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Advancing Free Trade
for Asia-Pacific **Prosperity**

Case Study on the Role of Services Trade in Global Value Chains: Telecommunications in Papua New Guinea

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EXECUTIVE SUMMARY

This report examines the effects of the deregulation of Papua New Guinea's mobile telecommunications sector, a process which began in 2007. The Papua New Guinean government's decision in the lead up to 2007 to end the monopoly of state-owned telecommunications provider Telikom resulted in rapid increases in mobile coverage and subscriber numbers, and sharp decreases in costs to consumers.

The improved availability and affordability of mobile phones in Papua New Guinea (PNG) since 2007 has brought significant social and economic changes. Hundreds of thousands of people now have access to telecommunications for the first time, and can keep in touch with friends and family. Health benefits have also followed, as people are better able to access emergency advice and assistance. Farmers and entrepreneurs can now access new economic opportunities and face reduced information costs. Companies now benefit from significantly lower communication costs, helping to spur economic growth and promote integration into global value chains (GVCs).

Alongside these benefits, the advent of widely available mobile phones has also triggered concerns. Some believe that mobile phones could encourage marital infidelity, and consumption of pornography. There is also a common perception that criminal gangs may use mobile phones to coordinate robberies. On balance, however, most agree that access to mobile phones has largely represented a positive development in PNG.

This report examines the social and economic impact of mobile telecommunications deregulation in PNG, considers the effects that reforms have had on PNG's ability to benefit from GVCs, identifies barriers and challenges and provides recommendations. The analysis is supported by quantitative measures, and by interviews with a cross section of mobile telecommunications stakeholders.

Key findings:

- Falling mobile telecommunications costs have driven down total costs for PNG contributors to global value chains (GVCs) by between two and five percent, resulting in an increased ability to supply key inputs such as energy, metals and agricultural goods to competitive global markets
- In 2016, it is estimated that this reduction in costs will boost GDP by between 0.9% and 2.3%
- Companies and other organisations have developed safety and transparency systems accessible by mobile subscribers
- Improved functioning of fresh produce value chains could contribute to PNG's participation in GVCs for processed food products
- Internet access in remote areas has enabled agricultural cooperatives to open new markets for their produce, facilitating sales of time-sensitive fresh goods
- Safety, health and transparency initiatives have all been enabled by access to mobile phones, leading to positive social and economic outcomes

SUMMARY OF POLICY CHANGES – PNG MOBILE TELECOMMUNICATIONS

Up to 2002	2002-2007	2007	2008-2009	2009-present
<ul style="list-style-type: none"> • State-owned Telikom – created by the Telikom PNG Limited Act (1996) - has monopoly rights on network, wholesale and retail services • Mobile network almost non-existent • Handsets, SIM cards, call tariffs prohibitively expensive • Internet-capable services not available 	<ul style="list-style-type: none"> • ICCC and Telikom agree in 2002 to extend monopoly rights for fixed-line services, mobile services, and the international gateway to 2007 • In 2002, Telikom establishes fully-owned subsidiary Pacific Mobile Services to operate the Internet gateway and provide mobile services • Pacific Mobile offers retail mobile services under the brand Be-Mobile • Network still covers just 2% of population • Handsets, SIM cards, call tariffs prohibitively expensive • Three telecommunications policies passed between 2005-2007, leading to uncertainty for investors • Towards the end of this period, ICCC decides to issue two new commercial licences. GreenCom (Indonesia) and Digicel (Ireland) selected 	<ul style="list-style-type: none"> • GreenCom fails to initiate operations, quickly folding • Digicel aggressively establishes its network and added subscribers at a rate of 100,000-150,000 per month • Within 8 months, network coverage has grown from 2% to 10%, and costs have come down by 80% 	<ul style="list-style-type: none"> • Government offers Telikom exclusive rights to operate international gateway • Digicel objects, and is represented by Ireland’s delegation to the WTO. • Reminding the government of conditions of WTO accession helps realign policies towards liberalisation • By the end of 2009, the government’s new ICT Bill favours open competition, allowing the liberalisation, allowing deregulation of key aspects of mobile telephony, including international calling and retail price-setting 	<ul style="list-style-type: none"> • PNG now has three mobile phone operators: Digicel; bmobile-vodafone; and state-owned Citifon • Competition has brought domestic call rates down by 68.1% • Digicel has continued infrastructure upgrades and now claims 90% coverage of the population • 3G – and even some limited 4G – networks are available in major population centres • Bmobile-vodafone offers lower call rates, but cannot match Digicel’s network at this time

1. BACKGROUND: MOBILE TELECOMMUNICATIONS IN PNG

Papua New Guinea (PNG) is a Pacific economy with a population of approximately 7.5 million people. An estimated 85% of people live in rural and remote areas. Low incomes, rugged terrain and limited road and electricity infrastructure have historically constrained communication between different parts of PNG, and for many of the same reasons, fixed line telecommunications have not reached into the more remote regions of PNG.

Against this backdrop – a large, dispersed rural population lacking reliable access to fixed line telecommunications – the advent of mobile telecommunications towards the end of the twentieth century was potentially transformative. However, it was not until the government moved to deregulate the mobile telecommunications sector that such a transformation was enabled.

PNG is not yet a major participant in global value chains (GVCs), except as a supplier of raw materials and resources such as timber, gold and natural gas, and via the export of some processed products, notably crude palm oil. As such, GVC links are relatively simple, consisting of major supply agreements with consumers of these resources, who may then add further value. For example, PNG is currently the top supplier of round logs to China, which is the world's largest manufacturer of processed timber products.

PNG's participation in GVCs is constrained by relatively high costs and a difficult business environment – the economy currently ranks 138th out of 189 economies on the World Bank's Doing Business index. The government promotes foreign investment with some success, particularly in the resources sector, and the attendant technology transfer is driving improvements in some industries. However, reduced transaction costs and red tape, as well as improved infrastructure, would greatly expand the benefits the economy could reap from participation in GVCs.

1.1 PRE-REFORM ERA: LIMITED MOBILE COVERAGE, HIGH COSTS

The pre-2007 period in PNG was marked by limited coverage of mobile telecommunications networks, concentrated in the major urban centres of Port Moresby and Lae. Handsets were expensive, and call tariffs were prohibitively high for the majority of the population. Telecommunications in PNG were provided by the state-owned monopolist Telikom. Initially Telikom was given monopoly rights over all fixed and mobile telecommunications services within PNG and with the rest of the world for the period up to 2002. A regulatory contract was then drawn up between Telikom and the Independent Consumer and Competition Commission (ICCC) that extended Telikom's monopoly rights - for fixed-line services, mobile services, and the international gateway - to 2007.

In 2002 Telikom established Pacific Mobile Communications Ltd (PMC) as a wholly-owned subsidiary to operate the Internet gateway and provide mobile services — the latter under the 'B-mobile' brand name. As a wholly-owned subsidiary of Telikom, B-Mobile was governed by the regulatory contracts on competitive behaviour under the *ICCC Act*. Nevertheless, B-mobile only ever provided limited mobile phone coverage with a poor quality of service even in urban areas (Watson 2011). Prior to 2007, less than 2 percent of the population lived in an area serviced by the mobile phone network (Watson 2011).

Telikom B-Mobile's limited technical capacities resulted in overloaded exchanges. Some of these issues were addressed in the period between 2005 and 2007, however the Independent Consumer and Competition Commission (ICCC) recognised that the mobile telecommunications monopoly was not in the best interests of consumers, and moved to issue two new operator licenses in 2007.¹

The new licenses were granted to Irish-based Digicel - an operator with a track record delivering mobile phone services in developing markets in the Caribbean – and Indonesian operator GreenCom. GreenCom quickly folded, never succeeding in bringing mobile services to market in PNG (Z.Kanu, 2009a and 2009b). By contrast, Digicel quickly and aggressively established and expanded a new network.

1.2 SINCE 2007: FALLING COSTS, RAPID UPTAKE

The PNG mobile phone market has been transformed by the liberalisation and deregulation driven by the national government that resulted in the entry of Irish operator Digicel. PNG now has over 3 million mobile telephone subscribers out of a population of 7.5 million. This is more than 21 times the rate of penetration that has been achieved by fixed-line telephony over a far longer time period (ITU 2013 & The Economist 2015). This has resulted in a far greater number of people having access to telecommunication services – such as voice calling and short message service (SMS) – and also to email and internet services. Digicel has used its mobile phone platform to market a variety of innovative services — for example, mobile banking and payment services and market information services — to individual households and businesses across PNG (ADB 2013).

Within 8 months of the Digicel's launch, mobile phone network coverage had grown from 2 percent to 10 percent of the population, handsets were one third cheaper and the cost of a SIM card had decreased by 80 percent (Watson 2011). The number of people with mobile phones grew from 100,000 to one million during the period 2006 to 2008, and the contribution of mobile telephony to GDP increased from 0.7% in 2007 to 2.5% just one year later (Watson 2011).

