<td>IXP</td>
<td>Internet Exchange Point</td>
</tr>
<tr>
<td>NICTA</td>
<td>National Information and Communications Technology Authority</td>
</tr>
<tr>
<td>NTN</td>
<td>National Transmission Network</td>
</tr>
<tr>
<td>O3B</td>
<td>Other three billion. A series of low earth orbiting satellites intended to provide faster download speeds than traditional, high orbit satellites</td>
</tr>
<tr>
<td>PANGTEL</td>
<td>Papua New Guinea Telecommunications Authority</td>
</tr>
<tr>
<td>PNG</td>
<td>Papua New Guinea</td>
</tr>
<tr>
<td>POM</td>
<td>Port Moresby</td>
</tr>
<tr>
<td>Tbps</td>
<td>Terabytes per second. A measure of transfer speed.</td>
</tr>
<tr>
<td>VSAT</td>
<td>Very small aperture terminal. A type of two-way satellite that transmits both narrow and broadband data to satellites in orbit. The data are then directed to other remote terminals or hubs around the planet</td>
</tr>
<tr>
<td>3G</td>
<td>Third generation cellular mobile technology</td>
</tr>
<tr>
<td>4G</td>
<td>Fourth generation cellular mobile technology</td>
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</tbody>
</table>
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Executive Summary

What is the issue?
Considerable improvements in PNG’s technological architecture have been made in recent years. Deregulation has driven considerable improvements in competition, and the rollout in 2008 of Digicel’s network has brought internet services to millions of previously unconnected Papua New Guinean citizens.

Notwithstanding these improvements, PNG’s internet infrastructure appears to be reaching its limits, and service outages are commonplace throughout the country. And although penetration has improved considerably in recent years, it remains amongst the lowest in the world.

In 2013, the International Telecommunications Union (ITU) ranked PNG’s internet affordability at 163rd out of 169 countries, with an entry level fixed broadband package estimated to cost 266% of gross national income (GNI) per capita. Since that time, internet prices have fallen markedly — in 2014 NICTA estimated that the price of a 1GB package ranged from around 20-80% of GNI per capita, while current estimates suggest a 1GB package can be obtained for around 10% of GNI per capita. These dramatic price reductions are likely to be driven by a number of factors, including reductions in the wholesale price (which has fallen by around 70% over that time), and increased competition in the retail market.

Nevertheless, we note that entry level internet packages still appear to be substantially above the ITU’s benchmark required to accelerate internet penetration (less than 3-5% of the average monthly income). Further, the costs of reliable internet services to businesses remain substantial — moderate-to-high data usage packages cost many thousands of Kina and the requirement for businesses to adopt redundancy solutions to manage intermittent service adds substantially to costs. Lack of reliability also results in numerous indirect costs to retail and business customers.

Why are prices high?
The reasons behind high internet prices are multiple. This study has identified a range of reasons spanning five broad categories: infrastructure; wholesale; regulation; retail and competition; and PNG specific issues.

Infrastructure
- Maintenance and capital costs for internet infrastructure in PNG are considerably higher than in other countries, although by how much is unclear. One estimate is around four to five times higher. This includes both maintenance costs incurred by Telikom for the undersea cables, and costs of maintaining the infrastructure required to transport internet signals between population centres.
- A lack of reliability and the need for internet traffic to be ‘offshored’ further add to the cost of providing internet services, adding more upward pressure on end user prices.
Wholesale

- Telikom pays approximately A$30 per megabit per second (A$30/mbps) to TPG (the owner of the PPC-1 cable) for bandwidth, then on-sells this bandwidth at a rate of K1,950/mbps, or approximately A$800/mbps. While the spot price of bandwidth appears comparatively low to the wholesale price passed on to Internet Service Providers (ISPs), we note that Telikom faces a range of costs in providing wholesale internet services including costs for operating the cable, maintenance, electricity, and various staff and overhead costs.

- Telikom has advised that all ISPs face the same wholesale access price. However we consider that the regulatory settings (as discussed below) are not necessarily well-designed to ensure that this price is efficient.

- Some stakeholders also commented that Telikom often appears reticent in allowing other parties to utilise its transmission infrastructure, effectively forcing them to either invest in their own infrastructure or not enter the market.

- The use of satellites when cable connections are available reflects not so much a business decision but rather a necessity based on the unreliability of cable access, and is also likely to add to costs faced at the retail level.

Regulation

- Deregulation of the ICT sector in the last decade has driven significant improvements in market entry and diversification of services. However, the regulatory environment has not kept up with the pace of market and technological change in recent years.

- While the provision of wholesale internet services is declared under the NICT Act, and hence notionally subject to non-discrimination and efficient pricing requirements, a number of regulatory gaps have been identified which in our view are likely to contribute to higher end user internet prices.

- In particular, with its focus being primarily on establishing a level playing field for ISPs, the regulatory framework appears to provide limited incentives in terms of ensuring that access charges are efficient, or in driving reductions in Telikom’s costs.

Retail and competition

- Over the past decade the retail internet environment has grown substantially, particularly due to and following the entry of Digicel to the market in 2008.

- Digicel appears to enjoy a considerable degree of market power in the retail ISP market, with ‘fringe’ providers seemingly unable to make inroads.

- The degree of Government involvement in retail is considerable, with three Government-owned retail service providers competing with the private sector and each other.

- There is very limited transparency of retail prices.

What can be done?

This review has identified potential policy responses through a two-step process. First, high level ‘end goals’, or strategic objectives, were identified to help guide the development and implementation of reforms. These objectives include:
• Reducing the wholesale access rate;
• Plugging the identified regulatory gaps; and
• Reforming the retail market.

Second, a series of policy options were identified which will support the achievement of the end goals. These policy options form the core recommendations of this report, and are presented below:

• **Recommendation 1:** A holistic ICT Industry Development Strategy should be developed which pays particular attention to internet infrastructure, wholesale and retail market competitiveness, regulatory issues and PNG-specific challenges.

• **Recommendation 2:** The regulatory framework should be strengthened, paying particular attention to regulatory gaps and the effectiveness of regulations in promoting competition at the retail level and efficient pricing practices at the wholesale level.

• **Recommendation 3:** A review of wholesale arrangements should be undertaken to consider both the underlying market dynamics and whether they are appropriate for the ongoing development of the sector, as well as the underlying causes of high wholesale prices and possible policy responses.

• **Recommendation 4:** Requirements for further transparency in retail prices, including regulations concerning the information on prices, terms and conditions that must be provided by retailers, and potentially a price monitoring system to monitor price movements.

• **Recommendation 5:** The Government’s role in ICT should be reviewed, with a focus on assessing the objectives of, and need for, Government participation in retail service provision, as well as identifying reforms to SOEs active in the ICT sector.

• **Recommendation 6:** A review of infrastructure delivery in ICT should be conducted to ensure prospective infrastructure investments are subject to an appropriate level of analysis, and to maximise the benefits of such investments.

We consider that timely implementation of the recommendations above, while remaining cognisant of the longer term strategic objectives, presents the best chance of meaningful reform in this area. Given the diversity of issues and stakeholders involved, it will be important for all players in the industry — be they public or private, retail or wholesale — to come together and work collaboratively to move the industry forward.
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1.1 Background to this engagement

Deloitte was engaged by the National Research Institute (NRI) to conduct a study into internet prices in PNG, focussing primarily on three broad questions:

- Why are internet rates in PNG high relative to other developing countries?
- What can be done to alleviate these cost pressures? and
- What impact do high internet rates have on general business and economic activity in the country?

As will be shown in Chapter 3 internet prices in PNG have historically been amongst the most expensive in the world. While the last few years have seen dramatic reductions in prices for entry-level packages, prices remain above efficient benchmarks and costs are particularly high for business customers. This has a considerable effect on the country’s day to day operations: it increases the cost of doing business; limits the capacity for innovation and technological advancement in PNG; and creates a barrier to average PNG citizens from enjoying the internet access that those in the developed world have become accustomed to.

Given the complex nature of the internet market in PNG, there are a range of potential policy measures that could be undertaken across all levels of the market to address the challenges posed by high internet prices and costs. This report has identified policy options through a two-step process: first by identifying high level strategic objectives for long term guidance of reform, and second by identifying a set of short-term policy responses to begin working towards the achievement of those objectives.

1.2 The considerable achievements to date

When Digicel entered the market in 2008¹, PNG essentially relied on dial-up internet connections. Since then however, the performance of the internet has seen massive transformation, to the extent that those in urban areas are now able to enjoy high speed internet at around the same bandwidth (speed) as their counterparts in other South Pacific Island nations (see section 2.4).

Notwithstanding this growth, PNG’s internet infrastructure appears to be reaching its limits, and service outages are commonplace throughout the country, including in the capital Port Moresby.

The review has also identified a range of regulatory and competitive issues which are likely to contribute in part to higher prices. In particular, costs and pricing in the wholesale internet market are somewhat opaque, and the retail market, while notionally competitive,

¹ Having received its licence in 2007, according to the Department of Communication and Information (2008).
appears to be largely dominated by a single player.

This is not to discount the importance of the regulatory agencies nor their achievements in recent years. The presence of an established regulator and legislation covering infrastructure and technology aspects, and that there is a well-established market for the provision of retail internet services, makes PNG well positioned to meet the challenges of the future.

The comments and suggestions for future work in this report are not criticisms of key organisations and stakeholders in the ICT sector, but rather as suggestions on options to reduce internet prices and ensure PNG is adequately positioned to meet the demands of an ever changing technological environment.

1.3 Methodology
This report has collected information from three sources:

- Interviews and consultations with relevant public and private organisations in PNG, including regulatory agencies, Internet Service Providers and key users;
- Statistical and qualitative data from recognised institutions in the ICT sector; and
- Experience and advice from experts in the fields of ICT, public development and regulatory frameworks.

Due to a paucity of publically available data and information, the insights gleaned from stakeholder consultations were central to this study.

Wherever possible, comments and references throughout this report refer to publically available sources. Where this is not possible, stakeholders’ views are referred to. No names or organisations are connected with individual comments except where permission was explicitly provided to do so.

1.4 Structure of this report
The remainder of this report is structured as follows:

- Chapter 2 provides an overview of the internet market in PNG as it stands today, including the infrastructure environment and internet usage, both currently and through time.
- Chapter 3 provides an introduction to internet prices in PNG, and a discussion of how high internet prices affect the economy.
- Chapter 4 discusses the multitude of issues that are likely to contribute to high internet prices. These are considered under the broad headings of infrastructure, wholesale, regulation, retail and competition, and PNG specific issues.
- Chapter 5 provides a discussion of specific policy responses, both in the context of long-term strategic objectives, and short-term policy recommendations designed to help meet those objectives.
- Chapter 6 provides some concluding comments.
- Appendix A provides a list of stakeholders consulted for this research project, without whose generous donations of time and expertise, this report would not have been possible.
The internet environment in PNG has come a long way in recent years — increasingly Papua New Guineans are beginning to access the internet in order to transform their lives, their businesses and their day to day activities.

