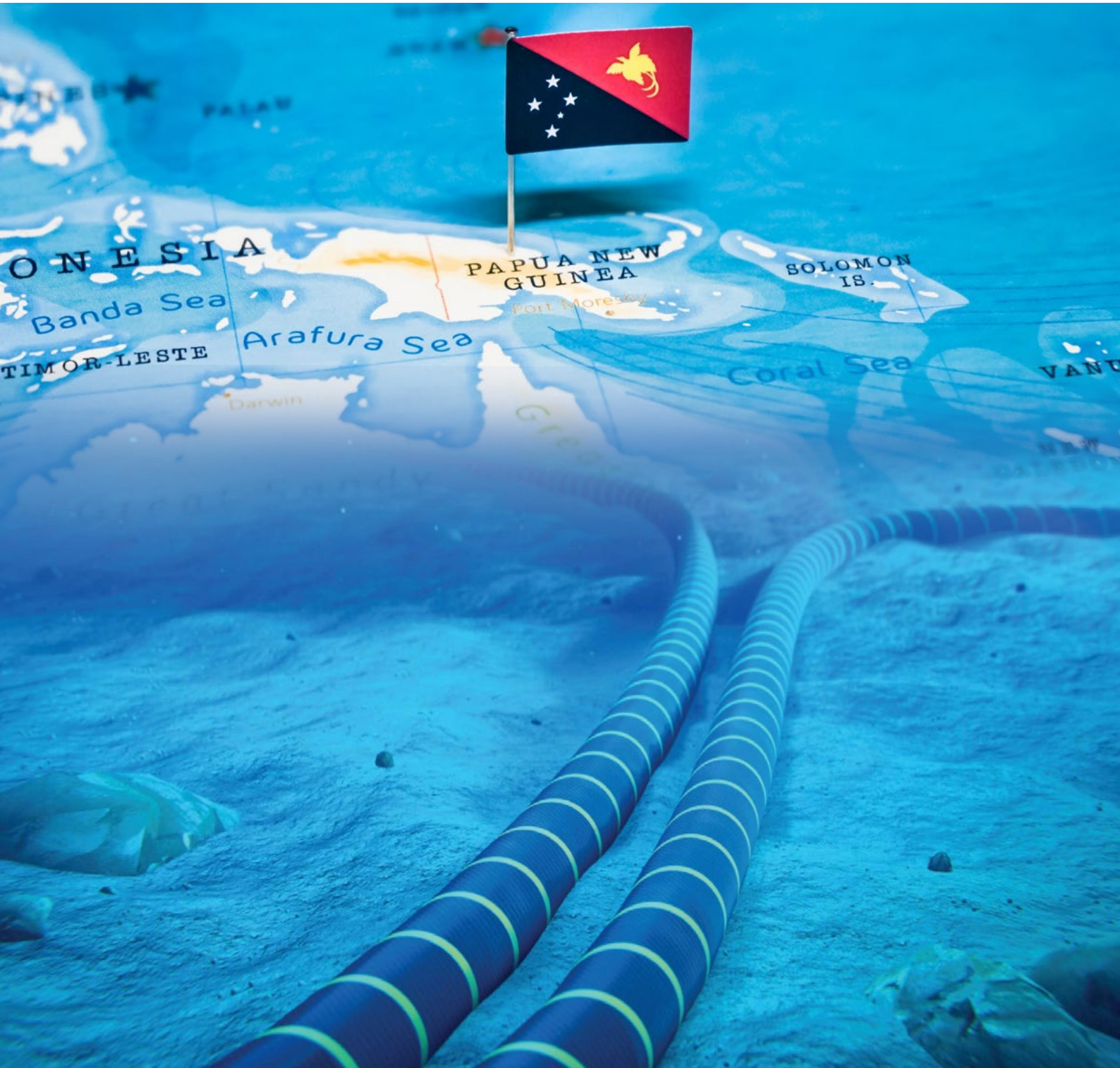
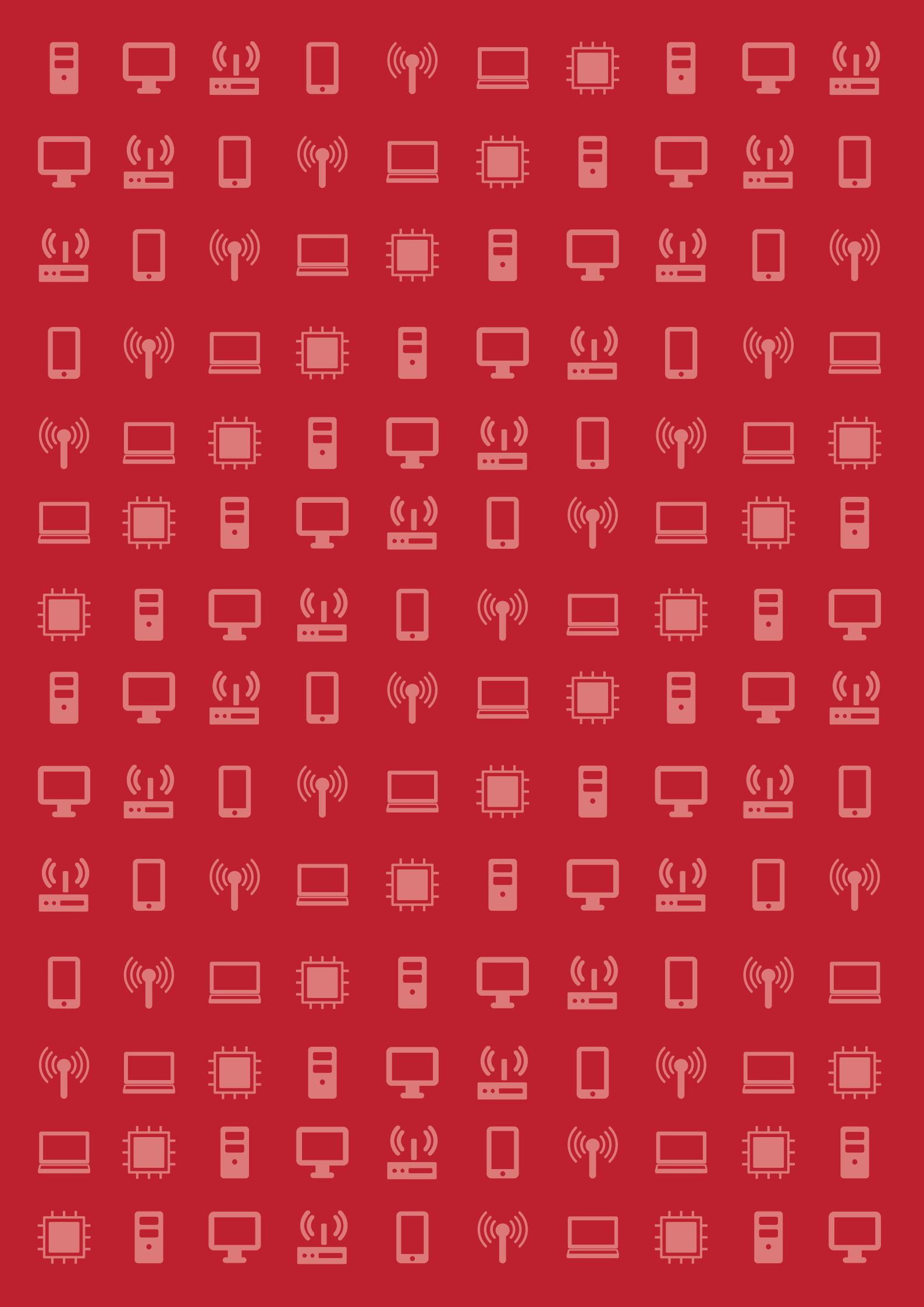
CIPS
Center for Indonesian Policy Studies