In remote parts of PNG, Digicel's arrival was seen as a public good, addressing the failures of state-owned Telikom PNG to provide either adequate fixed line or mobile services. The first years following 2007 brought some challenges for mobile telephony in PNG, including technical issues that resulted in poor compatibility between Digicel's mobile network and Telikom's fixed line and B-Mobile networks. During the same period, there were a series of legislative moves and resulting court cases; for example, the government's 2008 decision to grant Telikom exclusive rights to offer international calling services, and Digicel's subsequent legal challenges to this decision (Watson 2011). However, by the end of 2009, the government had adopted a new ICT Bill which promoted competition and allowed the liberalisation and deregulation of key aspects of mobile telephony, including international calling and retail price-setting. See the Summary of Policy Changes table on page 1 for details.

Digicel was successful in dealing with this policy uncertainty and its adverse implications for their PNG business. As the company is incorporated in Ireland, it was able to enlist the help of the Irish Government in government-to-government dialogue with the PNG Government on the issue. In doing so there is evidence that Digicel was able to rely on PNG's commitments on the liberalisation of its telecommunications services in the World Trade Organisation. Local

¹ Watson (2011)

businesses also put pressure on the PNG Government, including through the Port Moresby Chamber of Commerce and Industry (Duncan 2011 & Watson 2011).

Eight years on, Digicel has become the dominant mobile phone operator in PNG, the incumbent operator has structurally adjusted to the liberalisation of the market, and in-market competition has increased with the addition of a new operator.

PNG now has three mobile phone operators. In 2013 the PNG Government acquired 85 per cent of the shares in B-mobile – after having sold 50% of the operator in 2008 to a consortium of investors - as part of its plan to recapitalise the state-owned operator. After its recapitalisation, B-mobile signed a partnership agreement with Vodafone Group plc and relaunched its services in PNG and the Solomon Islands under the bmobile-vodafone brand (Vodafone 2014). In the meantime, Telikom PNG established its own 3G network, which currently services the major population centres of PNG under the Citifon brand.

Digicel has continued with technology upgrades to improve the quality of its mobile phone service. Upgrades have included the introduction of a 3G network overlay in key urban centres (ADB 2013).² This was the first high-speed mobile broadband service in PNG and has made possible a higher degree of connectivity and networking.

² Since 2014, Digicel has also added 4G coverage in some areas. See <http://www.businessadvantagepng.com/digicel-plans-expansion-mobile-network-creating-television-network/> (accessed 20/6/2016)

2. NEW OPPORTUNITIES ENABLED BY MOBILE PHONES

It is estimated that as of 2015 there were 3 million mobile phone subscribers in PNG. Mobile networks cover the vast majority of population centres. Digicel – with the support of the World Bank³ – now boasts coverage of 90% of the population, and is targeting 100% coverage in the coming years.⁴ However, coverage varies, with 3G (and even some limited 4G) networks in major population centres, and basic coverage in more remote locations. As a result, some functionality – including internet access – is not available in all locations.

Partly due to this uneven coverage, many mobile phone services currently offered in PNG rely on SMS and voice call functionality, rather than data-intensive internet applications. Unstructured Supplementary Service Data (USSD) tools (which use the telephone's keypad to trigger computer code in order to access information systems) can be used by both new smart phones and older-generation non-internet enabled handsets over 2G networks. Digicel users can use USSD for self-service account balance enquiries and purchase of data packages, and third parties also use USSD to provide information services such as internal company reporting of safety risks, which will be presented in the case study in Chapter 4.

Consumers and businesses in PNG can now access a wide range of services that were previously (before 2007) unavailable, or available only to a limited number of people in certain population centres. These services include the following:

1. General mobile telephony services, i.e. voice calling, short message service (SMS);
2. Information systems, such as market information systems (MIS) and reporting tools; and
3. Mobile financial services, such as mobile money, and mobile banking.

This section will examine each of these three categories, considering the degree to which they have created new opportunities for businesses, entrepreneurs and consumers.

2.1 GENERAL MOBILE TELEPHONY: A MAJOR ADVANCE FOR REMOTE COMMUNITIES

The advent – in the years following 2007 - of widely available mobile telecommunications in PNG represented a significant step forward for many Papua New Guineans. Perhaps more so than in many other economies, given that according to the World Bank, PNG still has just two landline connections for every 100 people.⁵ Before 2007, it was common practice for many in remote areas to travel to larger towns in order to make use of (expensive and frequently out of service) public fixed-line phones; mobile phones allowed them to make calls from their own villages, and to be reached themselves.

³ See <http://www.worldbank.org/en/news/feature/2015/09/29/connecting-the-unconnected-in-papua-new-guinea>

⁴ <http://www.businessadvantagepng.com/digicel-plans-expansion-mobile-network-creating-television-network/>

⁵ <http://data.worldbank.org/indicator/IT.MLT.MAIN.P2>

Uptake of mobile phones in PNG has been rapid and enthusiastic; however not without creating some misgivings. These misgivings have largely fallen into two categories: socio-cultural concerns (such as a fear that mobile phone use will increase infidelity and facilitate crime); and cost concerns (related to both the initial cost of buying a handset, and the ongoing cost of credit).⁶ Research undertaken by Dr Amanda Watson and others indicates that as mobile phone use becomes more normalised – and as the benefits of mobile phone use are more widely recognised - social stigmas may be reducing. Conversely, concerns related to the cost of mobile phone use may be on the increase.⁷

These misgivings notwithstanding, it is difficult to overstate the social and economic impact of access to basic mobile telephony. When surveyed by Dr Watson, many inhabitants of remote areas of PNG singled out their new ability to communicate with distant friends and relatives as the key benefit of access to a mobile phone (Watson 2011).

Some other functions that have been facilitated by mobile phones include:

- Emergency response: for example, the tsunami alert system that was evaluated positively in the *Australian Journal of Emergency Management* in October 2012;⁸
- Anti-corruption initiatives: for example, “Phones Against Corruption”, an SMS-based anonymous whistle-blower service launched by UNDP and the PNG Department of Finance in 2015, which has already resulted in the arrest of at least two government officials suspected of mismanaging millions of Kina in public funds;⁹ and
- Health programs: for example, the Maternal Health Phone Line established in Milne Bay province, which enabled health workers to address life-threatening child-birth emergencies remotely.¹⁰

Although it is difficult to quantify the impact of the advent of wide-spread mobile phone access, it is evident that the technology has brought significant benefits, particularly to those living outside main population centres.

⁶ For a complete exploration of these issues, see Watson (2011)

⁷ For example until November 2015, Digicel customers could purchase a bundle of 50 SMS for K0.5. In November 2015, the bundle offered changed to 60 SMS for K1.20, effectively doubling the per-SMS cost. Concerns about costs are perhaps to be expected, as mobile services providers transition their pricing strategies away from aggressive efforts to capture market share, and towards the ongoing servicing of an existing client base. However some have expressed concern that the market power of Digicel – in particular – in remote areas of the economy borders on an effective monopoly. The growing reach of competitors BeMobile-Vodafone and potentially Citifon should go some way to addressing these concerns.

⁸ Watson (2012)

⁹ See http://www.pg.undp.org/content/papua_new_guinea/en/home/presscenter/pressreleases/2015/04/10/new-corruption-cases-uncovered-with-phones-against-corruption-initiative.html

¹⁰ See Watson *et al* (2015)

Box 1: PNG innovators develop free messaging technique

It is clear that Papua New Guineans are constantly finding new and innovative ways to benefit from mobile connectivity. For example, many have discovered that they can send coded messages at no charge, through creative use of a Digicel service that is intended to allow users to request mobile credit from their friends and family.

The service – known as CreditMe – allows users to send a free *pro-forma* message to a friend's number, asking for the respondent to transfer credit to the sender's account. The sender can request any amount from K1 to K100. The creative use of this service is to use the amount requested as a code for a commonly understood meaning, with no expectation of the receiver actually transferring credit to the sender.

For example, in the evening, many users send CreditMe requests for K99 to all of their friends and families. The commonly understood coded meaning of "99" is that when read aloud it sounds like "nighty-night". Users can therefore say goodnight to friends without paying for an SMS (even if they have run out of mobile credit). Another example is "26" (pronounced "two-six") which translates as "too sexy". Groups of family and friends have developed long lists of common phrases that are understood to be represented by Kina amounts sent as CreditMe requests.¹¹

2.2 MOBILE-PHONE BASED INFORMATION SYSTEMS

Mobile services providers such as Digicel, as well as other entities, offer a variety of information systems accessible via the mobile network. One of the most commonly used systems is run by Digicel, and allows users to check their credit balance, buy data packs and take up special offers. This information system is activated by using Unstructured Supplementary Service Data (USSD) code. USSD codes are specific phone numbers that users enter to communicate with a service provider's computer systems. The main benefit of using USSD code rather than an internet-based app in a market such as PNG is that it enables information systems to operate over GSM or 2G networks, and using non-internet enabled handsets.