2.1 Regulation, legislation and policy

In 2008 the Government of PNG through the Department of Communication and Information released its National ICT Policy (hereafter referred to as the ’2008 ICT Policy’). The 2008 ICT Policy was a seminal moment in the governance and regulation of the telecommunications sector in PNG, and made a number of critical recommendations and reforms.

As discussed in Chapter 5, many of the critical reforms recommended in the 2008 ICT Policy were never undertaken, which is likely partly due to the fact that specific action plans aimed at achieving the broader strategies were never developed.

One important outcome of the 2008 ICT Policy was the establishment in 2010 of the National Information and Communications Technology Authority (NICTA), which was established as a successor to the previous Papua New Guinea Telecommunications Authority (PANGTEL). Established under the National Information and Communication Technology Act of 2009 (the NICT Act), NICTA reflects recognition by the Government of PNG of the ever changing technological landscape, and the importance of ensuring the internet is regulated in tandem with ‘traditional’ telecommunications. But while the establishment of NICTA was an important step forward, as will be discussed in Chapter 4, a number of regulatory gaps have been identified which in our view are likely to act as contributing factors to high end user internet prices.

A potential role in relation to ICT also exists for the Independent Competition and Consumer Commission (ICCC), PNG’s economic and competition regulator established in 2002. In theory, the general competition provisions of the ICCC Act also apply to the ICT sector (ICCC 2014). We also note that NICTA is required to consult with the ICCC in performing its functions (see for example, Section 42(b) and Section 224(5) of the NICT Act).

However, an apparent lack of clarity and coordination between these two agencies results in a number of regulatory gaps which are likely to contribute both directly and indirectly to higher prices. Further, a number of mergers and acquisitions in recent years have occurred which are potentially contrary to broader competition principles (see Chapter 4).

The most recent policy development in the ICT sector was the release of the National Broadband Policy in 2013 (NICTA 2013). Following this, PNG DataCo was established in 2014 with the remit of building, operating and maintaining the National Transmission Network (NTN). However, many of the other goals and objectives put forward in the Broadband Policy have not been met.
2.2 Market environment

PNG’s internet market environment is complex, with some form of Government involvement at every level of the supply chain. A snapshot of the wholesale and retail markets is provided in Table 2.1.

Table 2.1: Snapshot of wholesale and retail markets

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Wholesale</th>
<th>Retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major players</td>
<td>Telikom PNG</td>
<td>Digicel, bmobile, Telikom, Speedcast, Datec, Global, Daltron, Digitec (PNG)</td>
</tr>
<tr>
<td>Ownership</td>
<td>Telikom has exclusive access rights to PPC-1 cable; part ownership of APNG 2 cable.</td>
<td>Full ownership of company's assets/ investments.</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>APNG2, PPC-1</td>
<td>Some domestic network developments</td>
</tr>
<tr>
<td></td>
<td>Domestic microwave link Madang-POM</td>
<td>Access to satellites for international access</td>
</tr>
<tr>
<td>Market characteristics</td>
<td>Telikom is the sole provider of high speed wholesale internet.</td>
<td>Digicel has a dominant position in the retail market, but there is a competitive fringe.</td>
</tr>
<tr>
<td></td>
<td>To be independent of Telikom some companies prefer satellite connections (either partly or wholly). However satellite connections do not offer the same speed as cable.</td>
<td>Government owns 3 major retail ISPs (Telikom, Datec, bmobile).</td>
</tr>
<tr>
<td></td>
<td>Some major users bypass Telikom altogether by establishing satellite links with overseas providers.</td>
<td></td>
</tr>
<tr>
<td>Government involvement</td>
<td>Telikom 100% government owned. Satellite providers are privately owned.</td>
<td>Telikom 100% government owned; Datec was bought by Telikom in 2013.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bmobile owned by Government (85%) and Vodafone (15%).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Others privately owned.</td>
</tr>
<tr>
<td>Recent Developments</td>
<td>PNG DataCo established in 2014 to construct and operate NTN.</td>
<td>Following transfer of wholesale assets to DataCo, Telikom’s focus will turn to retail.</td>
</tr>
<tr>
<td></td>
<td>DataCo is meant to take over wholesale operations from Telikom, but timing on asset transfer is unclear.</td>
<td></td>
</tr>
</tbody>
</table>

Source: Compiled by Deloitte based on stakeholder consultations

As will be discussed later in this report, reform of both the wholesale and retail markets are likely to be necessary to reduce internet prices. Equally important however is that such reforms are cognisant of broader enabling factors for internet access — that is, the infrastructure environment and the regulatory and governance framework that oversees the market.

2.3 Infrastructure environment

There are three main ways for internet service providers (ISPs) to access internet connections in PNG: cable, satellite and microwave. Cable internet is by far the quickest since signals
travel at the speed of light; satellite and microwave links have varying degrees of speed but are not as fast as cable links, nor do they offer the same service quality as cable (e.g. in terms of latency and jitter).

A brief overview of cable and satellite technologies currently in use in PNG is provided below.

Table 2.2: Overview of infrastructure

<table>
<thead>
<tr>
<th></th>
<th>Cable</th>
<th>Satellite (Vsat)</th>
<th>Satellite (O3b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overview</td>
<td>2 main cables connecting PNG to mainland Australia, both of which are solely controlled by Telikom.</td>
<td>Various satellite networks owned by different providers, largely developed due to superior reliability relative to cable, and ability to access internet signals independently from Telikom.</td>
<td>Network of thousands of low earth orbit satellites designed specifically for Pacific Island nations where cables are prohibitively costly.</td>
</tr>
<tr>
<td>Speed (POM to Aust.)</td>
<td>10 ms (speed of light)</td>
<td>1/2 a second</td>
<td>1/3 a second</td>
</tr>
<tr>
<td>Accessibility and usage</td>
<td>Access to cables solely controlled by Telikom; ISPs must purchase bandwidth from Telikom.</td>
<td>Some companies (e.g. Digicel) utilise a combination of satellite and cable, while others (e.g. Speedcast) use only satellites.</td>
<td>According to O3b’s website the network is currently utilised by Digicel and the University of Papua New Guinea.</td>
</tr>
</tbody>
</table>

Source: O3b (2015) and stakeholder consultations

2.3.1 Cables and fibre connections

International connectivity into and out of PNG is currently supplied by way of submarine cable and to a lesser extent satellite-based services. Currently, there are two submarine cables landed in PNG that provide international connection. An overview of their characteristics is shown in Table 2.3.

Table 2.3: Overview of submarine cables into PNG

<table>
<thead>
<tr>
<th>Cable</th>
<th>APNG-2</th>
<th>PPC-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners</td>
<td>Telikom PNG; Telecom New Zealand; Telstra (Australia)</td>
<td>TPG; Telikom PNG (owns 80km ’spur’ which connects the PPC-1 cable to Madang)</td>
</tr>
<tr>
<td>Design capacity</td>
<td>1.136 Gbps</td>
<td>2.56 Tbps</td>
</tr>
<tr>
<td>Purchased capacity</td>
<td>1.136 Gbps</td>
<td>10 Gbps</td>
</tr>
<tr>
<td>Landing stations</td>
<td>Ela Beach, PNG</td>
<td>Madang, PNG (via 80km ’spur’ connected to the PPC-1 cable)</td>
</tr>
<tr>
<td></td>
<td>Sydney, Australia</td>
<td>Sydney, Australia</td>
</tr>
</tbody>
</table>

Source: Deloitte analysis

Note: Gbps = Gigabits per second; Tbps = Terabits per second. 1 Gigabit = 1 billion bits; 1 Terabit = 1 trillion bits
The APNG-2 submarine cable is the older of the two international cable connections in PNG, and the only cable which connects physically to Port Moresby. In service since 2006, 100% of its available 1GB capacity has been sold, and stakeholders have commented that the cable itself is in a very poor state of repair, with at least three of the five physical cables being out of service at any one time. This cable is part owned by Telikom PNG, Telstra (Australia) and Telecom New Zealand.

On the other side of the country, an 80km spur connects Madang to the PPC-1 cable on its way from Sydney to Guam. This cable uses a more efficient technology that allows higher bandwidth at a lower cost in comparison to APNG-2. Currently, this cable is underutilised and has enough capacity to supply internet to PNG even if the number of users were to increase dramatically. However, the quality of the signal is often hampered by the terrestrial networks needed to transmit that signal from Madang to Port Moresby.

Notably, the cable links extend only to the main island of PNG; other islands such as New Britain, New Ireland, etc., generally rely on satellite links.

A map showing the two undersea cables currently connecting PNG is shown in Figure 2.1. The spur that connects Madang to the PPC-1 cable is also evident.

**Figure 2.1: Map of undersea cables connecting to PNG**

![Map of undersea cables connecting to PNG](http://www.submarinecablemap.com/#/)

Internet quality and access are determined in PNG by the capacity of international and domestic infrastructure. Cable and fibre optic connections generally offer the highest available bandwidth and superior ease of maintaining the infrastructure. However, stakeholders commented that due to the reliance on terrestrial transmission towers, cables tend to suffer more frequent service interruptions than satellite connections.
2.3.2 Satellite connections

Capacity on international communications satellites is currently supplied by a number of satellite operators, including APT Satellite, AsiaSat, Intelsat, JSAT, and SES World Skies. In addition, there are a number of other satellite operators that have the potential to supply capacity in PNG.

Recently, a trend in PNG towards V-Sat technology has been observed. Numerous companies are adopting this new technology that, although expensive compared to other traditional internet connection methods, presents two key advantages:

- It is more reliable and does not depend on physical cables that can (and do) suffer regular outages and interruptions of service; and
- Once the initial investment in the required equipment has been made, rates of V-Sat bandwidth can be cheaper than traditional cable connection.

The expense of this type of satellite connection, however, means it is limited to companies and not individuals. Most corporate stakeholders interviewed for this project commented that internet access is a critical part of their business and if it is not available, business continuity can be at risk. This is the reason why companies tend to place more importance on reliability and quality of internet access rather than on price.

Another relatively recent development is the emergence of O3b (other three billion), a satellite network made up of thousands of satellites at a low orbit relative to ‘traditional’ satellites. Due to the shorter distance required for a signal to leave PNG and hit a low orbiting O3b satellite compared to a high orbiting satellite, the speeds offered by O3b are superior to other satellite providers.

2.3.3 Microwave connections

Microwave connections are a type of terrestrial connection that does not require continuous wires between two points. This technology uses the radio spectrum and can carry different types of information from phone calls to TV signals. Internet is also transmitted this way.

Currently, there is a microwave link in PNG which connects Madang with Port Moresby and other parts of the country. This link is owned by Telikom and was a key part of the National Transmission Network plan launched in 2014. As stated previously, there is no cable linking the high capacity PPC-1 cable in Madang and Port Moresby. This microwave link was designed to solve that shortfall.

Microwave technology is expensive and hard to maintain. Radio technology is complex, and the number of radio stations needed to cover a certain distance is high, adding considerable costs in terms of fuel, security, and maintenance. The reasons behind the decision to connect Lae and Port Moresby using microwave technology and not fibre optic are unclear, but it has meant a huge investment for Telikom (more than K53 million) — costs that must be recovered through prices.