Discussion Paper No. 16

Understanding the Regulatory Environment for ICT Infrastructure in Papua New Guinea

by Amira Husna Natanegara, Louis Budiman & Muhammad Nidhal





Discussion Paper No. 16

Understanding the Regulatory Environment for ICT Infrastructure in Papua New Guinea

Authors:
Amira Husna Natanegara, Louis Budiman & Muhammad Nidhal
Center for Indonesian Policy Studies (CIPS)

Jakarta, Indonesia
August, 2023

Acknowledgement:

This paper was produced with the generous support of the Center for International Private Enterprise (CIPE)

Cover:
shutterstock/hyotographics

CONTENT

List of Tables

List of Figures

GLOSSARY

ADB:
Asian Development Bank

AIFFP:
Australian Infrastructure Financing Facility for the Pacific

APC:
Authority to Pre-Commit

ATH:
Amalgamated Telecom Holdings

ATHIV:
Amalgamated Telecom Holdings International Venture

AUD:
Australian Dollar

B2B:
Business-to-business

B2C:
Business-to-consumer

BRI:
Belt and Road Initiative

BTI:
Bertelsmann Stiftung

C2C:
Consumer-to-consumer

CERT:
Computer Emergency Response Team

CS2:
Coral Sea Cable System

DFAT:
Department for Foreign Affairs and Trade

DFC:
United States International Development Finance Corporation

DICT:
Department of Information and Communications Technology

FDI:
Foreign Direct Investment

G7:
The Group of Seven

GNI:
Gross National Income

ICAC:
Independent Commission Against Corruption

ICT:
Information and Communication Technology

IGIS:
Integrated Government Information System

IPA:
Investment Promotion Authority

IT:
Information Technology

ITU:
International Telecommunication Union

IXP:
Internet Exchange Point

JBIC:
Japan Bank for International Cooperation

KSCN:
Kumul Submarine Cable Network

KCH:
Kumul Consolidated Holdings

LTE:
Long Term Evolution (4G LTE)

MSME:
Micro, Small & Medium Enterprises

MTDP:
Medium Term Development Plan

N3C:
National Cyber Coordinating Center

NCSC:
National Cyber Security Center

NEC:
National Executive Council

NICTA:
National Information and Communications Technology Authority

NPC:
National Procurement Commission

NSO:
National Statistical Office

OECD:
Organisation for Economic Cooperation and Development

PGII:
Partnership for Global Infrastructure and Investment

PGK:
Papua New Guinean Kina

PM:
Prime Minister

PNG:
Papua New Guinea

PPP:
Public Private Partnership

PPSDI:
Pacific Private Sector Development Initiative

RAL:
Reserves Activity List

RTI:
Right to Information

SIDS:
Small Island Developing States

SIM:
Subscriber Identity Module

SME:
Small and Medium-Sized Enterprises

SOE:
State-Owned Enterprises

TFEC:
Technical and Financial Evaluation Committee

TV:
Television

UAS:
Universal Access and Service

UASF:
Universal Access and Service Fund

UNCAC:
United Nations Convention Against Corruption

UNCTAD:
United Nations Conference on Trade and Development

UNESCAP:
United Nations Economic and Social Commission for Asia and the Pacific

UNESCO:
United Nations Educational, Scientific, and Cultural Organization

UNESCAP:
United Nations Economic and Social Commission for Asia and the Pacific

UNODC:
United Nations Office on Drugs and Crime

US:
United States of America

ICT INFRASTRUCTURE FOR A DIGITALLY EMERGING PAPUA NEW GUINEA

According to World Bank estimates, Papua New Guinea (PNG) achieved an annual per capita Gross National Income (GNI) of US$2,470 in 2022 (Trading Economics, 2022). This is considerably lower than neighboring countries such as Indonesia with a per capita GNI of US$4,580 (Jiao & Sihombing, 2023) or Fiji (US$13,370) (Trading Economics, 2023). A low income creates severe challenges for building a capital-intensive information and communication technology (ICT) infrastructure that would enable PNG to reap the benefits of the digital economy for business development, education, public health, etc.

Fortunately, the ICT services in PNG have shown significant improvement over the past decades. The introduction of competition in the market of mobile telecommunications in 2007 has played a crucial role in enhancing basic telephony access. It led to more affordable and a wider variety of services (Duncan, 2013; ITU, 2018) while the mobile network penetration rose sharply with the entry of Digicel PNG Limited (Digicel) and Bemobile Limited (bmobile) (ITU DataHub, 2021; UNESCAP, 2021). Currently, Telikom PNG Limited (Telikom), a state-owned enterprise (SOE), retains its position as the main fixed telephone service provider (GSMA, 2019, Foster, 2023) while the mobile services market is dominated by Digicel with around 90% market share.

> "The introduction of competition in the market of mobile telecommunications in 2007 has played a crucial role in enhancing basic telephony access."

In PNG's last-mile connectivity that describes the final leg of physical infrastructure giving end-users access to ICT services, mobile networks play the major role. They overshadow the fixed-line network, which is only accessible in a few urban areas (ITU, 2018). Still, the coverage of 3G and 4G (LTE) throughout the country remains limited and falls below the average in the Asia Pacific region. In 2021, only 64% of the population in PNG accessed 3G networks compared to the Asia Pacific average of 96%, while 4G networks only cover 50% of the PNG's population and remain well below the 95% average in Asia Pacific (ITU DataHub, 2021). This affects people's ability to access higher internet speeds, thus hindering their participation in the digital economy. In 2020, the Asian Development Bank (ADB) approved an investment of US$25 million into a greenfield 4G mobile network (Pham, 2020). The funds were to be given to ATH International Venture (ATHIV), a subsidiary of Fiji-based Amalgamated Telecom Holdings (ATH). In 2021, ATH formalized ADB's participation in the project that is set to be rolled out and operated by Vodafone Fiji Pte limited, ATH's largest subsidiary (Business Advantage PNG, 2021). 5G networks that are anticipated to be the fastest option for last-mile connectivity are not yet available in PNG.