Another entity that has made use of USSD systems is Joint Venture Stevedoring (JVS), a subsidiary of PNG conglomerate Steamships Trading Company. JVS has established a USSD-based reporting system with which employees can anonymously report breaches of safety standards. The company estimates that this system has resulted in a significant reduction in safety incidents in its operations. See the case study in Chapter 4 for more information.

Other information systems are SMS-based, allowing users to send a request for specific information that is transmitted via an SMS response. An example of this functionality is the Market Information System (MIS) that is provided by the Fresh Produce Development Agency (FPDA) in conjunction with Digicel. The FPDA MIS will be examined in more detail in the case study in Chapter 3.

¹¹ For an exhaustive exploration of commonly used codes and abbreviations in SMS communication in PNG, see Temple (2009)

2.3 MOBILE FINANCIAL SERVICES

Mobile financial services have the potential to bring significant economic benefits to many in PNG. As recently as 2013, 80 percent of the population was estimated to be “unbanked”, lacking access to financial services.¹² As a result, people’s capacity to save for the future, borrow to expand business activities and invest in education is severely limited.

Financial services delivered via mobile phone, rather than bricks and mortar branches, have significant advantages in the PNG context. The PNG’s terrain, the fact that 85% live in rural locations and the low participation in the formal workforce have all constrained the ability of traditional banks to reach customers. As a result, all of the major banks operating in PNG have developed some kind of mobile banking service, most using Digicel’s platform. In addition, the Asian Development Bank and Australian Aid conducted an 8-year project up to 2010, which targeted low-income women’s access to mobile banking services.¹³

Services offered include the ability to check account balances online and transfer funds to other accounts. However, subscribers must still visit a physical branch in order to make deposits.

As well as the mobile services offered by the banks, Digicel itself has launched a “mobile wallet” service called Cellmoni. With money in their Cellmoni mobile wallet, subscribers can buy mobile credit, send credit to friends, transfer funds to other Digicel users, and pay bills. They can also deposit funds in their Cellmoni account, and withdraw them when needed. As is the case with the mobile services offered by the banks, subscribers must visit a Digicel agent in order to deposit or withdraw funds from their Cellmoni account.

In other developing economies, mobile financial services have been taken up rapidly by unbanked populations. In Kenya, between 2007 and 2010, 40% of the adult population – 9 million users - adopted the MPESA mobile wallet system.¹⁴ Digicel doubtless hoped that these services would witness similarly rapid uptake in PNG. However, since its launch in 2011, Cellmoni has only attracted approximately 180,000 subscribers, or 2.5% of the population.¹⁵

That quick uptake has not eventuated may reflect reluctance on the part of some to exchange cash for intangible digital credit, and perhaps the fact that some subscribers cannot easily access a Digicel agent to deposit and withdraw funds.¹⁶ It is possible that this will change. One promising feature of Cellmoni is the ability to deposit cash before a journey, and withdraw it at the other end. Robbery along travelling routes in PNG is notoriously common, so the ability of travellers to safeguard their funds in this way would seem well-suited to the PNG context.

The most enthusiastic users of Cellmoni and equivalent services to date have been large companies and organisations that need to make payments (of royalties, salaries etc.) to large numbers of people. For example, New Britain Palm Oil Limited (NBPOL) reportedly makes regular payments to thousands of smallholder farmers and plantation workers. The company reportedly now uses Cellmoni to make these payments in a secure way, and to facilitate their

¹² See <http://www.pfip.org/media-centre/in-news/2013-1/80-of-png-unbanked-post-courier-png.html> (accessed 21/6/2016)

¹³ See <http://www.adb.org/results/banking-unbanked-papua-new-guinea> (accessed 21/6/2016)

¹⁴ http://siteresources.worldbank.org/AFRICAEXT/Resources/258643-1271798012256/M-PESA_Kenya.pdf

¹⁵ Based on interview with Digicel’s Director of Government Relations, Gary Seddon

¹⁶ Many users buy phone credit in the form of prepaid scratch-off cards, which can be bought, transported and resold by anyone. As a result, some subscribers may very seldom – if ever – enter the shop of a licensed Digicel agent.

record-keeping. In this way, mobile financial services have simplified complex financial transactions for export-oriented companies and their supply chains, adding value to agricultural exports.

Box 2: Mobile money transfer helps deliver emergency medical services

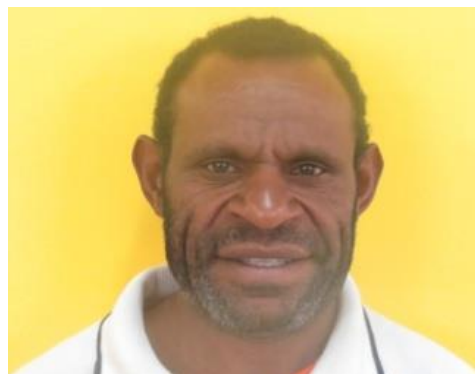
Gary Seddon – Digicel’s Director of Government Relations – presents another example of the impact of mobile money services. Mr Seddon accompanied a local political leader out to the remote island of Dyaul in New Ireland Province, in order to visit a recently opened Digicel tower that was providing mobile coverage to the island for the first time. On approaching the island by dinghy and coming within range of the new tower, the politician received an SMS advising that his uncle had fallen ill, and had been taken to the private hospital in the provincial capital of Kavieng. However, the hospital was refusing to admit him until pre-payment was made for his treatment.

Before even docking on Dyaul, the politician was able to use his Cellmoni account to transfer the required amount directly to the hospital, allowing his uncle to be immediately admitted and treated. He commented that just a few weeks before he would have been unable to help his uncle. Rather than sending him an SMS, at the very least a family member would have had to follow him out to Dyaul by boat, find him, and then transport cash back to Kavieng. The delay that was avoided thanks to mobile telecommunications and banking may well have saved his uncle’s life.

3. CASE STUDY – NEW OPPORTUNITIES AND REDUCED LOSSES FOR FARMERS, TRADERS AND PROCESSORS



Iga Anamo, Market Information Officer
FPDA (picture supplied)



Wayne Gorowe, Manager, Ambo
Fresh Produce, Eastern Highlands
province PNG (picture supplied)

Aim

To investigate the impact of the advent of widely available mobile telecommunications on the fresh produce industry.

Background

Fresh produce farming – at a subsistence, semi-subsistence and commercial level – provides livelihoods for an estimated 80% of Papua New Guineans.¹⁷ Much of this activity takes place in remote regions of PNG that have traditionally been poorly served by transport and telecommunications infrastructure.

Methodology

We conducted a series of interviews with Iga Anamo, Market Information Officer working for the PNG Fresh Produce Development Agency (FPDA)¹⁸, and with Wayne Gorowe, a farmer, processor and trader of fresh produce.

In addition, Charlotte Kakebeeke, Programme Director and David Shields, Livelihoods Programme Manager at Oxfam PNG as well as Topyy Sundu, Director of the Independent Reform and Restoration Movement (IRRM) provided detailed observations from outreach livelihoods projects conducted with farmers of fresh produce in the Highlands region.

These interviews were contextualised with desk research.

¹⁷ Bourke and Harwood (2009)

¹⁸ The FPDA is a national government agency tasked with promoting and improving the abilities of producers and processors of fruit and vegetables in PNG. The agency is headquartered in Goroka, Eastern Highlands province, with satellite locations in Mt Hagen (Western Highlands province), Lae (Morobe province) and Kokopo (East New Britain province)

Findings

- Most farmers, traders and processors of fresh produce in the Highlands region of PNG now have access to mobile phones.
- SMS is the most commonly used means of mobile communication, due to value and ability to transmit in areas with intermittent network coverage.
- Mobile phones have greatly simplified the organisation of road transport and coastal shipping for farmers and traders.
- Delays and supply chain bottlenecks have been reduced, with an attendant reduction in waste and spoilage of commodities.
- FPDA's Market Information Service (offered in cooperation with Digicel) has been taken up by very few farmers. Most believe that the service is too expensive, and that information is frequently out of date.
- Mobile telecommunications have helped increase returns to farmers. One trader estimates that his revenue has increased by 30% as a result.
- Some farmers have begun using internet-enabled smart phones to access social media in order to market their produce.
- Although mobile network coverage along major fresh produce trading routes (especially the Highlands Highway) is generally good, there are some black spots that remain.
- Mobile phone costs – especially those of dominant player Digicel – are perceived to have increased in recent years. Some users feel trapped, and would welcome more competition in the sector.
- PNG fresh produce is overwhelmingly sold for immediate consumption. However, recent research carried out by the National Agricultural Research Institute and the Australian Centre for International Agricultural Research (ACIAR)¹⁹ is examining the viability of a food processing industry in PNG. If successful, this initiative could result in greater connectivity between PNG and global food value chains.
- The ability to recharge handset batteries is a concern for many rural users who lack access to electricity.