2.3.4 Internet exchange point

To address the issues associated with internet offshoring noted in section 4.1 an internet exchange point (IXP) was constructed in late 2015 (PNG Technology News 2015a; NIC-TA 2015b). However, some stakeholders commented that this has a very small amount
The establishment of a Google cache within PNG that will locally store and host commonly visited websites is seen as one way to get around this issue. This would mean that for at least some websites, the content would be hosted locally, avoiding both the latency and the costs associated with signals having to travel offshore only to be re-routed back to PNG. While there appear to have been various efforts by a range of parties to establish a Google cache, we are not aware of any that have been successful at this stage. Further clarity on the progress of the actual or proposed establishment of a Google cache within the country is required as a matter of priority.

2.3.5 The National Transmission Network

The National Transmission Network (NTN) is the PNG Government’s over-arching infrastructure plan for internet in PNG, currently being implemented by PNG DataCo. The intent is for the NTN to eventually provide the entire country with high speed internet capabilities utilising fibre optic cabling assets (both existing and under construction).

A range of other projects have been mooted under the NTN, perhaps most significantly a fibre optic submarine cable network connecting Port Moresby with the Solomon Islands, Vanuatu and the West Coast of the USA. This is shown by the light green line in Figure 2.2. Necessary approvals have been obtained but construction is still in a planning stage and it will probably take some years until this initiative translates into a reality.

On the domestic front, there are few cables interconnecting the main cities of PNG. PNG DataCo recently finished its project connecting all the Highlands provinces to the main international hub at Madang. This project is expected to continue and reach Port Moresby at some point, although exact timing and cost is unknown.

Despite some apparent successes however, the progress of the NTN appears to have been slow, and many of the goals in the original National Broadband Policy (NICTA 2013) do not appear to have been met some three years on. In particular, PNG DataCo notes on its website that the asset transfer from Telikom to DataCo has not happened yet.1 Telikom’s delay in transferring assets has been noted a number of times recently in PNG’s print media.2 We understand that the basis for this transfer is to drive the roll-out of the NTN as well as remove vertical integration issues with Telikom operating in the wholesale and retail markets, as noted in section 4.1.4.

PNG DataCo advised during stakeholder consultations that it has conducted analysis which suggests a lower wholesale rate (perhaps as low as US$300/mbps or about K900/mbps per month) would be sustainable if and when the international submarine cables are transferred to it from Telikom. However, we also note that to the extent that further investments in infrastructure are made under the NTN, these costs may add to wholesale prices.

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1 http://www.pngdataco.com/index.php/ntn/ntn-other-projects
2 See, for example, The National, ‘Telcos must have clear functions’, 29/2/16; and The National, ‘New state entity needs real support’, 17/2/16.
2.4 Internet usage

2.4.1 Internet usage through time

Internet development globally has come a long way since the initial development of a public and open network in the 1990s. Over the past two decades the cost of internet access in most developed countries fell dramatically and it became widely available in many households. This had an enormous impact on the economies of many countries and revolutionised the way that global and domestic commerce was conducted. More recently, social media and the rapid introduction of mobile internet technologies such as smartphones have seen internet penetration skyrocket in most parts of the world.

According to the International Telecommunications Union (ITU), total internet usage in PNG (both mobile and desktop/fixed) reached around 10% of the population in 2014, a roughly three fold increase in just two years. This evolution is shown in Chart 2.1. It is likely that further gains in penetration have been made since then.
2.4.2 How does PNG compare with other countries?

One way to assess a country’s uptake of internet technologies is to compare its internet penetration with its per capita income. Using World Bank data, Chart 2.2 compares PNG’s global ranking in Gross National Income (GNI)\(^1\) per capita with its ranking for internet penetration. The results are striking. At the turn of the century, PNG ranked more favourably in terms of internet penetration than it did in terms of GNI.

By 2005 this direction had been reversed, and by 2010, PNG’s internet penetration was considerably lagging relative to its GNI per capita. Although the reasons for this are likely to be many and varied, two reasons stand out:

- Firstly, as discussed in the following section, internet prices in PNG were among the highest in the world at that time; and
- Secondly, PNG lagged behind in technology for much of last decade, with Digicel introducing high speed broadband to the country around 2008.

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\(^{1}\) Gross National Income is the total value of income from domestic and foreign sources received by residents of the country.
Compared with similar nations in the Asia Pacific region, internet usage in PNG is well below average and clearly more needs to be done to ensure the internet is widely available and affordable. Chart 2.3 shows the increasing gap in internet penetration between PNG, Australia and other developing Asia Pacific nations. Ultimately, this will affect not just PNG’s digital growth but also its economic growth.

Chart 2.3: Difference in internet penetration between Australia & developing countries

That said, while PNG has historically lagged behind other South Pacific nations in terms of internet uptake, the emergence of Digicel and broadband technologies in recent years has seen the country begin to catch up (although it still lags well behind most in terms of actual penetration rates). Table 2.4 shows that since 2010 PNG’s internet penetration rate grew at 64% per year, double the closest comparable Pacific Island nation, Samoa.

Table 2.4: Internet penetration in Asia-Pacific nations

<table>
<thead>
<tr>
<th></th>
<th>Internet penetration (% of pop’n)</th>
<th>Average annual growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Asia &amp; Pacific (developing)</td>
<td>1.9</td>
<td>8.3</td>
</tr>
<tr>
<td>Fiji</td>
<td>1.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Philippines</td>
<td>2.0</td>
<td>5.4</td>
</tr>
<tr>
<td>Vanuatu</td>
<td>2.1</td>
<td>5.1</td>
</tr>
<tr>
<td>Tonga</td>
<td>2.4</td>
<td>4.9</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.9</td>
<td>3.6</td>
</tr>
<tr>
<td>Samoa</td>
<td>0.6</td>
<td>3.4</td>
</tr>
<tr>
<td>PNG</td>
<td>0.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>0.5</td>
<td>0.8</td>
</tr>
<tr>
<td>Australia</td>
<td>47</td>
<td>63</td>
</tr>
<tr>
<td>US</td>
<td>43</td>
<td>68</td>
</tr>
</tbody>
</table>

In terms of potential broadband speed, PNG does not fare too poorly. The average speed for an entry level fixed broadband service in PNG is the second fastest of the selected Pacific nations shown in Chart 2.4 below. Note, though, that speed does not necessarily correlate with reliability, and stakeholders commented that reliability in PNG fares poorly compared to other nations.

Chart 2.4: Speed of entry level fixed broadband, mbps

Source: ITU (2015)
3.1 How high are PNG’s internet prices?

It is difficult to compare the end-user price of internet access across different countries. The internet architecture in countries differs markedly (as does the cost of providing it), and so too do the content and inclusions of internet plans. We have drawn on a number of publically available sources plus stakeholder consultations and our own analysis to develop a picture of internet prices and costs over the last few years.

The International Telecommunications Union (ITU) has created a composite ‘affordability index’ in an attempt to provide a base level of comparison of internet affordability across countries. The index shows the proportion of an average citizen’s income, as measured by GNI per capita, required to access an ‘entry level’ fixed broadband service. As shown in Chart 3.1, the price of a standard fixed internet connection in 2013 was more than two and a half times the income of an average PNG citizen (as measured by GNI per capita), placing PNG’s internet affordability at 163rd out of a global ranking of 169 countries.

Chart 3.1: Fixed broadband price as % of GNI per capita, 2013

![Fixed broadband price as % of GNI per capita, 2013](chart)

Source: ITU (2015)

However, a separate study by NICTA in 2014 raised some concerns around the calculation method to reach these figures and rankings. In particular, NICTA stated that the specific parameters used by the ITU are of questionable relevance to PNG. NICTA (2014) compared each of the major ISPs in PNG and found that the price of pre- or post-paid fixed broadband service with 1GB capacity varied from 21.7% to 80.6% of GNI per capita. The relevant section of NICTA’s results is shown in Figure 3.1.
More recent information indicates that the price of entry-level packages has come down substantially since the ITU and NICTA studies, with the price of a 1GB package in the order of K49-60 per month. This would put prices at around 10–20% of the average monthly income as defined by GNI per capita. Table 3.1 provides a high-level summary of prices for retail internet packages, and a comparison to the plans of the major providers in Australia.

Table 3.1: Comparison of retail internet prices

<table>
<thead>
<tr>
<th>PNG</th>
<th>Data allowance (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digicel</td>
<td>0.8–16.6</td>
</tr>
<tr>
<td>bmobile</td>
<td>0.8–10</td>
</tr>
<tr>
<td>Telikom (entry level)</td>
<td>1</td>
</tr>
<tr>
<td>Telikom (mid)</td>
<td>100</td>
</tr>
<tr>
<td>Telikom (large)</td>
<td>500</td>
</tr>
<tr>
<td>Australia</td>
<td></td>
</tr>
<tr>
<td>Telstra</td>
<td>100</td>
</tr>
<tr>
<td>Optus</td>
<td>Unlimited</td>
</tr>
</tbody>
</table>

Source: Information compiled by Deloitte from company websites and stakeholder consultations.
Note: Does not include other charges, such as sign-up fees, fixed charges, penalty rates, etc.

While prices of entry level internet packages have fallen by as much 70% in PNG over the last few years, we also note that:

- Cost per GB is many multiples of that in developed countries.
- Higher data plans are particularly costly, and do not demonstrate the same economies achievable from large purchases available to high users and business customers in developed countries.
- At around 10–20% of average monthly incomes, entry-level internet prices are still priced out of reach of the majority of PNG citizens, and above the ITU’s benchmark for driving rapid uptake of internet of less than 3–5% of average monthly incomes.

We also note that sourcing and interpreting the prices of retail packages is a difficult task, with very little publically available information on rates or terms and conditions of internet packages. Policies that improve the ability of customers to identify and compare retail internet
offers could assist in driving competition at the retail level and bring down prices (discussed further in section 5.2).

3.2 The effect of high internet prices

High prices have a direct impact on the number of internet users in PNG and the number of services provided through the internet. As noted above, although penetration has improved considerably in recent years, less than 10% of the population of PNG has access to the internet. The implications of prices for access were highlighted by the World Economic Forum in its 2015 ‘Global IT Report’:

According to the International Telecommunication Union (ITU), broadband penetration grows rapidly only when the retail price falls below 3 to 5 percent of the average monthly income. (WEF 2015)

Specific literature detailing the link between internet costs and economic growth in PNG is relatively scant. The discussion that follows utilises a combination of the following sources:

- Where possible, authoritative literature such as journal articles or reports from recognised institutions is sourced. In some cases literature relating to mobile phone penetration is referenced in lieu of internet specific literature.
- Articles from PNG-based news organisations, such as Business Advantage PNG.
- Observations and insights gleaned from consultations with stakeholders over a two week period in January 2016.
- Quantitative analysis conducted by Deloitte Access Economics on how cost of internet access affects business development prospects and consumer welfare in Australia.

The purpose of this discussion is not to exhaustively document the effects of high internet prices, but rather to provide a general overview of the transformative nature of internet access both in PNG and throughout the world.