On device adoption and affordability, the share of smartphone connections out of all mobile (SIM) connections in PNG has undergone a significant increase, going from 22% in 2018 to 80% in 2022 (GSMA Intelligence, 2023). The rise can be attributed to the declining prices of smartphones and the entry of new low-cost smartphone producers (Williams, 2019; GSMA Intelligence, 2023). During the period between 2021 and 2022, the price of the cheapest smartphone in PNG dropped significantly, from $135 to $28 (Alliance for Affordable Internet, 2022). In terms of computer usage, only 11% of households in PNG own a computer (ITU DataHub, 2016). The majority of

individuals in the country own more smartphones than computers, primarily due to factors such as affordability and the availability of broadband access.

Broadband access in PNG remains limited and the country's level of penetration remains one of the lowest in the world (UNCTAD, 2023). In 2021, only 32% of the total population of PNG were using the internet, but this represents a significant increase compared to 2% in 2011 (ITU DataHub, 2021). PNG has 11 mobile broadband subscriptions per 100 people, while the usage of fixed broadband is much lower at 0.21 out of 100 people. Despite the improvement in internet penetration, broadband internet access in PNG remains unaffordable for many in PNG. Mobile broadband subscriptions cost up to 20% of monthly GNI per capita while fixed broadband accounts for around 14% of the monthly per capita GNI (UNCTAD, 2023). This is way higher than the global target of less than 2% of GNI for broadband cost and multiple times more expensive than the average in the Asia Pacific region (ITU DataHub, 2022; UNESCO Broadband Commission, n.d.).

"Broadband access in PNG remains limited and the country's level of penetration remains one of the lowest in the world. In 2021, only 32% of the total population of PNG were using the internet, but this represents a significant increase compared to 2% in 2011."

Despite recent improvements, challenges remain, as service outages are still common (ITU, 2021). Lack of connectivity and electric utilities remain key obstacles that hinder internet access in rural regions that are home to approximately 85% of the PNG population (World Bank, 2019; World Bank, 2020a; UNESCO, 2023). Only 32.1% of the 10.2 million people of PNG had access to the internet at the beginning of 2022 (Kemp, 2023).

Data for the coverage of some common technologies used in middle-mile connectivity, such as fibre optic or copper cables, and satellites in PNG, are limited. As a critical link between first-mile and last-mile connectivity, the middle-mile deployment in the country is still a work in progress. The PNG Government plans to extend the submarine cable systems inland along public utility networks such as electricity lines, gas pipelines, but it can only rely on three internet exchange points (IXPs) (PeeringDB, 2023). These are part of the ICT infrastructure where networks exchange internet traffic and customers access global connectivity. The development of this infrastructure is still in its early stages in PNG, despite its importance for internet affordability and traffic management (UNESCAP, 2020).

In first-mile connectivity, connection to international submarine cables is important to enhance network redundancy, mitigate the impact of cable outages, improve connection bandwidth and speeds, and decrease data costs (ITU, 2022a). PNG is connected to four submarine cable networks, consisting of two interregional deployments, including PIPE Pacific Cable-1 that was officially completed in October 2009 and Coral Sea Cable System, completed in December 2019. Two domestic deployments include PNG LNG from April 2014 and the Kumul Submarine Cable Network completed in June 2020. Five islands in the country are connected through these cable networks (UNCTAD, 2023). According to data from the International Telecommunication Union (ITU) from 2017 (ITU DataHub, 2017), the international bandwidth usage in PNG was 40Gbps, with internet users having access to around 30Kbps. The capacity was lower than in most countries in Asia Pacific and worldwide in the same period caused by the limited number of submarine cable connections. The completion of the Kumul and Coral Sea submarine cable networks were highlights of the recent connectivity development in the country. It is expected that it will

significantly increase the bandwidth capacity and reduce the cost of data in PNG (World Bank, 2020a).

As connectivity progresses, the usage of digital platforms in PNG is also experiencing growth. Platforms for electronic payments, social media, e-commerce, digital services in tourism and entertainment are currently in use (Williams, 2019). PNG is one of the few countries among the Pacific Small Island Developing States (PSIDS) that has online payment getaways and it has the highest usage of mobile money wallets (UNCTAD, 2023). However, the adoption of digital platforms in the country is still in its early stages due to factors such as low financial inclusion, preference in cash-method payment, and low trust in technology (Williams, 2019). Security, trust, and social influence are key to boost technological adoption, particularly when it comes to purchasing behaviour (Davda, 2021; Nwaiwu et al., 2020, Kantika et al., 2022). Additionally, the number of merchants on e-commerce platforms is limited, because social media dominate the sector for business-to-consumer (B2C) and consumer-to-consumer (C2C) transactions (UNCTAD, 2023).

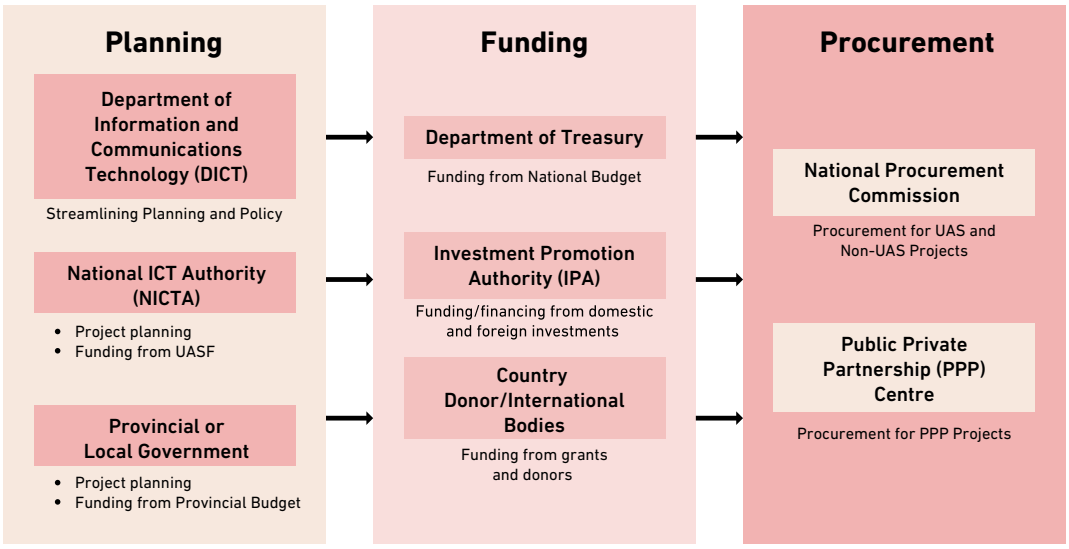
“the adoption of digital platforms in the country is still in its early stages due to factors such as low financial inclusion, preference in cash-method payment, and low trust in technology.”