¹⁹ See for example <http://aciar.gov.au/project/ase/2012/046> (accessed 28/6/2016)

3.1 SUPPLY CHAIN COMPLEXITIES MITIGATED BY MOBILE TELECOMMUNICATIONS²⁰



Farm Challenges:

- Excess/unpredictable production
- Lack of storage
- Difficulty planning/buying inputs
- Difficulty coordinating with other growers



Transport Challenges:

- Unpredictable timetable
- Security concerns/breakdowns
- Contingency planning (in the event of no-shows/breakdowns)



Port/shipping Challenges:

- Coordination with buyers
- Vessel scheduling, container availability
- Storage/refrigeration



²⁰ Photo credits: Tomatoes – “DSCN1136”, © 2013 cuifen.pui, Flickr | CC-BY | via Wylio; Truck - "Old truck", © 2011 Helena, Flickr | CC-BY | via Wylio; Port - "Port", © 2005 Eduardo Marquetti, Flickr | CC-BY-SA | via Wylio; Supermarket - "Supermarket", © 2007 ricardo, Flickr | CC-BY | via Wylio

3.2 IMPACT OF MOBILE TELECOMMUNICATIONS DEREGULATION

A high percentage of PNG's rural community (which makes up 85% of the total population²¹) is engaged in fresh produce cultivation at some level. 75% of the population relies on subsistence agriculture.²² Many subsistence farmers also grow cash crops to generate income. Key crops include sweet potato, banana, sago, taro, Chinese taro, yams and cassava.²³

The sector is characterised by high transport and storage costs and logistical complexities. Ms Anamo noted that most farmers and traders in the region around Goroka transport their produce to market in the major coastal port of Lae – approximately a six-hour trip – but that there is a complete lack of refrigerated road transport available. As a result, spoilage rates are high, and farmers and traders are obliged to travel in the cool of night, despite safety and security concerns. Chang *et al*²⁴ outline the difficulties faced by Highlands suppliers of fresh produce to the major markets of Port Moresby:

Vegetables that are considered hardier, such as onion, carrot, potato, sweet potato, English cabbage and avocado, were taken down to Lae via the Highlands Highway, either in 20-foot containers, 3-6 tonne open-back trucks, or in public motor vehicles (PMVs). Road transport of fresh produce from the Highlands to Lae requires 2-3 days, depending on what form of transport is used. They were then transferred to shipping containers and moved to Port Moresby by sea. At the time of writing, the average cargo dwell time in Lae port was 3.67 days. There is no indicator specifically for fresh produce although shipping company interviewees claimed it was about 2-3 days. Growers claimed there was considerable variation in this time. From Lae to Port Moresby, the ship must first go south-east, around Milne Bay, then travel north-west along the south coast towards Port Moresby, taking a further 48-52 hours steaming time to Port Moresby, with some variation due to weather or other factors... The whole journey from the Highlands to Port Moresby usually takes 7-10 days (Bonney et al. 2012).

More perishable and higher-value vegetables, such as tomato, broccoli, cauliflower, capsicum, spring onion, French bean, sugar fruit, wombok and lettuce, are in most cases flown directly from the Highlands to Port Moresby on regular passenger flights. The flight takes about an hour. In some cases, they are shipped by road to Lae (without refrigeration) and then in chiller containers from Lae to Port Moresby by sea. Mixed container loads of vegetables are problematic for postharvest quality because of a lack of understanding of differential ethylene production by different vegetables and fruit, as well as inadequate packaging and rough loading into containers (Bonney et al. 2012).

Against the backdrop of this complex logistics network and limited key transport infrastructure – and considering the perishability of fresh produce - timing and coordination between different actors in the fresh produce supply chain are crucial. If farmers, traders and processors seek positive returns from fresh produce, they must either pay the high price of air transport, or rely on a highly coordinated value chain.

The ability to plan, organise and trouble-shoot with different actors in the value chain was singled out as a key benefit of mobile phone ownership. Mr Gorowe – who regularly buys and transports fresh produce from Goroka to Lae, relying on third-party transporters (Public Motor

²¹ See http://www.pg.undp.org/content/papua_new_guinea/en/home/countryinfo.html (accessed 14/6/2016)

²² See http://www.pg.undp.org/content/papua_new_guinea/en/home/countryinfo.html (accessed 14/6/2016)

²³ See https://crawford.anu.edu.au/rmap/pdf/seminars/seminar_paper_669.pdf (accessed 14/6/2016)

²⁴ Chang *et al* (2015)

Vehicles (PMVs); typically, mini-buses or flatbed trucks operated by owner-drivers) – repeatedly made the point that now that mobile phone use is ubiquitous, he has been able to significantly reduce delays and find back-up transporters and buyers when necessary. Communication by SMS is particularly popular, due to its low cost and suitability to geographical areas with patchy network coverage.

Although most mobile phone users in rural parts of PNG still rely for the most part on base-level mobile services (voice calls and SMS), internet-based communication is being taken up by some. This is particularly true among those with higher disposable income (as smartphones are more expensive than basic handsets) in areas where 2G and 3G network coverage is common.

An example of the potential benefits of internet access for fresh produce farmers and traders in PNG was provided by Topyy Sundu, programme coordinator of the agricultural collective Individual Reform and Restoration Movement in Chimbu province. In July 2015, Mr Sundu posted an appeal on Facebook, stating that the farmers had produced six tonnes of onions, but were struggling to find a buyer. A journalist saw the appeal and filed an article in major daily newspaper *The National*, which included Mr Sundu's phone number. The story was read by a buyer in Alotau (Milne Bay province) who made contact and bought the entire shipment. This resulted in income of K11,000 for the farmers, for a consignment that may well have rotted in the absence of mobile telecommunications. See Box 3 for Topyy's story.

Remaining challenges

The challenge most often brought up in conversations about mobile telecommunications in PNG is that of costs. After initial enthusiasm regarding the affordability of mobile telecommunications post-2007, many users now believe that costs are rising.

The advent of Digicel in 2007 led to rapid cost decreases. According to details provided by Gary Seddon – Digicel's head of government affairs – before Digicel's entry, handsets were very hard to come by, and cost as much as K2000 (approximately USD700) each, with SIM cards costing K200-K300 (USD70-105). Calls were charged at a rate of K1 per minute, in 30-second increments with a minimum of three minutes. On entry, Digicel offered handsets including a SIM card for K70 (USD24.50), and initially offered two handsets for the price of one. Call tariffs were charged by the second, with no minimum, and subscribers could buy a bundle of 50 SMS for K0.50. In the early months, these offers drove growth in subscriber numbers of 100,000-150,000 per month. See Chapter 5 for detailed analysis of mobile telecommunications costs.

These gateway costs (handset and SIM card purchase) are still relatively affordable, and rates for domestic calls are also judged to be reasonable – in fact, as presented in Chapter 5, real call costs have continued to fall since 2007. However, many users complain that the per-SMS price of the popular SMS bundle has recently doubled (from 50 SMS for K0.50 to 60 SMS for K1.20). In addition, many internet users complain that the complexity of Digicel’s data plans – which when exhausted revert to a higher per-kilobyte rate - lead many to unexpectedly exhaust their credit.²⁵

Consumer sentiment towards Digicel fluctuates between strongly positive and sharply critical. The initial honeymoon period – during which the unprecedented access to mobile telecommunications was broadly viewed as a powerful social good - appears to have ended, and some users feel that Digicel is beginning to behave like a monopolist, particularly in remote areas of PNG where the bmobile-vodafone network has not yet reached. Interestingly, a closer look at the evolution of pricing shows that in real terms, mobile phone call costs continue to fall (see Chapter 5).

Another problem singled out by many rural mobile phone users is the ability to recharge handset batteries, as many locations lack a reliable electricity supply. Digicel has begun to address this issue, with the assistance of the International Finance Corporation (IFC),²⁶ by installing solar charging stations in locations throughout PNG, initially targeting 500 sites across PNG. However, in an economy where according to the World Bank in 2012 just 18.1% of the population had access to electricity²⁷, recharging batteries remains a concern for many users.

²⁵ See, for example, Kramer, Bryan, <http://www.pngblogs.com/2015/10/is-digicel-ripping-off-its-customers.html> (accessed 15/6/2016)

²⁶ See <http://ifcext.ifc.org/ifcext/spiwebsite1.nsf/a24f910d8d23aa078525753d00658ca8/1fa80e0c1ce7a16285257b63006cfff?OpenDocument> (accessed 15/6/2016)

²⁷ See <http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS> (accessed 15/6/2016)

Box 3: Onions and Facebook – new sales channels for PNG farmers



Topy Sundu – IRRM Program Manager (photo credit John Paul Sundu)

Topy Sundu is the Program Manager for the community organisation Independent Reform and Restoration Movement (IRRM) based in Womkama Village, Chimbu province. He coordinates the production and sale of onions from 130 farmer families in his village. With support from Oxfam for training and marketing, over two years the farmer group produced 69 tonnes of onions and sold them for PGK187,000. This increased their semi-subsistence village incomes by up to 400% from before they started growing onions. Topy says that mobile phones and the internet have helped these village-based farmers sell to markets all around PNG. He is able to contact buyers, arrange transport and coordinate their business activities all from his village on a mountain ridge in the shadow of Mt. Wilhelm, PNG's highest peak. It is one hour's drive on a rough dirt road to the nearest town, Kundiawa, and the larger markets are even further away, with Goroka four hours' drive away and Lae, PNG's biggest port and trading hub, at least a ten-hour drive.