3.2.1 On economic growth

In 2008, the Government of PNG estimated that liberalisation of the ICT market and the subsequent expansion of mobile phone services in PNG had contributed around 2.5 percentage points to GDP growth in the preceding two years (Pruaitch 2008). The internet is generally considered to be even more transformative; the World Bank has estimated that each 10% increase in penetration of broadband in developing countries provides a boost of about 1.38 percentage points to GDP growth (Qiang et al 2009).

The impacts of internet access on economic growth are many and varied, and this report does not attempt to cover all of the potential pathways through which increased internet penetration (through lower prices) can facilitate economic growth.1

At a high level, economic growth can be thought of as being driven by “the three Ps”: population, participation and productivity. While population growth is largely independent of technological advancement, the latter two factors are clearly benefitted by the internet.

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1 Readers who are interested in the potential economic impacts of internet access are encouraged to read Deloitte Access Economics (2015) for details.
Productivity gains

Productivity is the driver most crucial to long term economic growth, and access to broadband and the internet applications it facilitates can enhance productivity in a number of ways (Deloitte Access Economics 2013; Deloitte Access Economics 2015). These include allowing for:

- Improved communication tools;
- Better data management and software applications;
- Online, lower cost marketing;
- Online human resource recruitment and management;
- Applications that reduce administration costs;
- Online shops that reduce the need for bricks and mortar and reduce occupancy costs;
- Cloud technologies that can reduce IT spending; and
- Machine to machine technologies that can improve capital productivity.

Studies have also found that the impact on GDP growth of access to the internet and broadband is higher in lower income countries than higher income countries (Qiang et al 2009).

Logan (2012) notes the potential for ICT to at least partially ameliorate PNG’s infrastructure deficiencies, which is itself a key barrier to productivity growth in PNG. The Economist Intelligence Unit (2014) also noted the considerable barrier to business development presented by high prices.

Our stakeholder consultations revealed a number of ways in which high internet prices and the resultant limits on internet usage have a direct effect on businesses’ operations:

- One business interviewed is forced to make do with download limits less than what an average citizen in a developed country might enjoy (around 200GB of total downloads per month), and pays approximately K10,000 per month for that access. This reduces the capacity for employees to access information pertinent to improving their job performance, and forces senior staff to spend considerable time and effort ‘policing’ the company’s download limit.

- Another business interviewed is unable to quickly transmit information from one office to another, meaning information that needs to be transmitted instantaneously can often take upwards of twenty minutes.

- When researchers travelled to West New Britain as part of this study, the local hire car company did not have internet access. Instead, the operator was forced to telephone Rabaul and manually read out credit card details to complete the transaction. In addition to raising obvious security issues, a task that could have taken less than a minute instead took almost 30 minutes.

- Finally, as noted below, access to the internet can improve productivity of the workforce by substituting on-line services for tasks which may currently require significant time and effort, and reduce the amount of time spent on day-to-day tasks such as lining up at the bank.

Impact on participation

The impact of internet access on job creation comes in two forms: jobs directly and specifically created for the deployment of ICT technologies, and jobs indirectly created once ICT technologies are spread (Deloitte Access Economics 2015, Deloitte Access Economics
The internet allows for a better matching of workers and employers, and therefore ensures that the labour market is operating at its most efficient level.

As the internet becomes more accessible, the prospective labour market to local businesses will widen considerably; rather than being confined to hiring the best worker in a particular area, firms will be able to hire the best worker anywhere. It will also benefit the workers themselves; individuals will have access to a far greater pool of jobs, meaning they will be better able to match their skills with prospective employment.

The internet will not only improve the job prospects of those unemployed (or looking for work); it will also improve the participation rate primarily via the ability to telework. In the Australian context, Deloitte Access Economics estimated that NBN-enabled telework may create 25,000 additional jobs in fulltime equivalent terms from 2011–2 to 2020–21, with around 10,000 of these jobs being created in regional Australia (Deloitte Access Economics 2013; Deloitte Access Economics 2015). The ability to telework is particularly important in PNG where physical transport enablers such as roads and public transport are far less developed than elsewhere. The potential benefits from use of the internet may be much higher than in other countries where transport is easier. Analogously, in the regional/remote Australian context, 70% of people not in the labour force reported they would take up a telework employment opportunity if one was available to them (Deloitte Access Economics 2012).

3.2.2 On consumer wellbeing

Access to services

A regular occurrence in PNG is seeing hundreds of people line up outside the bank each morning in order to do their banking. These lines often take as long as three to four hours to conduct even the simplest of tasks, making it extremely difficult to undertake day to day activities while holding down employment. If all of these people were instead able to conduct their banking online, the potential benefits both to the economy and to the individual would be enormous.

Access to banking is just one example. Access to government services and access to online marketplaces provide other avenues through which the internet could transform everyday lives. In general, access to the internet allows access to services that either were not previously available, or were overly time consuming or burdensome to access (Deloitte Access Economics 2013).

Access to information

Nathan Kwasam (n.d.) of the University of Papua New Guinea discusses the benefits to ordinary citizens and students that can be provided simply by access to information in PNG.

One of the most common impediments to an efficiently operating market is information asymmetry. To the extent that buyers and sellers have incomplete and/or inconsistent sets of information, marketplaces will not function to the betterment of society, but rather to the betterment of the individual (or group of people) with the most information.

In the information age, it is not hard to see how a lack of internet access can seriously undermine an individual’s, a business’, and a community’s ability to access the information that it needs to improve its wellbeing. Indeed there is evidence in the Australian context that the internet has the greatest impacts where households face difficult circumstances, such as needing to find employment, move residence or where additional education is of
significant benefit (Qiang et al 2009).

With access to the internet, people in PNG who as little as ten years ago would otherwise have lived quiet, secluded (and possibly poverty stricken) lives in rural villages, literally have access to the world at their fingertips. They can spend minutes accessing information which previously would have taken days. They can seek out knowledge and services, or search for jobs utilising their unique skill sets. One blog post for example discusses the extent to which social media channels have provided ordinary Papua New Guineans an opportunity to start businesses, referring to the emergence of so-called ‘Facebook businessmen’ in PNG (Pacific Media Centre 2011).

The price barrier to information due to high internet prices in PNG is likely to create an uneven playing field for businesses. Those businesses who must settle for limited or even no access to the internet will clearly be at a significant disadvantage to businesses able to invest in the service. As noted in the following sections, lack of reliability requires businesses to invest in costly redundancy solutions, driving this cost barrier higher and further separating businesses into ‘haves’ and ‘have nots’ in so far as access to information is concerned. Thus, one of the most fundamental benefits of wider and more reliable internet access (including lower prices) is its potential to create a level playing field and ensure all PNG citizens are able to access the same information.

Information access can also have a far more fundamental role to play in terms of human welfare. In Vanuatu, for example, ICT has been credited as being a key contributor to minimising the death toll from Cyclone Pam. Internet access also assisted in disaster recovery efforts in the Nepal earthquake of 2015, with affected citizens able to post updates on social media and other channels (Internet Society 2015).

**Education**

Through the access to information and educational opportunities noted above, the internet could have a marked effect on peoples’ welfare. For example, PNG is estimated to have an adult literacy rate of only 56%, although the true figure may be even lower (UNESCO 2011). To some extent, high illiteracy rates may hinder internet access (Antonio & Tuffley 2014). However, over time internet access can also be a key driver in improving literacy rates through the delivery of education. IT technologies are a critical element of standard primary and high school learning curricula the world over. Access to the internet can transform the educational experience, especially where it is physically difficult to reach a school, or where teaching standards are low. Business Advantage PNG (2015a) notes the example of Unitech PNG, which utilises O3b technology for the delivery of course content.

Broadband and the internet have also had a significant influence on how the educational sector organises itself and how services are being delivered (Deloitte Access Economics 2015). The OECD (2013) identifies two key ways in which the internet can help make education more efficient. First, the internet improves education by enhancing remote communication and delivering teaching or training materials. Second, the internet greatly facilitates gathering of information using a myriad of services and applications such as online classes and seminars, dedicated webpages and online forums for expertise exchange.

**Healthcare**

In a country as remote as PNG, under connected by road and rail and facing enormous geographical challenges, the capacity for internet connectivity to generate tele-health opportunities is literally a life changer for remote communities.

*In neighbouring East Timor, O3b is used for tele-medicine, which allows med-
ical practitioners to continue providing medical services without the need to go to Dili for training. It has also meant they can access the International Learning Gateway, a data hub, which provides learning and training materials, which previously couldn’t be downloaded because the internet would time out or the data files were just too large to send. (Business Advantage PNG. (2015a)

Suwamaru (2014) conducted a survey of 727 Papua New Guineans across seven provinces to gauge their usage of mobile phones. The survey identified two major health related usages.

The first was through the ability to take pictures of injuries and transmit them instantaneously to medical professionals located hundreds or even thousands of kilometres away. The second impact was through the transmission of information — using mobile phones to disseminate healthcare ‘tips’ to rural communities, as well as to source vital medicines and supplies.

Although the analysis conducted by Suwamaru specifically focused on mobile phones, both of the avenues above would clearly also be applicable (potentially even more so) to internet access more broadly — through the availability of e-mail and teleconferencing technologies, for example.

**Impact on broader price levels**

It was noted earlier that internet access in PNG was estimated by the International Telecommunications Union to cost more than two and a half times per capita GNI. Despite the rapid growth in uptake noted earlier, this still precludes internet availability for the vast majority of people.

There are some specific economic effects of broadband that are not necessarily captured by economic growth or employment creation. Productivity gains and competition brought by improved internet availability bring price reductions in many products and services, and this results in benefits for households and consumer surplus (Deloitte Access Economics 2013).

For example, Galperin et al (2014) cite a number of instances where mobile phone access has brought about price reductions in the developing world:

- Increased mobile phone connectivity in South India resulting in reduced price dispersion across fish markets.
- The introduction of mobile phones causing a 20% reduction in price differences across grain markets in Niger.
- Text message updates sent to farmers in Columbia with price and weather information causing a reduction in crop loss.

It is easy to see how similar benefits might be generated in PNG through increased internet access. To the extent that cheaper and more reliable internet access lowers the cost of doing business — as per the discussion that follows in Chapter 4, and further discussed in Business Advantage PNG (2015b) — then it follows that consumer prices would fall as a result.
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The reasons behind high internet prices are multiple, and range from infrastructure related, to economic and market related issues, to PNG specific issues.

Figure 4.1: The various causes of high end-user internet prices

4.1 Infrastructure

4.1.1 Maintenance costs

Maintenance costs involve both maintenance of the PPC-1 cable and maintenance of the above ground infrastructure. Anecdotally, maintenance costs in PNG are considerably higher than what one might expect in a developed country. Due to a range of PNG specific factors discussed in section 4.5, maintenance costs were estimated by one stakeholder to be around four to five times higher than what one might expect in a developed country.

Maintenance of the PPC-1 cable

As noted previously, Telikom PNG owns an 80km ‘spur’ which connects the PPC-1 cable with a landing station in Madang. The PPC-1 cable itself (i.e. which stretches from Sydney to Guam) is owned by the Australian telecommunications company TPG. However, Telikom advised that it pays maintenance costs not only for that 80km spur, but rather for the entire 7,000km of the PPC-1 cable stretching from Sydney to Guam.