Developing the ICT infrastructure is of significant importance for PNG's small and medium-sized enterprises (SME) and their ICT adoption, which usually proceeds in four stages, from a) basic communication via fixed lines, mobile phones, or fax, to b) the use of basic information technology such as personal computers, printers, and basic software, to c) advanced communications through email, internet browsing, creating websites, and using e-commerce, and finally to d) applying advanced information technology such as databases, digital resource planning, inventory management, and customer relationship management (Kotelnikov, 2007). Most SMEs in PNG operate with around basic to advanced levels of ICT adoption. A study of 1,066 SMEs in 2014 showed that they mainly used mobile phones while the utilization of computers, websites, and the internet remained relatively low (Tebbutt Research, 2014). Still, SME in PNG have shown to experience an increase in product sales and business development when they applied any form of ICT. This includes SME in rural areas that are using computers, websites, and the internet (Odhuno & Ngui, 2018).

REGULATORY FRAMEWORK FOR ICT DEVELOPMENT IN PNG

Key government agencies are engaged in the planning, financing, and procurement of ICT infrastructure projects (Figure 1).

Figure 1.
Regulatory environment for ICT infrastructure projects in PNG



Source: Authors' analysis, illustration created by authors

> "Through its Universal Access and Service or UAS Secretariat, NICTA is also mandated to undergo and manage projects funded by the Universal Access and Service Fund (UASF). Such UAS projects are meant to improve availability of ICT services in rural and under-served areas of PNG."

Firstly, planning of ICT-related projects, including provision of infrastructures, is mainly led by the PNG's Department of Information and Communications Technology (DICT). DICT has the main function of maintaining policy and service delivery oversight and coordination for communication and information related matters. In 2020, through the National Executive Council (NEC) decision No. 252/2020, the department expanded its functions to oversee transformation efforts of PNG's digital economy (DICT, 2023a). The PNG Government has also established an independent regulatory authority, the National Information and Communications Technology Authority (NICTA) formalized through the National Information and Communication Technology Act of 2009. Its core mission is to regulate areas of telecommunications, radiocommunications and broadcasting with the objective of achieving the long-term economic and social development of PNG (NICTA, 2023). Through its Universal Access and Service or UAS Secretariat, NICTA is also mandated to undergo and manage projects funded by the Universal Access and Service Fund (UASF)[1].Such UAS projects are meant to improve availability of ICT services in rural and under-served areas of PNG.

[1] Universal Access and Service Fund (UASF) in the ICT sector is typically funded by licensing fees and a percentage of revenues allocated from telecommunications operators and service providers.

While ICT development projects aiming to improve access for rural and underserved communities usually fall under the responsibility of the UAS Secretariat, DICT's main organisational mandates revolve around national ICT policy and strategy development. In the context of ICT project planning, however, there are instances where both entities take the roles of executing and lead agencies. In practice, the boundaries in the responsibilities between the two bodies within the context of ICT infrastructure projects remain unclear. The Digital Transformation and Digital Government Plan, for instance, names DICT and NICTA both as the executing agencies but without clear information about their respective responsibilities and level of involvement. It appears relevant that NICTA and the DICT act in a coordinated manner and state publicly which agency shall take the leading role in specific ICT projects in order to avoid confusion and inefficiencies among multiple stakeholders.

Secondly, funding of PNG's ICT infrastructure projects originates from multiple sources both from domestic and foreign funders. As governed in the Public Finances (Management) Act 1995, projects can be fully or partially funded by the PNG Government depending on the scale and jurisdiction of the project. For national-scale projects, public funding is channeled from the National Budget. While projects under provincial or local jurisdictions can receive funding allocations from the provincial budget. UAS projects that are administered by NICTA can rely on the UASF as the primary funding source. ICT infrastructure projects are also open to foreign or international investment in the form of loans or grants. The Investment Promotion Authority administers and facilitates new investments for business activities in PNG.

Thirdly, procurements of public-funded projects are administered through a standardized procurement system overseen by the National Procurement Commission (NPC) (Government of PNG, 2019). As formalized by the National Procurement Act 2018, the public procurement framework applies to all PNG public and statutory bodies. The National Procurement Commission's main function is undertaking timely, transparent, and non-discriminatory procurements on behalf of the state. Under the Public Finances Act, the Authority to Pre-Commit (APC) Committee was established as part of the procurement system. The APC Committee is responsible for overseeing the strategic direction of procurement of public/statutory bodies and regulating, enforcing and reporting on the compliance in accordance with the Act. In addition, the APC Committee has the authority to approve the procurement plans of all public/statutory bodies in line with the national budget before the procurement is conducted. Meanwhile, the NPC Board approves and awards contracts — subject to certain classification of the procurement value — as a result of the procurement. In general, the NPC Board oversees procurement operations for all public/statutory bodies, including procurements delegated to the provincial, district and special committees of the board. Exceptions of the national procurement system apply to Public Private Partnership (PPP) projects as the procurement is overseen by the PPP Center, a body established under the National PPP Act to promote and manage PPP initiatives in PNG.

ICT Infrastructure Planning

Since building ICT infrastructure is highly capital intensive it requires careful planning that addresses the geographical context, includes the needs and demands of local constituencies, and weathers geopolitical tensions with growing frictions between global powers. Given that planning ICT infrastructure is always a massive undertaking and meets with challenges in most countries, PNG also has unique challenges as ICT infrastructure development cannot follow roads or rail lines. There are no roads between the capital Port Moresby and other major towns and there are no major railways. This limited and poorly maintained road network isolates people from economic opportunities and essential services (World Bank, 2022a).

“Since building ICT infrastructure is highly capital intensive it requires careful planning that addresses the geographical context, includes the needs and demands of local constituencies, and weathers geopolitical tensions with growing frictions between global powers.”

Planning of ICT infrastructure is further complicated by the geographical conditions of PNG. The Highlands Region cuts through the main island from the West to the East separating the Momase Region in the North from the Southern Region. Other islands form the Island Region with yet another level of challenges for ICT infrastructure. These four regions are significant for politics, government services and corporate operations. They are further split into 20 provinces, the Autonomous Region of Bougainville and the National Capital District.

Still, PNG remains a unitary state with centralized decision making and where provincial governors retain their seats in the national parliament. The national government exercises control over key policy areas, including in ICT infrastructure. This centralized structure has limitations when it comes to extending certain policies and service delivery mechanisms to local areas (Interview, 2023). In effect, it provides local communities and stakeholders with little influence on ICT policies. Responsibilities for delivering ICT infrastructure lie with central agencies but due to a lack of adequate human capital and resources as well as proper transportation infrastructure, the government struggles to effectively extend digital services to all parts of the country (World Bank, 2020a). The private sector therefore faces risks when making long-term investment decisions and engages in national-level initiatives to influence important government initiatives. The Pacific Private Sector Development Initiative (PPSDI) has, for instance, supported the formulation of the PPP policy, SOE reforms, and National Competition Policy (PSDI, 2022).