The internet is increasingly becoming a powerful marketing tool for IRRM. Topy can share information about their produce via Facebook, and communicate with a much wider audience than before. This is connecting them to the rest of the economy, and sharing their success with the world. In 2015, Topy posted from his Facebook page about the challenges of selling onions from rural locations, where he currently had 6 tonnes of onions ready for market but with no buyer. This post was picked up by a national newspaper journalist, who contacted Topy and interviewed him. In the story the journalist included Topy's mobile number. Within a week, a buyer had called him and purchased the 6 tonnes at a good price, sending the onions to Alotau, all the way across PNG. Not a big deal for national transporters and businesses, but for a small farming group, it was eye-opening to the potential of mobile phones and the internet to sell their produce. Oxfam is now helping IRRM to set up an IRRM business page, and use it as a marketing tool to increase information about their produce by buyers across PNG.

Under the HARVEST program, funded by Oxfam New Zealand and the New Zealand Aid Programme, Oxfam will support 4 community groups and 2 businesses to use mobile phones and the internet to improve information sharing for agricultural extension work, as well as increasing marketing and sales. Along with agricultural training and financial literacy skills, the program aims to help over 2000 rural farming families in the PNG Highlands to use this new technology to build their rural businesses, increase their incomes and improve the lives for their families.²⁸

²⁸ Story by David Shields – Oxfam PNG Livelihoods Programme Manager; Topy Sundu IRRM Program Manager.

4. CASE STUDY –SAFETY AND WORKFORCE MANAGEMENT IN THE TRANSPORT AND STORAGE SECTOR

Aim

To investigate the impact of mobile telecommunications deregulation on the transport, storage and stevedoring sector in PNG.

Background

Steamships Trading Company – the parent company of both East-West Transport and Joint Ventures Stevedoring (JVS) – is a diversified company that has been present in PNG since 1924. Steamships is now part of Hong Kong, China-based Swire Group. East-West Transport is a major player in PNG's road transport sector, and JVS has stevedoring operations at seven major ports around PNG.

Methodology

Interviews were conducted with Gordon McMasters, General Manager East-West Transport and Joint Ventures Stevedoring for Steamships Trading Company, and David Toua, General Manager Corporate Affairs for Steamships Trading Company.

These interviews were contextualised with desk research.

Findings

- Mobile phone availability has greatly increased the ability of Joint Venture Stevedoring (JVS, a Steamships Group company that partners with local landowner companies to run stevedoring operations at ports throughout PNG) to organise its casual workforce of 300-500 people in Lae.
- Coca-Cola and Laga (a grocery wholesale business that is part of the Steamships group) saw a drop of as much as 30% in sales of soft drinks and ice creams when Digicel entered the market. This is thought to be due to consumers choosing to buy prepaid flex cards over soft drinks and ice creams.
- The spread of mobile phone use partly led to East-West Transport withdrawing from the highlands highway route. It was suspected (but not proven) that some drivers and raskols (bandits) were communicating regarding cargo being carried, and the best location for a hijack.
- All permanent East-West and JVS staff now have company phones. The company pays their credit, and they are authorised to top up each other's credit when necessary.
- Coverage is generally good in Steamships' operational areas, there are few black spots.
- Charging phones is an issue in many settlements/villages. Solar systems are beginning to be deployed to address this.
- JVS's USSD-based safety incident reporting system has been a success.

IMPACT OF MOBILE TELECOMMUNICATIONS DEREGULATION

Mr McMasters outlined several key ways that the deregulation of mobile telecommunications services – and the attendant falling costs and increasing coverage – has simplified business, reduced costs and increased revenues for East-West Transport and Joint Venture Stevedoring (JVS) in PNG. These benefits include an increased ability to manage large workforces; reduced communication costs; and innovative ways to improve worker safety in stevedoring operations.

Mr McMasters cited the example of JVS' stevedoring operation in Lae, PNG's busiest port. The Lae operation involves a casual workforce of 300-500 workers, who are drawn from a community that lives on the opposite bank of the Markham River from the port. JVS' agreement with the landowner company that acts as a joint venture partner includes commitments to providing employment and training for the local community. In practice, this means that shifts must be shared out equitably, leading to relatively complex human resources management.

Before the widespread adoption of mobile phones, communicating the work roster was a complex business, involving asking workers who were travelling back to the village at the end of each work day to advise others that they had a shift the following day. This complexity led to increased demands on the time of some workers (who had to carry messages) and sometimes shortfalls in the number of workers required for any given day.

In recent years, labour force management has been greatly simplified, thanks to the availability of mobile phones. All permanent employees are issued a mobile phone by the company, which also covers the cost of credit. Many casual workers also have phones, and managers are now able to call key contact people to circulate rostering information, rather than needing someone to travel across the river with the message.

Another example of the positive impact of mobile telecommunications that was cited by Mr McMasters was a safety initiative launched by Joint-Venture Stevedoring in cooperation with Digicel. Worker safety is a major concern for JVS' stevedoring operations – as is the case on most wharves around the world. Stevedoring is an inherently risky activity, and the company works hard to maintain a culture of safety and risk minimisation. Around 2013, JVS Ports and Terminals Manager Neil Papenfus approached Digicel's Director of Government Affairs Gary Seddon with an idea for a mobile phone-based safety incident reporting system.

Based on Mr Papenfus' directions, Digicel produced a USSD tool that anyone can use to anonymously report a safety incident, or situation of concern. Users key in the dedicated phone number, and then use drop-down menus to report the kind of incident and the location. The message is then automatically forwarded as an email to a company safety officer, who contacts the relevant Port Manager to trigger an investigation.

The system is part of a broader safety push within the company, so it is difficult to isolate its specific effects. However, Mr Papenfus is confident that it has helped improve safety outcomes. He cites the example of one late-night message that alerted safety officers of a port worker under the influence of alcohol. An investigation was immediately launched, and the worker dismissed.

Mr Papenfus believes that in the absence of the USSD system, no one would have reported the incident for fear of reprisals. The anonymous reporting system removed an intoxicated worker from the dangerous environment of the wharf, avoiding a likely accident.

JVS' incident reporting system has been presented at international stevedoring conferences, and port managers from a number of international companies have showed interest in replicating it.

Remaining challenges

JVS and East-West Transport rate mobile coverage in their areas of operation as good. Mr McMasters noted that there were few problematic black spots. However, as more and more smart phones are taken up, and more and more staff members rely on email communication in the field, areas without 3G data networks are becoming problematic for some users.

The other challenge raised by the company respondents was the lack of electricity supply for charging handsets in remote communities. As was the case with the fresh produce value chain participants, the solar base station project being rolled out by Digicel with the support of the IFC was commended, but it was noted that there remained many parts of the economy where access to electricity was severely constrained.

5. EFFECTS OF LIBERALISATION: MORE ACCESS, LOWER COSTS

Taken together, the research and interviews highlight that the liberalisation of mobile phone services in PNG in 2007 has had the following impacts:

- Lower prices charged to PNG households and businesses for telecommunications services both within PNG and between PNG and the rest of the world, resulting in estimated total cost reductions of between 2 and 5 percent for export-oriented industries, and as much as a 2.3% increase in GDP;²⁹
- Increased accessibility for PNG households and businesses to the telecommunications services delivered within PNG, particularly in rural and remote areas ; and
- The opportunity to introduce new services for PNG households and business delivered over mobile telephony platforms.

The price and service quality impacts of mobile phone liberalisation can be expected to have had positive impacts on the PNG economy, as a whole. Liberalisation has facilitated improved access to Global Value Chains (GVCs) for businesses and households based in PNG, both as importers and exporters of goods and services at the primary, intermediate and final stages of production. Liberalisation has also reduced the transaction costs that all PNG businesses and households face in participating in such GVCs.

Other things being equal, the relatively small and underdeveloped nature of the PNG economy means that the industries that are most exposed to international trade are likely to have benefited the most from mobile telecommunications liberalisation. These benefits are likely to have increased the degree to which these industries can participate in GVCs, as –for example – exporters of logs for further processing have been able to reduce costs and profitably export from marginal forestry concessions that had been uneconomic in the past.

²⁹ See Section 5.2 for details regarding how the total industry cost and impact on GDP estimates were calculated.