It is expected that Telikom would seek to recover its costs for access to the PPC-1 cable through charges to its customer base, and these charges may also include some level of risk-based premium. We also note that Telikom and others have advised that the maintenance of the PPC-1 cable is a key contributor to the wholesale-retail price differential. However, without access to information regarding the actual charges levied by TPG on Telikom, or the inputs to and calculation of Telikom’s own charges, we are unable to determine
whether or not the charges levied are appropriate. Further details on the key cost drivers of wholesale services are provided in section 4.2. The ICT sector in PNG is currently characterised by a significant lack of transparency around its cost structure. Obtaining a better understanding of the true costs and cost drivers, particularly of the wholesale sector, will be fundamental to ensuring that services are being priced appropriately, and also assessing the costs and benefits of infrastructure upgrades.

**Maintenance of above ground infrastructure**

Infrastructure costs are not unique to PNG. Older infrastructure costs more to maintain, and when budgetary pressures occasionally force maintenance to be undertaken on a reactive rather than a proactive basis, these pressures are intensified. This is especially prescient when considering the ageing, above ground infrastructure that is required to transmit the bandwidth purchased from the PPC-1 landing station at Madang to Port Moresby and the rest of PNG.

PNG specific factors (discussed in more detail in section 4.5) mean it is difficult to access some infrastructure assets in rural and remote areas. The lack of a national road network often means that what might be routine maintenance tasks in some parts of the world become a major exercise in PNG, involving the leasing of helicopters, dedicated security staff, and often the importation of the relevant tradespeople from neighbouring countries.

These factors are exacerbated by the lack of a fibre linkage between Madang (where the PPC-1 cable lands) and Port Moresby, and the consequent reliance on overland transmission tower relays. The extent to which the fibre rollout currently underway by DataCo may ameliorate some of these factors is yet to be seen.

A key piece of work to be undertaken following on from this report is an analysis which considers the extent to which different maintenance costs for different infrastructure solutions may influence the relative benefits and drawbacks of those solutions.

### 4.1.2 Reliability issues

The reliability of internet access in PNG is a well-known concern. Outages are common and often severe, and force most businesses to adopt backups, or redundancies, of varying sophistication. A common redundancy, for example, is for an individual firm or business to utilise the services of multiple ISPs in case one of them goes down.

For example, a business might utilise both Telikom and Digicel as an ISP, with the ability to switch between the two as and when the need arises. This results in duplication of ISP costs, as well as additional operating costs from the business's perspective — both in establishing the redundancies (i.e. enabling systems to switch between ISPs as required), and ensuring they are in working order. Stakeholders advised that instances where it becomes necessary to switch between ISPs due to an outage are extremely common, often occurring as frequently as once or twice a week.

By contrast, ISPs in developed countries tend to deliver services in such a way as to create redundancy in their own networks — that is, it is the service provider that ensures that its customers receive continuity of service in the event that part of the network suffers an outage.

The reasons for this difference highlight many of the core issues discussed in this Chapter. Specifically:
• Greater competitive pressures in other countries mean that if a customer is unhappy with their service then he or she has multiple ISPs to choose from, whereas in PNG customers have relatively little choice.

• In terms of infrastructure, in PNG there is really only one cable from which to access high-speed broadband internet, so if there is a fault in the cable ISPs cannot switch to another.

A lack of reliability in the network affects retail prices in two main ways: first by increasing maintenance costs and forcing wholesalers and retailers to push up their prices accordingly; and second by increasing the risk of operations, forcing operators to add a risk premium to their margins.

Further, while perhaps not directly influencing the retail price of internet access, reliability concerns add a considerable cost to businesses by forcing them to adopt ‘work arounds’ such as redundancies.

4.1.3 Offshoring of internet traffic

The vast majority, if not all, of the internet traffic in PNG is hosted externally. Internet signals have to physically leave PNG in order to access content from an exchange platform offshore (typically Sydney), and then return to the country to deliver the content. This increases both latency (the amount of signal which is ‘lost’) and the cost of accessing web pages, emails, data transfers (uploading/downloading of documents), and other day to day internet uses.

Notwithstanding the internet exchange point discussed in section 2.3, in the majority of cases at present, when a customer demands access to a website (i.e. enters a website in the address bar or clicks on a web link), a signal is sent from the ISP (e.g. Digicel or Telikom) to whatever offshore location the website is hosted at, transmitted back to the ISP’s servers, then finally transmitted to the customer. While this all happens in a matter of seconds it is clearly a far more costly exercise than if websites were instead hosted locally.

Infrastructure investment

Many alternative future infrastructure solutions were raised during consultations, some of which are summarised below.

Table 4.1: Future infrastructure alternatives

<table>
<thead>
<tr>
<th>Cable</th>
<th>APNG-2</th>
<th>PPC-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable solutions:</td>
<td>Connect PNG with Australia or the USA?</td>
<td>Overland cables (perhaps with utilisation of electricity poles)?</td>
</tr>
<tr>
<td></td>
<td>PNG to be a global connection hub?</td>
<td>Undersea cables (i.e. stretch around the coast from Madang to POM?)</td>
</tr>
<tr>
<td>Non cable solutions</td>
<td>Satellite (Vsat or O3b?)</td>
<td>Underground cables?</td>
</tr>
</tbody>
</table>

When assessing future infrastructure solutions and the extent to which these solutions are able to bring about a reduction in end user costs it is important to consider whole of life costs, demand for services, and customers’ ability to pay.

It is commonly argued that construction of infrastructure projects, such as the National
Transmission Network described in section 5.1, will reduce costs and ultimately end user prices. A number of stakeholders commented that construction of a new cable connecting Port Moresby to Madang would be the single quickest way to reduce costs.

However without detailed cost and demand modelling it is not clear whether such an investment, which would most likely improve services, would also reduce costs at the end user level. This is especially challenging in developing countries where low internet penetration and income constraints on the part of end users mean that demand may not be sufficient to support significant investments by ISPs, which ultimately rely on increasing their user base and throughput to recoup the high fixed costs of investments.

In that regard, while fibre optic cabling solutions would undoubtedly be preferable from a speed perspective, a holistic analysis would consider the extent to which other infrastructure solutions might have differing cost/reliability/speed trade-offs which warrant consideration. The typical approach to assessing these types of investments would be a cost-benefit analysis taking into account both direct impacts on users and the broader implications for productivity and growth in PNG. Key factors to be considered when comparing alternative infrastructure solutions should include:

- Demand for the service (including access, quality, speed and reliability).
- Upfront capital and financing costs.
- Ongoing operations and maintenance costs.
- Useful life and replacement costs.
- Risks including obsolescence, asset failure, social and environmental factors.

4.2 Wholesale

4.2.1 Wholesale access fees

Telikom purchases wholesale internet bandwidth from both the APNG and PPC-1 cables and on sells that bandwidth to retail ISPs. That said, due the APNG cable having already reached its maximum capacity, most if not all, internet usage is conducted through the PPC-1 cable.

ISPs advised during our consultations they are charged a wholesale access rate of K1,950/mbps, or approximately A$800/mbps. Telikom has subsequently advised that this wholesale rate will fall to K1,570/mbps as of 1 July 2016, and the same rate is charged across all customers while the satellite landed cost has come down to US$650, or approximately K1,950/mbps (O3b, Speedcast and Kacific).

We note that these rates represent a very substantial reduction in charges — Telikom advised that wholesale prices were K6,000/mbps as recently as 2013, making the current rates a reduction of around 70% over the last three years. While we note the views of a number of stakeholders that satellite services are not good substitutes for cable services, and that this was also a key finding from NICTA’s review, the price response from Telikom suggests that there is some substitution effect and resulting competitive tension on prices at the wholesale level.

Telikom has advised that it can pay as low as approximately A$30/mbps to TPG, (the owner of the PPC-1 cable) for access to bandwidth from the PPC-1 and APNG2 cables (it is a spot market). It is important to note that in providing wholesale access services to the market, Telikom will also incur a range of other costs, including operations, maintenance
and electricity costs plus costs for staff and company overheads.

That said, a lack of data surrounding the cost structure of the wholesale access market makes it difficult to identify the relative influence of different cost drivers and whether the wholesale price is set at an efficient level. We also note that Telikom’s costs and prices have not been subject to review by NICTA for compliance with the requirements of the NICT Act, and further analysis to determine the breakdown and drivers of these costs could form part of the recommended review of wholesale arrangements discussed in section 5.2.

4.2.2 Vertically integrated monopoly service provision

One provider of high speed internet access

Many stakeholders raised concerns at the lack of access to wholesale internet services. In particular, concerns were raised over the fact that Telikom has exclusive access to both the APNG and PPC-1 cables, and thus exclusive access to the fastest internet speeds permitted by current technology. To the extent that this provides Telikom with market power in supplying wholesale level internet services, Telikom may be able to charge prices higher than those that could be sustained in a competitive market.

For retail ISPs, the only alternative to negotiating access to Telikom’s cable network is to independently provide satellite internet coverage. This is the approach taken by dedicated satellite providers such as Speedcast, and notably also by Digicel (for at least a portion of its network).

The issues surrounding Telikom’s monopoly in wholesale internet provision are not new. In fact, NICTA raised many of the same issues back in 2012 during an inquiry on market access (NICTA 2012).

The fact that Telikom is a monopoly provider of cable internet is not necessarily a bad thing. A legitimate argument could be made that a natural monopoly exists; having multiple spurs connecting PNG to the PPC-1 cable owned by multiple companies, for example, might not be an optimal scenario.

But if it is established that a natural monopoly exists, it is critical that the regulations surrounding that monopoly sufficiently protect the interests of consumers.

The pertinent question, therefore, is twofold:

• First, does Telikom’s position in the wholesale market present characteristics of a natural monopoly?
• Second, is the regulatory framework both supportive of the monopolist while at the same time protective of consumer rights and interests?

Addressing both of these questions is the subject of recommended policy responses described in section 5.2.

Vertical integration

Further complexity is added by the fact that Telikom competes in the same retail market as the ISPs that it supplies wholesale level internet services to. It may therefore have an incentive to limit access to wholesale level internet services for its competitors, or alternatively to levy additional fees to competing ISPs.

In discussions with stakeholders, there were several instances where retail ISPs claimed Telikom had acted in a way that constrained competition at the retail level, for example by
restricting access to infrastructure and engaging in retaliatory practices. Notably, NICTA has advised that it has not been made aware of any such instances, and we note that without a full investigation it is not possible to state whether these issues truly relate to uncompetitive behaviour or are simply the normal workings of the market.

However, we believe it is important to recognise the concerns of stakeholders about the level of competition in the market and the implications for end user prices. In particular, the regulatory framework should provide appropriate protections for smaller market participants with legitimate grievances, and the regulator should be appropriately resourced to manage complaints.

That said, changes are underway in the wholesale market. Specifically, the Government’s intention is for Telikom’s assets to be transferred to DataCo, with DataCo becoming the new wholesale internet provider and Telikom focussing only on retail. This solution should alleviate concerns about any incentive Telikom currently has to deny access — as a wholesale only provider, DataCo should not have an economic incentive to deny access to any particular ISPs.