The National ICT Roadmap 2018 and the Medium Term Development Plan (MTDP) 2023–2027 form the strategic pillars and provide directions for digital transformations in PNG. The National ICT Roadmap from 2018 intended to integrate ICT policies and programs that had been fragmented across different government agencies. It was meant to provide an overarching policy that guided the development of the ICT sector (DCI, 2018) and an outline of the strategic direction for the department’s future activities. The roadmap differentiates between short-, medium-, and long-term activities that should align with the Digital Transformation Policy 2020 and Digital Government Plan 2023-2027. It was designed as a living document that was to be updated along rapidly unfolding changes of the ICT market but to date, no updated or new versions of the ICT Roadmap have been released.

Meanwhile, the MTDP 2023-2027 sets the government’s development agenda, objectives, and strategies to foster nationwide economic growth (OCHA, 2023). The plan includes several

key priority sectors, such as the ICT sector, which the government integrated into their policy directions and intervention programs under its signature policy called "Connect PNG". The Connect PNG strategy was designed to accelerate development and enhance infrastructure inclusivity in critical sectors, including telecommunications, transportation, energy, housing, water, and sanitation. In addition, the development framework encompassed investment plans as a critical component, outlining financial resource allocation for each ICT project and program (Connect PNG, 2021).

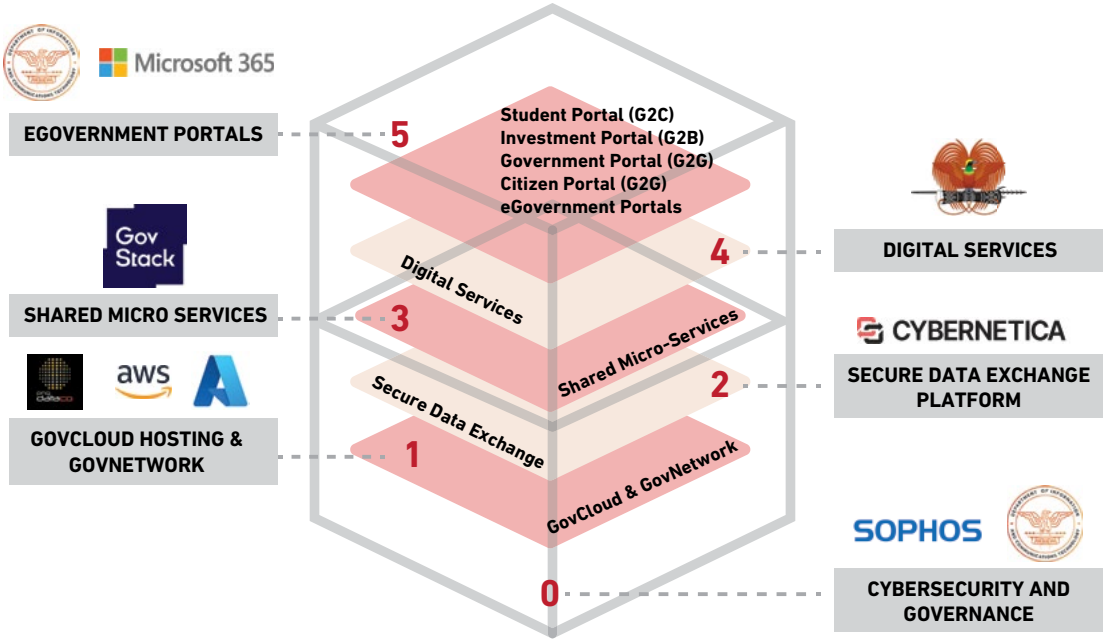
Planning of large-scale capital-intensive infrastructure that extends to all parts of the country requires a vast amount of data on logistics, finances, the economy, the environment, geography, and society in general (UNESCAP, 2018). Yet, PNG faces challenges in collecting and publishing real-time statistical data, particularly also related to the ICT sector. The primary authority responsible for data collection is the National Statistical Office (NSO), established in 1981 under the Statistical Service Act. It is the central agency in PNG for providing statistical information to meet the needs of the government for the formulation of policy and planning (UN Statistics Division, 2014). Under Section 106 of the 1998 Reformed Organic Law on Provincial and Local Level Government, the NSO was given the mandate to assist in creating statistical databases at the provincial and local-level government levels for policy formulation and planning at these levels (InforMEA, n.d.). Despite this mandate, the coordination of data collection and management among government agencies and departments has been limited. It also appears that the ICT regulatory bodies NICTA and DICT lack sufficient ICT project databases, performance indicators, and publicly accessible project trackers. This absence of real-time and coordinated data collection in the ICT sector affects the country's ability to develop and implement effective, consistent, and sustainable ICT policies and strategies.

"Planning of large-scale capital-intensive infrastructure that extends to all parts of the country requires a vast amount of data on logistics, finances, the economy, the environment, geography, and society in general (UNESCAP, 2018). Yet, PNG faces challenges in collecting and publishing real-time statistical data, particularly also related to the ICT sector."

In 2014, the Integrated Government Information System (IGIS) was first introduced as a national scale major initiative to centralize government data digitally and enhance public access to information (ASPI, 2020). However, the PNG Minister of ICT publicly stated in 2020 that he found its implementation ineffective (PNG Buzz, 2020) and its continuation became unclear. The Digital Transformation Policy 2020 noted that phase 2 and phase 3 of IGIS were never executed. It was criticized that the system failed to establish a platform for data sharing among government agencies and its failure to meet the required specifications to support the finance departments' Integrated Finance Management System (OGP, 2018; DICT, 2020; Arnold, 2017). Following this setback, the government adopted the PNG Digital Transformation Policy in 2020 (DICT, 2020) that outlined a strategic framework for the digital transformation in the government sector. It maintained the objective of enhanced public access to information and focused on accelerating the use of cloud-based applications for inter-agency information sharing. Subsequently, the PNG Digital Government Plan 2023–2027 (DICT, 2023b) was introduced to translate the policies of the previous master plan into specific programs and investments.

In June 2023, the PNG Department of Information and Communications Technology (DICT) then introduced the PNG Government Technology Stack 2023 (Figure 2), a framework provisioned within the Medium Term Development Plan 2023–2027. It encompasses various layers and components of digital infrastructure, enabling technologies and applications, and user interfaces for ICT projects, including the digital government agenda (DICT, 2023c). The technology stack approach aims to streamline government service delivery, reduce costs, and avoid redundant investments across ICT sectors. The design of all government ICT projects must now align with the technology stack framework to accelerate the country's digitalization agenda. However, as a newly implemented framework, the technology stack is still in its early stages within the government digital transformation agenda, and progress remains to be seen.