Box 4: Data constraints

Establishing the precise extent of the economic impact of mobile phone liberalisation in PNG for the economy as a whole, and for individual industries or sectors within it, is challenging. The key problem is a lack of suitable data. Much of the data that such exercises require are either not collected for PNG or when they are collected the results are not necessarily made available to the public.

For example, the PNG national accounts are prepared by the PNG Treasury and published as part of the Government's annual budget. The published PNG Treasury estimates of the value-added by industry grouping are so highly aggregated that they do not permit the identification of the GDP contribution of the telecommunications industry as a whole, let alone its mobile phone operators.

Moreover, the Government has yet to publish an Input-Output or Supply Use Table for the PNG economy. Such tables play a critical role in national accounting as they provide a snapshot of the value of the goods and services that each industry group buys from and sells to every other. Depending on their level of industry disaggregation, these tables can specify the value of the telecommunications services that every other industry group uses as an intermediate input in its own production.

For the purposes of this report, we have addressed these constraints by referring to the PNG GDP data that is available and data on industry structure and value adding published by other economies such as Fiji and Cambodia. Doing so has allowed us in Section 5.2 to infer the likely impacts of mobile telecommunications policy reform on the total costs of major export industries, and on GDP.

Aside from data constraints, another major difficulty in establishing the overall economic impact of liberalisation is that other structural changes have occurred in the PNG economy since 2007 and some of them have been much larger in scale. The most important are undoubtedly the changes generated by the PNG Liquefied Natural Gas Project, which is being undertaken by Exxon-Mobil and its joint venture partners.

Because of the scale and scope of the economy-wide impacts of the PNG LNG Project, they are quite difficult to disentangle from the rest, including those associated with mobile phone liberalisation. The LNG project is a massive undertaking; the investment in its initial phase alone totals US\$19 billion.³⁰ Construction work on the project began in PNG in 2010 and LNG production commenced in April 2014.

5.1 STRUCTURAL CHANGES IN THE PNG ECONOMY SINCE 2007

Over the period from 2007 to the present, gross domestic product (GDP) in PNG has grown strongly in real terms—that is after accounting for domestic inflation—increasing by over 86 per cent in aggregate (see Figure 1).³¹

³⁰ Excluding investments in specialised LNG carriers.

³¹ These national accounting estimates were sourced from PNG Treasury, *National Budget Volume No. 1*, for the budget years ending 31 December 2011 to 2016 inclusive [Accessed on 24 June 2016 at: http://www.treasury.gov.pg/html/national_budget/national_budget.html]

Nearly 60 percentage points of the aggregated growth in GDP was accounted for by two industry groupings—Oil and gas extraction (36.7 percentage points) and Construction (22.1 percentage points).³² Their contributions predominantly reflect the impacts of the construction and commissioning phases of the PNG LNG Project, which fell entirely within this period.

The next largest contributions to the total growth in GDP are from Agriculture, forestry and fishing (9.0 percentage points) and Transport, storage and communications (8.6 percentage points).

The strong contributions to growth in GDP from the LNG Project are highlighted by the fact that the share of annual GDP contributed by Oil and gas extraction rose six-fold—from 2.9 to 18.5 per cent of GDP. The growth in the share of Construction was more sedate—rising from 13.6 to 17.5 per cent of GDP.³³

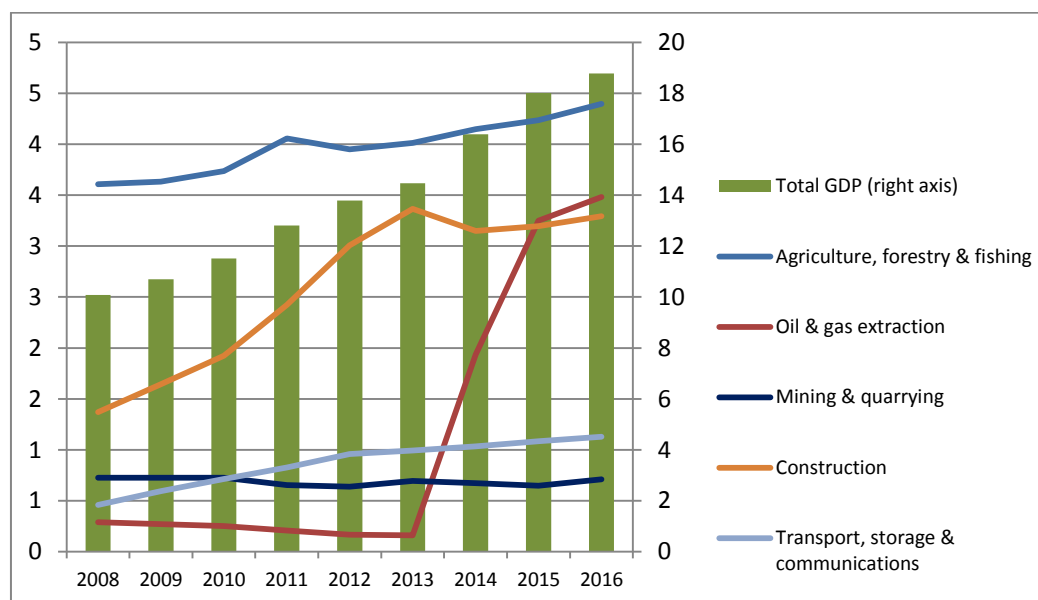
Most of the other industry groupings lost ground relatively speaking. For example, the GDP share contributed by Agriculture, forestry and fishing fell by 12.4 percentage points to 23.4 per cent of GDP, while that of Mining and quarrying approximately halved to just 3.8 per cent of GDP. The contraction in the relative size of these industry contributions to GDP were heavily concentrated in PNG's traditional export commodity industries. This, in turn, suggests that the development and production of LNG for export has led to significant 'crowding-out' of other export activity up to the present day, although it should be noted that in constant prices terms, the value of exports from the Agriculture, Forestry and Fisheries sector has increased by 22 percent from K3.6 billion in 2008 to an estimated K4.4 billion in 2016 (see Figure 1).³⁴

Transport, storage and communications was the only other industry grouping to contribute a growing share of GDP over the period from 2008 to the present. Their share went from 13.6 to 17.5 per cent of GDP over this period. The size of their gain suggests that the PNG LNG Project was not the only factor behind the strong growth in this industry sector. The other obvious driver is the liberalisation of domestic mobile phone services in 2007.

³² Most economies, including PNG, use the UN International Standard Industrial Classification of All Economic Activities (ISIC) for the purposes of national accounting. At the highest level of aggregation the ISIC industry groupings are: Agriculture, forestry and fishing industries; Oil and gas extraction; Mining and quarrying; Manufacturing; Electricity, gas and water; Construction; Wholesale and retail trade; Transport, storage and communications; Finance, real estate and business services; and Community, social and personal services. Post and telecommunications is one of the subdivisions of Transport, storage and communications.

³³ *National Budget Volume No. 1*, for the budget years ending 31 December 2011 to 2016 inclusive [Accessed on 24 June 2016 at: http://www.treasury.gov.pg/html/national_budget/national_budget.html]

³⁴ Sources for Figure 1: *National Budget Volume No. 1*, for the budget years ending 31 December 2011 to 2016 inclusive [Accessed on 24 June 2016 at: http://www.treasury.gov.pg/html/national_budget/national_budget.html]

Figure 1: PNG GDP, constant prices (Kina billions)

Source: Data from PNG Treasury, Budget Volume No. 1, 2012, 2013, 2014, 2015 & 2016, Government of PNG, Port Moresby

5.2 PRICE & SERVICE IMPLICATIONS OF MOBILE PHONE LIBERALISATION

Digicel's entry into the market for mobile phone services in PNG together with its aggressive expansion of its mobile phone network has increased the extent of the competition in that market. As a consequence, by 2012 Digicel has become the dominant mobile phone operator in PNG with 74 per cent of all mobile phone subscriptions, 88 per cent of all mobile phone revenue, and 91 per cent of all mobile phone calls.³⁵

This increased competition has, in turn, led to progressive reductions in the prices, in real terms, that PNG households and businesses have to pay for their communication services. It has also generated substantial improvements in the quality and the availability of mobile phone services in PNG, particularly in rural and remote areas of PNG. Some of these enhancements have been partially funded by the World Bank and the Asian Development Bank (ADB).³⁶

Table 1 details the call charges demanded by the major mobile phone operators in PNG — namely Digicel and bmobile-vodafone³⁷ — before and immediately after Digicel's entry into the market in 2008, as well as at the present time. All call charges are shown both in nominal and real terms.

Mobile phone call rates have declined progressively in real terms since the commencement of competition in 2008. Most of the falls occurred in the year that Digicel entered the mobile phone market. As would be expected, the largest price declines occurred in off-peak call rates. Across the board the drop in call rates averaged almost 70 per cent in real terms for domestic calls and 36 per cent for international calls. See Tables 1 and 2.