However, the creation of DataCo without reform of the underlying regulatory or policy environment will arguably result in little other than replacing one government owned monopoly with another. So while the incentive for vertically integrated pricing dynamics might be removed, the underlying market dynamics that cause a monopolist to charge a higher price than a competitive market will still exist.

Finally, it is worth noting that no concrete timeframe has been set for the transition of Telikom’s assets to DataCo, nor has there been any form of change management plan mapping out what needs to be done to effect the transfer.

4.2.3 Cable versus satellite

Telikom is the only provider of cable internet access. Several ISPs provide internet services via satellite and some, most notably Digicel, are also active in the provision of wholesale satellite connectivity.

Indeed, in its response to NICTA’s 2012 pricing inquiry, Telikom (2012) argued that, due to the possibility of retail ISPs utilising satellite as opposed to the fibre optic cable bandwidth controlled by Telikom, “there exists an avenue for substitution of the wholesale capacity market”. We also note that in recent years Telikom’s wholesale prices appear to have responded to the competitive pressure provided by the satellite alternative, lending some support to Telikom’s assertion that the products are substitutes.

However, in its report on declaration of wholesale services, NICTA determined that satellite and cable services are not effective substitutes (NICTA 2012, p.13):

> Wholesale customers may of course access international connectivity via satellite-based services. However, it is widely recognised that quality differences and capacity constraints make satellite-based connectivity an inferior substitute for international connectivity for fibre-optic cables for many types of communications services. For example, the high latency of satellite transmissions can affect the quality of voice and data transmissions. Accordingly, NICTA staff do not consider that international access via satellite can realistically be considered an effective supply-side substitute.

As a result of this finding, NICTA recommended that wholesale internet services be de-
clared under the NICT Act, subjecting them to the pricing guidelines therein (see section 4.3 below for further details on NICTA’s decision and its implications).

We also note that there are some fundamental differences between the services provided by cable and satellite connections, which appear to support NICTA’s conclusions and the declaration:

• Stakeholders interviewed for this project were generally of the view that satellite connections were more reliable, albeit slower, than the cable connectivity offered by Telikom (see section 2.3).

• A satellite connection does not provide sufficient download speeds to be used as a primary connection for some applications. Indeed, some corporate stakeholders noted that satellite connections are used for less critical tasks such as email, while cable connections are generally used for more business critical activities.

4.2.4 Infrastructure duplication

Another issue raised during consultations was a lack of infrastructure sharing. Specifically, once wholesale bandwidth is purchased from Telikom, it is perceived as difficult for smaller providers to utilise other companies’ transmission infrastructure (e.g. transmission towers, etc.). Anecdotally, one of the hills surrounding Port Moresby has five or six transmission towers on it, each with only one antenna. It is also worth noting that several of these towers are in fact owned by separate government entities (bmobile, Telikom, PNG Power).

This lack of sharing of basic infrastructure is unlikely to represent a prudent approach to investment, and also creates considerable barriers to entry for smaller companies unable to afford their own infrastructure. This could ultimately lead to higher prices by duplicating costs which could have otherwise been shared and restricting competition.

On the other hand, an argument could also be made that by forcing infrastructure owners to share, the incentives to build the infrastructure in the first place might be lessened. Perhaps unsurprisingly, this is the argument put forward by those who own the infrastructure. Note for example the following quote from Digicel which was included in the Government’s follow on report from the 2008 ICT Policy (Department of Communication and Information, 2009).

Such excessive regulation will result in reducing Digicel’s incentive to invest and in Digicel scaling back its investments in PNG, including in rural areas. (p.34)

NICTA has advised that infrastructure sharing arrangements are in place, however, these arrangements do not appear to be in use, and furthermore, it is not clear whether they suit the needs of market participants.

4.3 Regulation

4.3.1 Roles and responsibilities

As was discussed in Chapters 2 and 3, the internet has a huge role to play in the continued development of PNG. Central to that development is an effective regulatory environment. The regulatory environment should ensure that competition, and efficient outcomes with respect to infrastructure investment, operation and use, are promoted in order to promote the long term interests of consumers. The absence of appropriate regulation could reduce consumers’ ability to access the internet at reasonable prices, and in turn the internet’s po-
tential to play a transformative role in PNG’s economy and society.

The fact that PNG has two well established regulators with a potential role for covering the ICT sector — NICTA and the ICCC — is in itself a great positive. Further, deregulation of the telecommunications sector more generally in the last decade has driven market entry and increased the penetration of ICT across PNG. However, some ambiguity exists over the roles of the ICCC and NICTA in the ICT sector, and it appears as though the regulatory framework may not be achieving all of its objectives.

4.3.2 Effectiveness of regulation

NICTA has conducted a number of important reviews in recent years, including:

- An inquiry into the need for declaration of wholesale internet services in 2012.
- Preparation of the National Broadband Policy in 2013 (NICTA 2013a).
- Determination of ‘service specific pricing principles’ for wholesale internet services in 2013 (NICTA 2013b).
- A review of retail pricing in 2014, which estimated the proportion of GNP per capita made up by internet prices and sought comments on ways in which NICTA could reduce prices.

While NICTA has published a multitude of determinations inquiries, issues papers and consultation papers, anecdotal evidence suggests that many determinations do not end up coming into effect. In other words, it appears difficult for NICTA to bring its recommendations into force.

Declaration of wholesale internet services

In its 2012 inquiry into the need for declaration of certain wholesale services in international connectivity markets, NICTA found that Telikom had a position of significant market power in the provision of wholesale services. In particular, NICTA found that the declaration criteria in s.128 of the Act were met, being that declaration of the wholesale service was seen as appropriate to promote competition in the retail market.

Following NICTA’s inquiry, on 26 March 2013, the Minister for Communications and Information Technology declared the following wholesale services under s.130 of the National Information and Communications Technology Act 2009 (the Act):

- The international submarine cable transmission capacity service; and
- The international submarine cable gateway access services.

The implications of declaration under the Act are that Telikom must provide access to wholesale internet services in compliance with certain non-discrimination obligations, and the price of access must be consistent with the General Pricing Principles and any relevant Service Specific Pricing Principles.

The General Pricing Principles are broad principles based on standard concepts of efficient
costs typical to economic regulation. However, to our knowledge, NICTA has not undertaken any assessments of Telikom’s prices to ensure that they do comply with the General Pricing Principles.

NICTA has also determined a set of Specific Pricing Principles for submarine cable access. However these Specific Pricing Principles only apply in the event that NICTA makes a determination specifying the prices that Telikom is to apply. Given that NICTA has not made such a determination it is not clear how these Specific Pricing Principles are intended to be implemented in practice by Telikom (if at all).

The terms of access to wholesale internet services are in the first instance, subject to commercial negotiations between Telikom and ISPs. If agreement on access cannot be reached, an ISP can ask NICTA to oversee a reference interconnection offer (RIO) from Telikom to the ISP, and failing that, NICTA can determine the terms of access through arbitration. To-date, no ISPs have asked NICTA to assist in negotiating terms of access with Telikom.

Effectiveness of the current regime

Despite the fact that wholesale internet services are currently regulated, we note that there may be a number of reasons why the current regulations and regulatory framework are not driving reductions in the costs of services for end users.

There appears to be a lack of visibility in the industry about the meaning of declaration under the Act, and in particular, the provisions concerning how prices should be set (that is, with reference to the efficient costs of providing the service as required by the General Pricing Principles).

NICTA has noted that it has not received any complaints from ISPs concerning Telikom’s terms of access or charges, and thus has not been required to step in and arbitrate any disputes between Telikom and the ISPs. This could be due to a number of factors:

- In terms of competition, the Act is primarily concerned with whether or not the practices of Telikom are impacting competition at the retail level — not whether it is exercising market power at the wholesale level to earn excess profits. To the extent that Telikom’s charges are too high, if the prices offered to ISPs are essentially the same, then competition in the downstream sector would not necessarily be negatively impacted — all competitors would face the same or similar input costs, and pass through those costs (whether efficient or not) to end users.

- There may also be limited visibility or understanding in the industry of Telikom’s obligations to levy prices that are in line with efficient costs under the declaration, or of NICTA’s role in managing disputes. Given that NICTA has faced a number of appeals and legal challenges in relation to its regulation of the telecommunications sector, there may also be a lack of confidence in the regulatory regime to achieve its intended outcomes in the event of an arbitration.

It is also not clear what steps NICTA might take to proactively investigate whether or not Telikom is abiding by the pricing requirements in the Act — that is, there is limited clarity on what Telikom’s actual costs are, whether these are in line with efficient costs, or even what the efficient costs of providing the service are.

We also note that NICTA has broad information gathering powers, however we understand that these have not been tested in relation to accessing agreements between Telikom and the ISPs, without which regulating costs and prices is a difficult, if not impossible, task.
4.3.3 Regulatory gaps

With an already established regulatory framework, PNG is well positioned relative to many other developing countries to meet the challenges of an ever changing technological environment. But the discussion above indicates that there are certain areas in which the existing regulatory arrangements might be insufficient to meet the demands of the future.

In reviewing the market we have identified the following areas in which gaps in the regulatory framework may be affecting NICTA’s ability to effectively regulate the market, potentially leading to higher prices for end users:

• Responsibility for monitoring the nature and level of competition across the ICT sector as a whole is unclear — particularly, the inter-relationships between competition at the wholesale level (which is largely the responsibility of NICTA, but only in so far as it has implications for competition between participants at the retail level) and competition at the retail level (where the ICCC appears to have some role, via its responsibility to monitor compliance with its consumer protection mandate under the ICCC Act).

• Sections 81 and 82 of the ICCC Act note that obtaining pre-approval for large scale mergers and acquisitions is voluntary. The implication of this is that large mergers which contravene the competition laws in the ICCC Act might go ahead, but it might then be difficult for the ICCC to retrospectively reverse a merger or unwind an agreement that had already taken place.

• Although NICTA’s determinations and the Government’s declaration of wholesale services require that wholesale access fees should be levied on the basis of efficient costs, it appears that the framework is not well positioned to ensure that this occurs. It is reported, for example, that wholesale access agreements between Telikom and ISPs are subject to non-disclosure agreements, giving NICTA limited oversight of whether the pricing principles are being abided by.

We consider that a review of the current regulatory objectives and settings should be undertaken as a matter of priority. This could include examination of issues such as the regulatory test (as to whether more intrusive regulation is required), and the determination of efficient costs of services, such as by increasing transparency about what the efficient costs of providing services are, so that industry participants are better able to negotiate competitive and efficient terms of access.

4.4 Retail and competition

4.4.1 Retail market structure issues

While it is acknowledged that Digicel’s entry has had an enormously beneficial impact on PNG’s economy, and indeed has singlehandedly brought the internet to millions of people, we also note that because of its dominance Digicel appears to now hold significant market power in the retail market.

While there are some smaller players — Global, for example — these companies do not appear to have a sufficient market presence to challenge Digicel. For a range of reasons, such as infrastructure, scale and funding limitations, smaller market participants are unable to capture significant market share:

• There has been a degree of consolidation in the retail market in recent years — for
example, Digicel acquired Remington, Telikom acquired Datec.