Figure 2.
PNG Government Technology Stack 2023



Source: DICT (2023d)

Besides its importance for the digitalization of government services, the PNG government sees ICT technologies among the major drivers for the competitiveness of domestic SME. Prior to the implementation of the SME Policy 2016, previous SME policies and programs had not succeeded due to program misalignment with existing programs, inadequate capacity, and lack of coordination (PNG SME, 2016). A key objective of the PNG SME Policy 2016 was to improve access and application of ICT by (1) providing ICT providers, support systems, and tools for SME business development; (2) establishing an SME Corporation as an ICT information hub for SME to facilitate the access to market information; and (3) implementing adequate ICT policy, legislation, and measures to shield SME from cyber crimes.

However, despite the establishment of the SME Corporation, uncertainty and limited public information about the progress and implementation of the aforementioned policies remained. Regulating SME is also a tedious task because the majority of SME are engaged in the non-formal sector (World Bank, 2019; BTI, 2022). ICT issues have been a particular challenge for SME development in PNG. SME, especially those in remote and rural areas, encounter various barriers and challenges such as poor communication infrastructure, high telecommunications costs, expensive ICT equipment, and lack of a skilled workforce (Mishra & Smyth, 2016; Al Busaidi et al., 2019). SME in PNG not only exhibit low levels of ICT adoption but are also more vulnerable to digital security risks due to limited risk awareness and resources (Mishra & Smyth, 2016; Udhono & Ngui, 2018).

Involving SME in the planning and development of ICT infrastructure is seen as a key instrument to facilitate their business development. Governments have generally understood that providing a transparent and accountable procurement process can assist SME gaining greater access to economic opportunities. The PNG SME Policy 2016 has recognized the importance of public-private partnerships (PPP) as a key policy to stimulate the development and growth of SME. The inclusion of SME in PPP frameworks can provide them with a more equitable access to resources through the collaboration between a public entity and one or more private entities. This is particularly important as major ICT infrastructure projects are typically dominated by large corporations, while SME often encounter constraints and have limited capacity when engaging in infrastructure procurement and delivery (World Bank, 2020a; APEC Policy Unit, 2021). Participation of SME in this kind of partnership between the public and private stakeholders can address this challenge. It also allows SME to gain exposure to the expertise, practices, and insights from the larger counterparts (ENISA, 2018). However, the current regulatory framework and the efforts to encourage SME involvement in ICT infrastructure through PPP are still in their nascent stages in PNG. Despite being one of the few Asia-Pacific Island Developing States (SIDS) with a PPP Act (UNESCAP, 2019) and having enacted enabling policies such as the National SME Policy, there is a lack of corresponding implementing regulations, guidelines, and measures that can create a conducive environment for SME in PPP initiatives.

“The inclusion of SME in PPP frameworks can provide them with a more equitable access to resources through the collaboration between a public entity and one or more private entities. This is particularly important as major ICT infrastructure projects are typically dominated by large corporations, while SME often encounter constraints and have limited capacity when engaging in infrastructure procurement and delivery.”

In general, the Public Private Partnership Act 2014 stipulates that the PNG Government may enter into a PPP with the private sector in investment, financing and/or delivering critical infrastructure, including those under the telecommunication sector. The Public Private Partnership Policy 2014 (a supplementary document to the Act) clarifies the scope for the PPP policy. Public-private projects are those with a total cost of Papua New Guinean Kina / PGK 50 million (approx. US$14 million) and above, but the National Executive Council (NEC), also known as the PNG government cabinet, may alter the minimum value of PPP projects. The Act also established a PPP Center to assist the relevant public body — including line agencies, provincial or local government, and state-owned enterprises — in determining the form of private sector participation in the PPP project. Arrangements between a public body and the private partner are subject to approval by the Minister and the NEC.

ICT Infrastructure Funding

The PNG MTDP IV 2023–2027 has highlighted key investment areas in the ICT sector, such as the program for national telecommunication infrastructure, the national satellite program, the national cybersecurity program, government and private network infrastructure, and government cloud and digital services. National Security has been elevated to a priority in MTDP IV and seeks national intelligence, cybersecurity, and national business protection in bilateral and multilateral partnerships.

To finance the development of ICT and other priority sectors, the MTDP identified several primary financial sources, such as public investment, foreign direct investment (FDI), and loans and grants. PPP are predominantly steered towards the natural and mining sectors, because these are the main sources of the country's export revenues. They are not included as one of the targeted financial sources for the ICT sector.

Universal access and services in ICT is generally defined as the aim of achieving affordable, equitable, quality and efficient information and communication services to all individuals (ITU, 2002). The scope of universal provision of ICT services includes telephony, broadcasting, and internet or broadband access (World Bank, 2012). In PNG, the UASF is the key source of funding for ICT related projects (Table 1) that extend digital infrastructure to the most disadvantaged and underserved regions. The National Information and Communication Technology Act 2009 on Universal Access and Service Regime section established the UASF to promote the long-term economic and social development of PNG. According to the Act, the UASF trust receives government contributions, industry levies, monies paid by any persons, and other grants or loans. Operator licensees are mandated to contribute to the fund by paying a percentage of their net revenues. The percentage is not a fixed number, rather NICTA will annually determine the appropriate proportion levied at the beginning of the fiscal year. Government contributions to the UASF originate from loans or grants of international agencies. The UASF is channelled exclusively to UAS projects and will be disbursed if a project has received ministerial approval.

Table 1.
Proposed UAS Projects for 2023

UAS Initiative	Program	Project	No. of Sites	Indicative Budget (PGK)
Broadband Internet Initiative	Program 1 – Mobile Broadband	Greenfield 4G	19	20,000,000
		4G Upgrade	54	2,500,000
		Blackspot	not specified	1,000,000
	Program 2 – Fixed Broadband	Connect the Schools	4	1,400,000
		Connect the Medics	4	600,000
		Connect our Farmers	4	600,000
		MSME ICT Hubs	4	1,400,000
		Community Networks	1	350,000
		Local Government Offices	4	600,000
Meaningful Connectivity Initiative	Program 3 – Digital Literacy	Training Component for the Fixed Broadband Connectivity Project	12	50,000
		Public Awareness and Capacity Building to support Digital Government Plan 2023-2027	4	75,000
		Public Digital Skills Training Project	5	75,000
	Program 4 – ICT Applications and Content Development	Digital Government Applications and Content Projects	1	100,000
		Public Applications and Content Projects	1	100,000
	Program 5 – Affordable Smart Devices	Smart 4G Mobile Devices Projects	not specified	200,000
		Fixed Broadband Devices	21	200,000
		Set-top Boxes	not specified	400,000
Broadcasting Initiative	Program 6 – Radio Broadcasting	TV-Analog to Digital	3	1,400,000
	Program 7 – Television Broadcasting	Radio	3	1,200,000

Source: A Consultative Paper on the Proposed UAS Projects for 2023 (NICTA, 2022)

Other investments in ICT infrastructure follow the Public Finances (Management) Act 1995. It regulates funding for ICT projects that originates from the national budget and in the form of transferred grants to provincial and local governments. Within each fiscal year, PNG's national budget shall separate appropriations for a development budget for approved projects. The makeup of the budget is raised through the imposition of taxes and raising of loans as authorized and controlled by the Parliament. The Act's part IX on provincial and local-level governments stipulates that conditional grants for infrastructure development shall be made by the national government to provincial and local governments. The Act also allows and stipulates that government contributions to donor-funded projects shall be transferred to trust accounts to ensure the targeted use of dedicated funds and prevent the diversion of resources.