³⁵ NICTA, 2012, *Recommendation Report: A report to the Minister recommending the introduction of a retail service determination*, PNG National Information and Communications Technology Authority, Port Moresby

³⁶ See, for example, <http://www.worldbank.org/en/news/feature/2015/09/29/connecting-the-unconnected-in-papua-new-guinea> (accessed 29/6/2016)

³⁷ Formerly B-Mobile

Impact of deregulation on mobile phone costs

Table 1: Domestic mobile call rates in PNG, PGK per minute	Average Peak	Average Off-peak	Average all calls
Rate before Digicel's entry, 2008 prices	K1.80	K1.60	
Rate after Digicel's entry, Sep 2008 prices	K0.99	K0.49	
Rate before Digicel entry, 2016 prices (d)	K2.22	K1.98	
Rate as at 15 Jun 2016, 2016 prices	K0.79	K0.49	
Decline in real call rate since Digicel's entry, percent	64.5%	75.1%	

Table 2: Outbound international mobile call rates in PNG, PGK per minute	Average Peak	Average Off-peak	Average all calls
Charges before Digicel's entry, 2008 prices	K2.45	K1.60	
Charges after Digicel's entry, September 2008 prices	K1.48	K0.99	
Charges before Digicel entry, 2016 prices (d)	K3.03	K1.98	
Charges as at 15 Jun 2016, 2016 prices	K1.64	K1.64	
Decline in real call rate since Digicel's entry, percent	45.8%	17.0%	

Table 3: Pre-paid mobile phone call rates by operator, PGK per minute	Digicel		b-mobile-vodafone		Average	
	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
On-Net Domestic Mobile	0.79	0.49	0.50	0.25	0.76	0.47
Off-Net Domestic Mobile	0.99	0.68	0.77	0.47	0.97	0.66
Domestic Landline	0.99	0.79	0.77	0.47	0.97	0.76
Average domestic rate	0.81	0.51	0.53	0.28	0.79	0.49
Average international rate	1.62	1.62	1.90	1.90	1.64	1.64

Sources: Company websites

Notes for Tables 1, 2 and 3:

The rates for 2008 are taken from Batten *et al* (2009)

Peak period is from 0800 to 2000 hours on each weekday

Averages assume 2/3 of all calls are made in the peak period

Real vs nominal costs estimated on the basis of the movement in the implicit GDP deflator over this period (IMF 2016)

Sources Tables 1 and 2:

Aaron Batten, Jonathon Gouy and Ron Duncan, 2009, 'Papua New Guinea economic survey: from boom to gloom?', *Pacific Economic Bulletin*, 24(1), pp. 1-26

PNG, 2008, Submission to the ICCC Review of the ICT Sector, Department of Treasury & Finance Port Moresby, September quoted in Batten *et al* 2009

IMF, 2016, World Economic Outlook Database, April

Digicel initially took the initiative in terms of price competition in the PNG mobile phone market. However, as demonstrated in Table 3 above, the other major operator — bmobile-vodafone — has now responded with generally lower domestic call rates. As a consequence, the strong downward pressure on mobile phone call rates looks set to continue, at least in real terms.

The real decline in mobile phone call rates has clearly generated significant benefits for households and businesses in PNG. Unfortunately, comprehensive data on the composition of household expenditure and business expenditure on intermediate inputs by industry in PNG—such as to be found in an Input-Output Table—are not publicly available. A comparative examination of the Input-Output Table for Fiji, which has been published by ADB, indicates that about 30 per cent of the value of the output of Agriculture, forestry and fishing in that economy is accounted for by their purchases of Transport, storage and communications services.³⁸ For Mining and quarrying — which in this version of the International Standard Industry Classification system includes Oil and gas extraction — the equivalent intermediate services represent 29 per cent of the value of its output. These industry sectors are the source of almost all of PNG's exports.

It is plausible to assume that the expenditure on mobile phone services by each of these sectors would be around one-quarter³⁹ of their total expenditure on Transport, storage and communications services. This means that their expenditure on mobile phone services would account for between 7 and 8 per cent of the value of their output (one quarter of the 29 and 30 percent of total costs in the Agriculture, forestry and fishing and Mining and quarrying sectors respectively that is attributable to Transport, storage and communications).

On this basis, the real declines in mobile call rates that we have estimated to have occurred since liberalisation to the present time (detailed in Tables 1 and 2) would have reduced the total costs of production in each of those industry sectors by between 2 and 5 per cent.

This reduction in costs for these key export sectors suggests that in 2016, the positive impact of mobile telecommunications deregulation in PNG contributed between 0.9% and 2.3% to the economy's GDP. This equates to between K172 million and K429 million.⁴⁰

5.3 BROADER IMPACTS OF MOBILE TELECOMMUNICATIONS

As has been stated elsewhere in this report, analysis of the economic impact of widely available mobile telecommunications in PNG is limited by a scarcity of data. However, it is illuminating

³⁸ ADB (2005). Fiji was chosen as it is the economy that has good data coverage that is the closest match to PNG in terms of geography, development challenges and position in the global trading architecture. However, it must be noted that there remain differences between the two economies, specifically associated with the relative importance of the size of the tourism and resources sectors. From a telecommunications point of view, Digicel is present in both PNG and Fiji.

³⁹ This is a common-sense, conservative assumption of the likely proportion of Transport, storage and telecommunications costs accounted for by mobile telecommunications, considering PNG's relative lack of fixed line infrastructure. Unfortunately, we do not yet have a data source against which to test this assumption.

⁴⁰ This estimated contribution of mobile telecommunications deregulation to GDP is found by applying the estimated 2%-5% reduction in total industry costs in the three key export sectors (Agriculture Forestry and Fishing; Mining and Quarrying; and Oil and Gas Extraction) to the projected contribution of these three sectors to total GDP in 2016. Note: one key export that is not covered by these three sectors is palm oil, which is classed as a manufactured good. As a result, our estimated contribution to GDP of mobile telecommunications deregulation is likely to be conservative.

to examine previous research that has focused on mobile telecommunications in other developing economies.

Lower search and information costs

It has been observed that mobile connectivity in agricultural value chains can significantly reduce search costs for producers, traders, processors and consumers. Research presented by Aker and Mbiti (2010) on fresh fish value chains in India indicated that the results of mobile phone use included a reduction in the variation in prices for fish in different markets.

Before the widespread availability of mobile phones, search costs – that is, the cost to traders and producers of finding out market prices in distant areas – were prohibitively high, usually requiring a trip in person. After the advent of mobile phones, these search costs declined sharply, as traders and farmers were able to call friends and associates in distant market locations to check on prices in real time.

The net effect of these reduced search costs was that in low production areas (in the case of fish, this would refer to inland markets), traders and consumers both make gains, while in high production areas (near fisheries), gains made by traders (who can learn of market opportunities in distant, low production areas) are partly offset by losses to consumers (who now see part of the local catch exported to other locations). Researchers found that the overall net effect of lower search costs was positive, but the distribution of the benefits between producers, traders and consumers was ambiguous.

Jensen (2007) cited by Aker and Mbiti (2010) found that in the Indian example, the effects of mobile phones include welfare improvements for both fishermen and consumers: *“fishermen's profits increased by 8 percent, consumer prices declined by 4 percent and consumer surplus increased by 6 percent.”*

In the case of PNG, the research above appears to support anecdotal reports from fresh produce growers and traders who state that mobile phones have allowed them to learn about and access distant markets. The IRRM onion farmers who connected with a distant market in Alotau provide an interesting example of this.

Less wastage

The research conducted by Aker and Mbiti (2010) also found that the lower search costs enabled by the advent of mobile phones led to less wastage in value chains of highly perishable commodities. It appears that lower search costs allow producers and traders of fresh produce to identify more sales opportunities for time-sensitive commodities, leading to a greater probability of selling goods before they spoil.

This finding is supported by the experiences of Wayne Gorowe, the fresh produce trader profiled in Chapter 3. Mr Gorowe estimated that mobile phones had allowed him to increase his turnover by 30%, thanks to a combination of reduced spoilage and more frequent trips to market.

Increased employment

Research elsewhere has identified the ability of mobile telecommunications to drive growth in employment, particularly in remote areas. Klonner and Nolen (2008) found that the establishment of mobile phone networks in areas of South Africa coincided with a 15 percent

increase in employment, most of which went to women. It is believed that the ability to search for – and be advised of – job opportunities was mostly responsible for this increase.

As well as driving employment growth by reducing search costs, mobile telecommunications have been observed to lead to entirely new employment opportunities. For example, the Communications Commission of Kenya (2008) observed that formal employment in the Kenyan private transport and communications sector increased by 130% between 2003 and 2007, coinciding with the widespread availability of mobile phones.

Mobile phones have also created supplementary economic activity and cottage industries, such as reselling of flex cards, and stalls offering battery charging (from a generator or car battery), and renting out handsets.