- As discussed above once bandwidth is purchased it is difficult for smaller players to access the requisite infrastructure.
- Outside of major cities (in Kimbe for example which researchers visited for this study), Digicel’s dominance is virtually unabated.

The market for retail internet service provision might best be described as monopolistic with a competitive fringe. However there are a range of factors that prevent the fringe from making a notable impact on the market itself. Further understanding of precisely what those barriers are is vital to determining the best way forward for the retail market. For example, if it appears that large players are buying up bandwidth just to keep competitors out, ‘use it or lose it’ provisions similar to those applied to some gas markets might be worth considering.

Following its 2014 review of retail prices, NICTA released a final report which noted its intention to commence monitoring of retail prices (NICTA 2015a). This report noted that the imposition of a price cap on retail internet services might be considered should affordability not improve.

However, while we do recommend monitoring of retail prices (see section 5.2), we note that regulation of the retail sector without applying similar oversight of wholesale prices (particularly given the vertical integration in the market) could risk squeezing margins of smaller retail players and ultimately reducing competition. Therefore, we consider that regulatory oversight of the wholesale market should take precedence over retail price controls.

### 4.4.2 Government involvement in retail

A related issue is the degree of government involvement in the market. A few years ago for example, Telikom acquired Datec, and bmobile was acquired by the Government of PNG through an 85% shareholding in 2013. The end result is that PNG has three government owned retailers — Telikom, Datec and bmobile — all competing with one another in the same marketplace.

Government participation in the retail market may be justified on the grounds that in the absence of such participation, there would be a reduction of private sector involvement. Indeed, this appears to be the primary rationale for the Government’s strong degree of involvement at present.

From an economic standpoint, however, there seems little justification for direct government participation in the market for retail internet provision. Successful companies in the internet market are usually well funded, have a strong brand presence and marketing strategy, and are agile and innovative. They can create new products and respond quickly to market developments and competitive trends — these are not characteristics typically associated with government ownership.

The high level of government participation in the market is likely to drive up prices in a number of ways:

- By driving out private sector participants who may be more innovative and cost conscious, but are unable to establish a customer base due to barriers to entry — PNG is a relatively small market, and will only be able to sustain a limited number of market participants. With three government players, the participation by the private sector will necessarily be reduced.
Conflicting objectives — government operators often have broader objectives than pure profit maximisation (community service obligations or minimum access requirements for example), which can drive up costs and prices.

The recent partnership between bmobile and Vodafone is a promising way to get some private sector expertise and competition in the industry, and provides a real chance for increased competition for Digicel. However, talks are also underway between Telikom and bmobile to merge their retail business; this is a matter of some concern since it would both reduce the number of competitors and strengthen the Government's foothold in the retail market.

4.5 PNG specific issues

This section discusses some PNG specific issues — these being skill shortages, geographical challenges and landowner relations — that also drive higher prices in PNG. For example, stakeholders advised that such issues make maintenance costs in PNG some four to five times higher than what would otherwise be the case in a developed country such as Australia.

By raising the risk profile associated with doing business in PNG, these factors drive up costs for market participants (typically manifested in higher financing costs, but also in insurance, maintenance, labour, and other inputs) which ultimately flow through to higher prices for customers. Recently, for example, internet services were down in PNG due to sabotage of cable infrastructure. Such events clearly impose a huge cost on operators, which eventually need to be recovered through retail prices.

4.5.1 Labour market

Difficulties in gaining access to the highly skilled labour required in the ICT sector create significant costs for domestic and international companies alike.

In the context of ICT, a maintenance task that might take an hour in Australia could well take days in PNG, because of the need to (a) bring a technician in from a neighbouring country such as Indonesia or Malaysia; (b) pay that technician for his or her time; and (c) if necessary, import parts and equipment.

Further, large and infrequent resource extraction projects, such as PNG LNG, tend to draw skilled labour away from other sectors and lead to not only shortages, but very high wage inflation as other employers are forced to compete with resource projects for labour.

As PNG continues on its path to development, we would expect access to skilled labour to improve. However, this is a long process and skill shortages are likely to remain, purely due to the relatively small size of the PNG economy.

4.5.2 Geographical

As with many South Pacific Island nations PNG's geography is not conducive to transmitting internet signals. The main island of Papua New Guinea is the only island for which an undersea cable is ever likely to be feasible; other islands do not have sufficient population, and as such will likely always be reliant on satellite and/or microwave technologies.

Further, PNG’s mountainous terrain complicates the task of getting the internet signal from the PPC-1 cable connection at Madang to Port Moresby. At present, the signal is
relayed to Port Moresby via a network of transmission towers which adds considerably to the cost of maintenance and also reduces reliability of the signal. In future DataCo intends to supply much of the island with fibre optic cables; however the timing and cost of this rollout remain unclear.¹

4.5.3 Landowner relations

A prescient concern raised by many stakeholders is that at present the signal is transmitted over tribal areas in the PNG highlands. Such areas are often not considered safe to travel, and a lack of road networks make accessibility an issue. One stakeholder commented that a lack of accessibility combined with a lack of skilled labour means that tasks which may take a couple hours elsewhere, would in PNG require importation of skilled labour, hiring of a helicopter, plus three or four days’ time to complete. Another issue is that landowner groups often put compensation demands on Telikom for the use of their land.

It is not hard to see how such issues add considerably to the cost of doing business in PNG. While there is little that can be done in the near term to explicitly address the issue of landowner relations, any future infrastructure plans need to be especially cognisant of these issues.

¹ http://pngDataCo.com/index.php/ntn
This chapter provides a description of recommended policy responses for addressing the issues noted in the previous chapter. In many cases further analysis will be required to further refine and develop the appropriate policy response to the issues.

The most important point to make at the outset is that the five drivers discussed in the previous chapter need to be considered holistically.

Addressing issues in relation to wholesale access without strengthening of the underlying regulatory frameworks, for example, will reduce the efficacy of both policies. Addressing issues in retail service provision without also addressing wholesale access could prove equally fruitless.

A two-step process was employed in answering the underlying question ‘where to from here?’:

- First, a top down approach was employed to ensure a holistic view of the issues is applied. Three long term strategic objectives were defined to address the underlying issues which cause higher prices. These long term objectives are described in section 5.1.
- Second, a bottom up approach was employed in order to identify practical policy responses which could be implemented in the short-term.

### 5.1 Long term policies

The previous chapter identified a range of reasons for the high internet costs in PNG. Some of these are natural (i.e. geographical), and others are physical (infrastructure related). However, many relate to human driven factors which can and should be addressed.

While the issues causing high prices are reasonably clear, in many cases the precise policy responses that might alleviate these issues are unclear at this stage. As is so often the case, the time taken to implement reforms or the various intermediate steps required mean it is all too easy to lose focus of the ‘bigger picture’.

With that in mind, we have identified three key avenues through which internet prices in PNG could be reduced:

- Reduction of the wholesale rate,
- Plugging regulatory gaps, and
- Reform of the retail market.

Achieving these ‘end goals’ will be a long drawn out process, and some disagreement is inevitable over what specific policies, procedures and strategies should be implemented, and in what order. Some short term policy recommendations are provided in the following section which we believe provide useful ‘first steps’ in the achievement of all of these longer
term objectives.

5.2 Short term recommendations

5.2.1 Recommendation 1: develop a holistic ICT industry strategy

The most recent whole of government policy relating to the ICT sector was the 2008 ICT Policy, released some eight years ago (Department of Communication and Information, 2008). Following the 2008 ICT Policy was a further report (Department of Communication and Information, 2009) which provided further details and recommendations on the implementation of key reforms.

Taken together, these reports led to some very important reforms, most notably being the introduction of competition in retail and the establishment of NICTA. However, it does appear that the effectiveness of these reports has been somewhat underwhelming. Some probable reasons for this are noted below.

First, the 2008 ICT Policy might be better termed an industry development strategy. The 2008 ICT Policy (and the subsequent report in 2009) set out the high level vision espoused by government for the development of the ICT industry, complete with high level goals and objectives, such as the introduction of competition or reform of Telikom. However, both reports lacked a comprehensive action plan. Identification of clear action items, including the responsible agencies, indicative timeframe and measurable key performance indicators (KPIs) would have allowed progress against the recommendations to be tracked. While some of the recommendations have been acted on, some clearly have not.

Further, the technological environment has changed considerably since 2008, meaning an update of the 2008 ICT Policy is now required. A number of things have changed since then and the 2008 ICT Policy could not have been expected to cover many of the prescient issues relating to the internet market in 2016:

- In 2008, smartphones were relatively rare in PNG, meaning the dominant force in the ICT sector, and consequently the primary focus of the 2008 ICT Policy, was mobile communication. Today, internet usage plays a far more significant role in the broader ICT sector;
- Considerable improvements have been made in internet technologies, infrastructure and usage since 2008 (see Chapter 2);
- The introduction of the PPC-1 cable has both reaffirmed Telikom’s monopoly in high speed internet access, and widened the gap in speed between cable and satellite internet access; and
- Since 2008 the rapid growth in Digicel’s network has given it a dominant market position in retail internet provision.

Finally, the 2008 ICT Policy did not cover many of the specific issues identified in Chapter 4 as leading to high internet prices, such as maintenance costs and the wholesale access fees charged by Telikom for use of its network.

1 While it is acknowledged that various reviews, determinations, etc. have been released since then (most notably the National Broadband Policy released in 2013), these do not constitute broader whole of government and whole of industry policies.
We recommend that an updated ICT industry development strategy be developed as a critical first step in reducing internet prices and ensuring they remain competitive over time. The new strategy should include a comprehensive action plan complete with timeframes and deliverables, which it can be measured against to track progress. The strategy will also call for the development of specific policies where necessary — such as in retail competition, wholesale access, and infrastructure sharing.

5.2.2 Recommendation 2: strengthening regulatory frameworks

Effective regulation is crucial to the development of economies, to the competitiveness and success of industries, and to the overall wellbeing of society as a whole. But ineffective regulation can have the opposite effect: it can hinder the growth and development of industries, it can reduce individual (or business) freedoms, and can ultimately slow down the pace of economic development.

Innovation and technological change is a key driver of the need for regulation. Some success has been achieved by NICTA which has facilitated greater access to telecommunications markets, and it is commendable that NICTA itself has instigated a number of very important reviews into various aspects of the industry.

Nevertheless, this report has identified a number of instances in which apparent regulatory gaps are likely to at least contribute to high end user internet prices in PNG. In our view, two key changes to the regulatory architecture could go a long way towards removing those gaps.

An important pre-requisite for effective regulation of the ICT sector is complete operational independence of NICTA, since decisions can easily become controversial — particularly where a decision by NICTA that is in the interests of customers may reduce revenues earned by government-owned entities, thus reducing the scope for dividends to be paid to the Government.1 This issue is dealt with by Section 40(2) of the NICT Act, which prohibits government from directing NICTA in its decisions:

Subject to this Act, NICTA is not subject to direction or control by the Minister or any other person in the performance of its functions.