The final source of funding, not just for ICT infrastructure projects, are domestic and foreign investments. The Investment Promotion Act 1992 aimed to promote and facilitate investments in PNG by domestic or foreign actors. The Act allows foreign investors to engage in building, construction or assembly projects. Activities that were reserved for citizens and national enterprises were listed in the Investment Promotion Regulation 1992. Activities related to telecommunications and ICT are not included in the list, except for 'Installation and servicing of Telephones, Telex, Data, Facsimile, Cellular mobile, HF, Trunk mobile, Coastal radio'.

The new government led by Prime Minister James Marape that took office right before the global pandemic in 2019 is struggling to reverse the trend of dwindling FDI in PNG with only US$90 million in 2021 (World Bank, 2022b). Among the areas that provide opportunities for foreign investors is the telecommunication sector. Digicel Pacific that holds the largest market share in PNG has been acquired by Telstra Australia and Vodafone PNG — Amalgamated Telecom Holdings Ltd. and entered PNG as the third mobile operator. Anticipated investment exceeds US$399 million according to the Investment Climate Statement of International Trade Administration of the U.S. Department of Commerce (U.S. Dept. of Commerce, 2022a). Moreover, the Special Economic Zone Authority Act from 2019 provides new companies that operate in the zones with concessions and tax relief in the first 10 to 15 years. The Ihu Special Economic Zone was the first to be approved and received government funding (U.S. Dept. of Commerce, 2022b).

"As an essential bridge between Asia and the Pacific, PNG's strategic position and its abundant natural resources have the potential to attract FDI, particularly from China and Australia."

As an essential bridge between Asia and the Pacific, PNG's strategic position and its abundant natural resources have the potential to attract FDI, particularly from China and Australia (Vats, 2020). Both countries have provided funding for PNG's key infrastructure projects, including ICT and submarine communication cables (Table 2). As a traditional player in the Pacific, Australia has invested some US$6 billion worth of aid to PNG between 2008 to 2021. However, only US$71.65 million of its financial assistance has been allocated to ICT projects, including the Coral Sea Cable System (CS2), as reported by the Lowy Institute Pacific Aid Map project (Lowy Institute, 2022). China on the other hand, exerted its influence in the region by providing US$950 million during the same period, with one-third (US$327 million) going into ICT projects, including the Kumul Submarine Cable Network (KSCN) (Lowy Institute, 2022).

Table 2.
Active Submarine Cable Networks in PNG

Name	Deployment Scope	Route	Year	Ownership	Funding
PIPE Pacific Cable-1	Interregional	Australia to Papua New Guinea and Guam	2009	Private	Private company from Australia
PNG LNG	Domestic	Papua New Guinea	2014	SOE	Papua New Guinea government and private companies (oil and gas platforms)
Kumul Submarine Cable Network	Domestic	Papua New Guinea and Indonesia	2020	SOE	Papua New Guinea government and Exim Bank loan (China)
Coral Sea Cable System	Interregional	Australia to Papua New Guinea and Solomon Islands	2020	SOE from Papua New Guinea and joint venture company from Solomon Islands	Australian government

Source: compiled from TeleGeography (2023), UNCTAD (2023), and Institute of National Affairs (2021).
Note: The Australia-Papua New Guinea-2 (deployed 2006) was decommissioned in 2021. Table 2 only includes operational cables at the time of writing.

The laying of two latest subsea fibre-optic cables in PNG, the KSCN and the CS2, are considered part of the 'battle for influence' between China and Australia in the Pacific region. Most of PNG's infrastructure projects are funded by international partners and technology mostly originates from third-party providers (Watson, 2021). The KSCN is part of the Chinese Belt and Road Initiative while the CS2 subsea cable deployment is funded by Australia and part of Australia's Pacific Step-up that serves the core purpose of ensuring the Pacific Islands won't fall under the influence of China (Layton, 2022). The two projects have been seen as competing for influence and leverage in PNG and the Pacific, where both China and Australia have strategic and economic interests. The projects have also raised concerns about potential security implications of giving Chinese or Australian authorities access to sensitive data and communication in the region (Wesley, 2020; Parkes, 2021).

The KSCN—a 5,457 km submarine fibre optic cable linking fourteen PNG coastal provinces and neighboring Indonesia—was financed to around 85% through a concessional loan from China's Exim Bank and the remaining 15% were supplied by the PNG Government through PNG DataCo Ltd.'s parent company Kumul Telikom Holdings (Figure 3). The KSCN was set to provide stable, reliable, and high-speed internet connection in PNG and help reduce internet prices as well as driving the overall digital economy by enabling socio-economic development of PNG. Yet, it has been criticized that the landing stations are distantly located from major switching centers of second-tier telecom providers. This can result in high costs and deter customers from benefiting from KSCN (Suwamaru, 2020).

The Kumul Consolidated Holdings' website stated US$270 million (PGK 879 million) as the loaned amount for the KSCN (KCH, n.d.). However, other sources across various media channels have reported different figures. The State Enterprises and Investment Minister, Hon. William Duma, communicated the amount to be US$200 million (PGK 661 million) in August 2018 (The National, 2018; Suwamaru, 2020), while a former PNG Government advisor reported the loan figure to be US$279 million (PGK 1 billion) (Wall, 2020). The discrepancy was also reflected in the Institute of National Affairs' review report in 2021 (BRI Monitor, 2021). Moreover, the actual project loan agreement as well as the borrowing terms of the preferential buyer's credit remain unclear. A lack of vital project information makes it difficult to verify whether the project was completed as per the initial plan and within the budget limit set by the loan. Chinese funds worth US$3.47 million were reportedly also extended to provide maintenance and repair of the KSCN, which was partially destroyed during the devastating earthquake in September 2022 (Telecompaper, 2022; Moises, 2023).