6. REMAINING BARRIERS AND CHALLENGES

As has been noted elsewhere in this report, PNG's ability to participate in and benefit from GVCs is constrained by high costs and a difficult business environment. Communications costs reductions and services improvements that have been enabled by deregulation have helped address some of these issues; however much remains to be done to address the broader costs of doing business, if PNG is to meaningfully improve its ability to benefit from GVCs.

In terms of mobile telecommunications, some key challenges identified during the writing of this report relate to: social norms; costs and coverage; and electricity supply.

6.1 SOCIAL CHALLENGES

Many Papua New Guineans have expressed concerns about the perceived cultural changes associated with widespread access to mobile telecommunications. Dr Amanda Watson's research identified perceived damage related to sex, pornography and crime.

Dr Watson found commonly held concerns regarding the ability of mobile telecommunications to facilitate extra-marital affairs – echoing concerns in other developing economies including Jamaica and Trinidad, and also (as Dr Watson pointed out) echoing fears that surfaced in the USA with the advent of telephones in the late 1800s. Interestingly, Dr Watson's research found that mobile phones may also facilitate the uncovering of extra-marital affairs, as SMS conversations and call lists are discoverable.

Another fear prompted by the advent of mobile phones to remote areas is the ability of criminal groups to coordinate their activities. This was noted during interviews for the East-West Transport Case Study. Dr Watson points out that such fears – including, for example, raskol (bandit) gangs will be able to advise each other of vulnerable targets carrying valuables or of the movements of police officers – echo similar concerns noted in Sudan and other parts of Africa, as well as Jamaica.

A fear of the destructive influence of easy access to pornography – particularly by children - was also identified in Dr Watson's research as a social concern related to the availability of mobile phones. These concerns have led to mobile phones being banned at some schools.

6.2 MOBILE PHONE COSTS AND NETWORK COVERAGE

Network coverage remains a barrier in some parts of PNG. While it is true that coverage has expanded rapidly, the quality and nature of coverage varies from one part of PNG to another and particularly from urban to rural areas.

Data network availability in particular remains limited in many parts of PNG. Reliable 3G coverage is still limited to urban centres, meaning that access to internet-based services remains patchy. Although affordable smart phones are becoming more commonly available, network limitations constrain their usefulness. As a result, examples such as the one presented in Section 3.2 of internet-based services unlocking economic opportunities remain relatively rare.

Although the real costs of mobile phone calls continue to fall, people still perceive that costs are high and even rising. This is likely due to some costs – such as for the SMS bundle – increasing, and also to the fact that data costs are considered high. As was discussed in the Case Study in Chapter 3, there is a perception among some consumers that despite the falling costs of calls, Digicel is behaving increasingly like a monopolist.⁴¹

6.3 ELECTRICITY SUPPLY

As identified earlier, the availability of electricity to charge handsets is another key challenge to mobile phone use in remote areas of PNG. As presented earlier, the World Bank estimates that just 18.1% of Papua New Guineans have access to electricity. Digicel and the International Finance Corporation have invested significant funds in addressing this problem by installing solar charging stations in hundreds of locations across PNG, but more remains to be done to reach those who still lack access to electricity.

⁴¹ See, for example: <https://masalai.wordpress.com/2013/12/18/is-digicel-becoming-a-bigger-better-network-a-worrying-thought/> (accessed 18/7/2016)

7. CONCLUSIONS AND RECOMMENDATIONS

The advent of widely available mobile telecommunications in PNG – enabled by the process of deregulation carried out by the government - has been transformative in several key ways, particularly in remote parts of PNG. Many of these effects were almost immediate.

It is estimated that the effects of this liberalisation include a boost to GDP of up to 2.3%. For businesses telecommunication deregulation has brought about estimated total cost savings of two to five percent (see Section 5.2). This represents an improved ability to benefit from global value chains, as cost savings in the agriculture, mining and gas extraction sectors help PNG competitively supply these inputs to trading partners.

Also important - though more difficult to measure - have been improvements in safety and financial transparency that mobile telecommunications have helped deliver. The anonymous safety incident reporting system launched by Joint Venture Stevedoring presents an example of the innovative ways in which mobile phones are being used to drive improvements in PNG's supply chains. The first Case Study demonstrates how farmers and traders have been empowered by access to market information, and by the ability to reduce delays in complex fresh produce value chains.

Transparency International's Phones Against Corruption shows how mobile phones can help address systemic issues faced by many developing economies. Dr Amanda Watson's research on the lifesaving interventions enabled by the Maternal Health Phone Line provides a good example of how mobile connectivity can improve health outcomes.

Most of the research to date on mobile telecommunications in PNG has found that these economic and health considerations are important, but are eclipsed by the impact that mobile telecommunications have had at a personal level on the quality of life for millions in remote areas of PNG. Most respondents surveyed by Dr Watson reported that the ability to connect with friends and family represents the greatest benefit of mobile phone ownership. The significance of this ability is only understood when one considers that for some people in remote areas who have relocated for marriage or work – and who lack the money to travel back to their ancestral village – the first time they used a mobile phone may well have been the first time in decades they heard their mother's voice.

The importance of reliable electricity supply that was presented in Chapter 6 demonstrates the inter-linked and complementary nature of various aspects of the enabling conditions required for PNG's ongoing economic development, and specifically for the economy's ability to benefit from GVCs. Without electricity, mobile network coverage is of little use to remote communities. Without transport infrastructure, mobile connectivity will not help farmers get produce to market. However, the inverse is also true; improvements in one area can spur improvements in others. For example, expanding mobile network coverage in remote areas of PNG has led to the World Bank-supported solar electrification project referred to in Chapter 3. Policy makers should explicitly consider these inter-reliant webs of enabling conditions required for meaningful economic development. Researchers Aker and Mbiti (2010) remarked that in multiple African economies, it had been noted that mobile telecommunications in isolation are not enough to drive development. The gains enabled by mobile phones still depend on traditional development improvements, such as road infrastructure, electrification and water.

As explored throughout this report, concerns remain regarding the rapid changes that have been wrought by mobile telecommunications in PNG. Infidelity, crime and pornography are all legitimate concerns, as is the fear that the costs of mobile phone ownership may be too high for some subscribers. Linked to the issue of costs is concern – among some – that Digicel’s dominant position in the mobile telecommunications market carries a risk of an effective monopoly, particularly in remote regions not covered by competitor bmobile-vodafone.

Experience in other economies indicates that the government of PNG should pay close attention to the issue of effective competition in the mobile telecommunications sector. Research presented in Aker and Mbiti (2010) found that in a number of African economies, average call prices fell by up to 90 percent following full liberalisation, but that economies including Sierra Leone and Zimbabwe had seen some of these gains disappear after re-establishing mobile telecommunications monopolies.

In order to maximise the positive aspects of the spread of mobile telecommunications – while addressing these concerns – the following recommendations are presented.

Mobile telecommunications operators (Digicel, bmobile-vodafone and any future entrants) should continue to address network black spots, and progressively upgrade rural networks to provide internet access. Improved services will increase opportunities for economic connectivity and drive better health outcomes. Government policy settings should be optimised to encourage and enable this process.

The government should ensure healthy competition in the mobile telecommunications sector. This may involve reducing barriers to entry for additional operators. New entrants may be able to reach agreement with incumbent network operators on renting bandwidth, rather than building a parallel mobile network. The recently announced PNG Data Co – a state-owned enterprise that will be responsible for PNG’s international submarine cables and overall telecommunications infrastructure – is considering policies that may promote cooperation between telecommunications operators, and reduce network duplication.

The government should also prioritise electrification projects in remote parts of PNG. International donors – including the World Bank – could support these efforts, as the benefits of electrification go further than just the ability to recharge mobile phones. Donors should also consider technical assistance initiatives to support the capacities of PNG government officials to effectively promote and enable the mobile telecommunications sector. Equally important – if PNG industries are to gain the full benefits of improved communication capabilities – is continued investment in transport infrastructure.

A peripheral recommendation for the national government – and specifically for the Bank of PNG – that has been identified during the writing of this report is to increase the publication of official economic data. Better data coverage will enable useful comparisons with other economies at a similar stage of development, and will allow the government to identify initiatives that have the best chance of contributing to positive change.

ACRONYMS

2G/3G	Second/Third Generation mobile phone network
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
FPDA	Fresh Produce Development Agency
GDP	Gross Domestic Product
GVC	Global Value Chain
ICCC	Independent Consumer and Competition Commission
ICT	Information and Communication Technology
IFC	International Finance Corporation
IRRM	Independent Reform and Restoration Movement
ITU	International Telecommunications Union
JVS	Joint Venture Stevedoring
LNG	Liquefied Natural Gas
MIS	Market Information System
NARI	National Agricultural Research Institute
NBPOL	New Britain Palm Oil Limited
PMV	Public Motor Vehicle
PNG	Papua New Guinea
SIM	Subscriber Identification Module
SMS	Short Message Service
UNDP	United Nations Development Programme
USSD	Unstructured Supplementary Service Data
WTO	World Trade Organisation

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