NICTA also needs to have the legal, financial and practical capacity to enforce its determinations and impose penalties if necessary on regulated entities that do not comply. As noted in section 4.3, although NICTA has overseen the declaration of wholesale internet services in PNG, it is not clear that the implications of this are widely acknowledged in the industry or that the form of regulatory oversight is appropriate for addressing high prices.

We recommend a review of the current regulatory objectives and settings be undertaken as a matter of priority. This should include, among other things:

- A ‘regulatory test’ as to whether more intrusive regulation is required. In particular, if the key concern around the wholesale sector is that prices are not reflective of efficient costs, then the current regulatory framework, which concerns whether or not the wholesale services are negatively affecting competition in the retail market,

1 In Australia the ACCC caused controversy recently by ordering Telstra to cut its wholesale fees by almost 10%, despite pressure from the Prime Minister to order otherwise — http://www.smh.com.au/business/accc-overrules-prime-minister-turnbull-to-cut-telstra-phone-internet-prices-20151008-gk4x7m
is unlikely to be effective in driving down costs.

- A regulatory mapping exercise, which for each point in the supply chain identifies the optimal regulatory framework, the existing regulatory framework, and the gap between the two.

- Assessment of the approach to determining efficient costs of services, such as by increasing transparency about what the efficient costs of providing services are, so that industry participants are better able to negotiate competitive and efficient terms of access.

5.2.3 Recommendation 3: review of wholesale arrangements

This recommendation has two parts. The first is gaining an understanding of the underlying market dynamics, and how the wholesale market could best operate so as to meet the longer term objectives identified in section 5.1.

While there can be little doubt that the wholesale market is one of the biggest drivers of high prices, a fundamental question to be resolved is determining whether or not there is scope for competition in wholesale, or whether the interests of customers are better served by a single service provider.

In order to determine the optimal approach, a review of competition in the wholesale market should be conducted which includes a review of infrastructure, scale of the market, the wholesale markets in other countries, and an assessment of what (if anything) is preventing competition in wholesale.

Having determined the optimal market structure in wholesale, it then becomes necessary to determine whether high prices are reflective of monopoly pricing, or whether they themselves are the symptoms of some broader issue (such as an unfair agreement for cable access, for example).

As described in section 4.2, in all likelihood the reality is a combination of the two. To the extent that market dynamics justify more prescriptive regulatory oversight of the sector, some level of pricing oversight, possibly including pricing determinations, may be warranted to protect the interests of customers and support market entry.

For example, NICTA could adopt an approach similar to the Australian Competition and Consumer Commission in regulating wholesale access prices. This would involve the following:

- Once every two or three years NICTA would initiate a review of wholesale access fees. To conduct this review it would require the requisite data from regulated entities and estimate the efficient price to be charged for wholesale access on a cost plus basis.

- The draft review would then be released and comment sought from regulated entities plus other interested parties.

- NICTA would then review feedback and issue its determination on the efficient level of wholesale access price for the coming two to three years.

We recommend that a review of wholesale arrangements be undertaken to consider both the underlying market dynamics and whether they are appropriate for the ongoing development of the sector, as well as the underlying causes of high wholesale prices and possible policy responses. The implementation of pricing determinations as described above should
also be considered.

5.2.4 Recommendation 4: transparency and monitoring of retail prices

As noted earlier in section 3.1, in what is perhaps a reflection of the extent of effective competition in the market, several retail internet providers in PNG do not publish their end user prices. This limits consumers’ ability to ‘shop around’ in deciding on their preferred internet provider, and means there is a significant lack of transparency about what the true costs of retail internet services are (for example, it is very difficult to ascertain the extent to which customers might be subject to access fees, fixed charges, penalty rates, and termination fees).

The ICCC’s price monitoring approach in the PNG petroleum sector provides an example of how such a scheme might work. Every month, the ICCC publishes updates of the key inputs into petroleum prices on its website and in national newspapers. In a similar way, monthly or quarterly internet process of retail providers could be published on a monitoring website, with key information around the terms and conditions of each offer also provided.

Price monitoring can promote competition by comparison among retail internet providers and address information barriers to consumers identifying and comparing alternative offers in the market. It could also assist in establishing whether reductions in wholesale rates are being passed through to retail prices.

We believe there is a strong case to introduce more transparency into retail internet pricing. This could be achieved via regulations on the type of information that providers must include on their websites and in offers to customers, even the introduction of a price monitoring system for PNG internet prices. NICTA would be an appropriate agency to implement the monitoring system. However, there may be benefits from leveraging the experience of the ICCC in applying similar regimes in the petroleum sector in PNG.

5.2.5 Recommendation 5: review the role of government in ICT

The Government has a pervasive role in all aspects of PNG’s internet market — from the purchasing of wholesale internet right through to the delivery of retail internet services.

Essentially, this recommendation involves considering the justification for direct participation in the market — as noted in section 4.4, this largely comes down to a belief that in the absence of government participation there would be insufficient private sector competition.

Reform of SOEs is not a new concept and in fact was noted as a key priority in the 2008 ICT Policy, and has resurfaced in the Government’s White Paper of 2014 on reforming the various SOE sectors. In relation to Telikom PNG, the 2008 ICT Policy noted:

It is critical to the success of the ICT sector in PNG that Telikom PNG is transformed into an efficient company, possibly in collaboration with a private sector partner (in a Public Private Partnership (PPP) type structure), capable of competing on its merits against new and efficient entrants. (pg. 16)

Reform of Telikom (and DataCo), and the introduction of market pressures to those companies, will almost certainly assist in the reduction of internet prices. Importantly, introducing market pressure does not necessarily mean privatisation. Arrangements such as management outsourcing contracts, or even operating as a ‘true’ corporatised SOE could impose some market pressure on the incumbent while still retaining government owner-
ship and control.

We recommend that the Government’s role in ICT be reviewed, with a focus on assessing whether the current settings remain appropriate for delivering the Government’s objectives. This should involve consideration of government participation in the wholesale and retail sectors, as a comprehensive operational and functionality review of the relevant state owned entities.

5.2.6 Recommendation 6: review of infrastructure delivery

Section 1.2 introduced PNG DataCo’s plans for the roll out of its National Transmission Network (NTN). Without discounting the importance of this initiative in addressing not just infrastructure but broader economic issues in PNG, we make a number of observations.

• First, it is clear that the roll out of the NTN is behind schedule; however, the precise reasons for this are unclear.

• Second, to the best of our knowledge there has not been a comprehensive stocktake or comparison of alternative infrastructure solutions.

• Third, although the benefits of infrastructure investment are readily understood by industry players, we consider that a formalised benefits realisation strategy could be useful in ensuring the net benefits to the broader economy of any prospective infrastructure solution are maximised.

Infrastructure investments have often been considered a ‘silver bullet’ when it comes to addressing PNG’s internet service challenges. However, as noted in Chapter 4, it is important that any investments are made with a clear understanding of the trade-offs between costs and improved services. In the context of the NTN, there are a number of alternate delivery pathways, such as the route and timing of network expansions, which could have significantly different implications for future costs and revenue recovery. Further, infrastructure investments in the absence of reform of the underlying wholesale, regulatory and competitiveness issues identified in Chapter 4 are unlikely to maximise the benefits of those investments.

We recommend that a review of infrastructure delivery in ICT be conducted. This review would aim to compare alternative infrastructure investment pathways and ensure a plan is in place to maximise the benefits of such investments looking forward.
This report comes amid a rapidly changing time for the internet sector in PNG. Construction of the NTN is continuing (albeit absent the foreshadowed transfer of assets from Telikom PNG to DataCo), and there has been much commentary in the media about the high prices and inaccessibility of internet services taken for granted in many countries.

Infrastructure investments are one part of the solution, but while service levels are likely to improve with increased investment, it is not always the case that increasing investment will ultimately reduce costs for customers.

Further, infrastructure investment without reform of the other factors identified in this report may do little to improve long term price outcomes, and may even result in higher costs and prices. What is needed is a holistic approach to sustainably lowering internet prices over the long term which recognises the multiple and diverse factors which cause those high prices.

This report has identified three high level strategic objectives which in our view are central to reducing prices (and keeping them low). Those objectives include:

- Reduction of the wholesale rate currently charged by Telikom PNG to ISPs;
- Plugging of the regulatory gaps identified in this report; and
- Reform of the retail market, and in particular the Government’s role in that market.

To guide the achievement of the broader strategic objectives, this report has also identified a number of policy recommendations, including:

- Development of a holistic ICT industry development strategy;
- Strengthening regulatory frameworks and governance, paying particular attention to the regulatory gaps identified;
- Review of wholesale markets and competition, to address the monopoly provision of wholesale internet access;
- Monitoring of retail prices to ensure transparency of retail prices and that cost reductions in the wholesale market are passed through to retail prices;
- Reviewing the role of government in ICT, paying particular attention to reform of State Owned Entities in the ICT sector; and
- Review of infrastructure, considering the costs and benefits of alternative investment pathways as well as ways to maximise the net benefits of any future investment.

The order in which these recommendations will be implemented is a matter for discussion at all levels within the industry. The most important thing is that the recommendations are viewed as a package — reform needs to occur holistically, with a focus at all times on achieving the three high level strategic objectives which in our view will ensure long term price reductions. Implementing only one of the recommendations is unlikely to achieve
the desired effect.

This report should be seen as a first step in addressing what is a complex and deep seated issue. It is important for all players in the industry — be they public or private, retail or wholesale — to come together and work collaboratively to move the industry forward.


Minister for Communications and Information Technology. ‘Wholesale service declaration No.1 of 2013’, 12 March 2013.


NICTA, 2012. ‘Public Inquiry into the need for declaration of certain wholesale services in international connectivity markets’, 4 September 2012.


tech.pngfacts.com/2015/01/png-to-enjoy-enhanced-internet-service.html


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Appendix A: Stakeholders Consulted

Deloitte and the NRI gratefully acknowledge the assistance and the time donated by the following stakeholders who were consulted as part of this review.

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Representative(s)</th>
<th>Title</th>
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<tbody>
<tr>
<td>bmobile</td>
<td>Angin Wape</td>
<td>Regulatory and Compliance Manager</td>
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<tr>
<td>Comtrade Trustees Services Ltd</td>
<td>Derrick Takendu</td>
<td>IT Manager</td>
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<td>Comserv</td>
<td>Lawrence Tang</td>
<td>Assistant General Manager</td>
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<tr>
<td>Datec</td>
<td>Keith Anderson</td>
<td>ISP Manager</td>
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<tr>
<td>Digicel</td>
<td>Gary Cobain</td>
<td>Head of ICT Solutions</td>
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<tr>
<td>Global Technologies</td>
<td>Andrew Edwards</td>
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<td>ICCC</td>
<td>Steven Sugl</td>
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<tr>
<td>Nasfund</td>
<td>Allan Sayers</td>
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<tr>
<td>New Britain Palm Oil</td>
<td>Anthony Price, Emmanuel</td>
<td>Country Manager, PNG; IT Manager</td>
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<td></td>
<td>Bungag</td>
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<td>Phil Braz</td>
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<td>Speedcast</td>
<td>Scott Tipping</td>
<td>Country Manager</td>
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<td>Telikom PNG</td>
<td>James Lani</td>
<td>Manager, Wholesale</td>
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