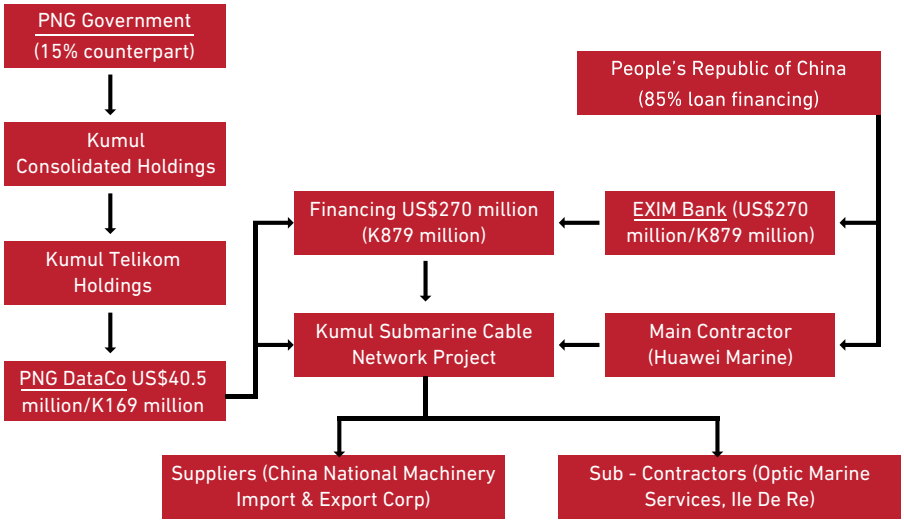
While the PNG Government welcomed the laying of KSCN by Huawei Marine (now HMN Tech), concerns have emerged on how PNG will repay the amount it borrowed from China's Exim Bank to fund the project. AidData's Global Chinese Development Finance Dataset (2021) finds that the underlying commercial contract with PNG DataCo and Huawei was reportedly overpriced by 30-50%, creating a heavy debt load for Kumul Consolidated Holdings (KCH). According to a report published in The Australian, there were also concerns that revenue generated by the Australian-financed CS2 might have been used to cross-subsidize the KSCN by facilitating loan repayment to the China Exim bank (The Australian, 2020; Aiddata, 2021).

Moreover, another Chinese loan of US$53 million for a data center project remains controversial (Moss, 2020; Noone, 2021). The data center was planned by Huawei and meant to host all information of PNG government departments but was deemed below expected cybersecurity standards (Grigg, 2020). The PNG Communication Minister Timothy Masiu labeled the data center a "truly failed investment" and said the loan for its construction should not be repaid (Moi, 2020).

Pacific Island countries, including PNG, are particularly susceptible to debt distress due to the inherent weakness of having limited domestic markets, small populations, limited land and remote geographical location, which all impede exports and imports (Deng, 2022). This vulnerability to debt distress is further exacerbated by the significant Chinese lending without proper financial scrutiny, potentially trapping these island nations[2] in unsustainable debt (Smyth, 2019).

[2] Tonga, Vanuatu and Samoa are already among the countries most heavily indebted to China, according to a Lowy Institute report (Rajah et al., 2019

Figure 3.
Kumul Submarine Cable Network Stakeholder Mapping



Source: The Institute of National Affairs (2021)

The Coral Sea Cable System (CS2) on the other hand was mainly funded by the Australian Government funding through its official development assistance. The cost of the project is approximately US$144 million (AUD200 million) and was carried out in partnership between the Australian Department of Foreign Affairs and Trade (DFAT) and the two infrastructure providers: PNG DataCo Limited and the Solomon Islands Submarine Cable Company Limited (Global Infrastructure Hub, 2020). The CS2 is part of larger Australian investments in infrastructure projects in the Pacific region, strategically aimed at supporting the future digital economies of PNG and the Solomon Islands, as well as to counter China's growing influence in the Pacific region (Submarine Cable Networks, 2019). The 4,700 km fibre-optic submarine cable directly connects Port Moresby in PNG and Honiara in Solomon Islands to the global internet hub of Sydney, Australia. The main contractor involved in CS2 was Australia-based Vocus Communications with France-based Alcatel-Lucent Submarine engaged as a sub-contractor to build and lay cables (Submarine Cable Networks, 2019).

Initially, the CS2 project had been granted to HMN Tech (Huawei), which, in 2017, entered into a contract with the Solomon Island Submarine Cable Company (Huawei, 2017). The former PNG State Enterprises Minister Sasindran Muthuvel reportedly said that Huawei was the preferred communication equipment supplier at that time (The National, 2020). Other reports saw that PNG was obliged to use Huawei equipment because PGK 1.6 billion (about US$470 million) funding for PNG's telecommunications rollout had been sourced from China's Exim Bank (Business Advantage PNG, 2020; The National, 2020). However, the Australian Government's security concern regarding potential Huawei-installed cables from Port Moresby and Honiara to Sydney threw its involvement in the CS2 into question. At the time, Australia had also prohibited Huawei's involvement in its 5G and national broadband networks (Clark, 2021). Concerns that were denied by Huawei alleged that products of the Chinese company might have vulnerabilities that can be exploited by the Chinese government for spying purposes (Hartcher, 2023).

Looking at the public sentiment, some Papua New Guineans expressed their discontent over Australia's attitude towards Chinese investment and aid in their country. There were concerns that an Australian-centric viewpoint overshadowed PNG's status as an independent country, engaging in agreements on equal footing with other sovereign nations (James, 2021). Meanwhile, a strong Chinese footprint in PNG has recently also raised concern among the local people. One such concern is that the socioeconomic benefits of China's multi-billion investments may be benefiting the Chinese living and working in PNG, while the profits fail to meaningfully reach the local population. Moreover, the presence of unfinished or unused Chinese projects has cast doubt surrounding the effectiveness of Beijing's aid, stoking uncertainty and suspicion that it is worsening corruption in the country instead (The Straits Time, 2023). Sentiments like these go partly back to a lack of information, since neither China nor some Pacific Island states publish detailed information about the grants disbursed (Noone, 2021).

Australia remains by far the biggest donor to the Pacific Island nations (PNG, Oceania region, Solomon Islands, Fiji, Federal States of Micronesia) contributing 20% of the official development assistance in the region (US$4.25 billion) in 2020. China had been the second largest donor contributing 14% in 2016 (US$2.36 billion) (Lowy Institute, 2022)[3] but the country's development financing in the region has decreased significantly since 2016. The reasons were seen in limited absorption capacity by the recipient countries and more cost-effective alternatives offered by other development partners (Dayant et al., 2023).

Chinese investment in subsea cables in the Pacific region may have addressed a void caused by a historic lack of Western interest in the Pacific region (Noone, 2021). The Australian Government on the other hand launched the Australian Infrastructure Financing Facility for the Pacific (AIFFP) in 2019 "to provide grant and loan financing for high quality, transformational energy, water, transport, telecommunications and other infrastructure" (AIFFP, n.d.). Approved projects include subsea cables in Palau and the Federated States of Micronesia. Business circles expect that the PNG Government also looks into opportunities created by the AIFFP (Interview, 2023).

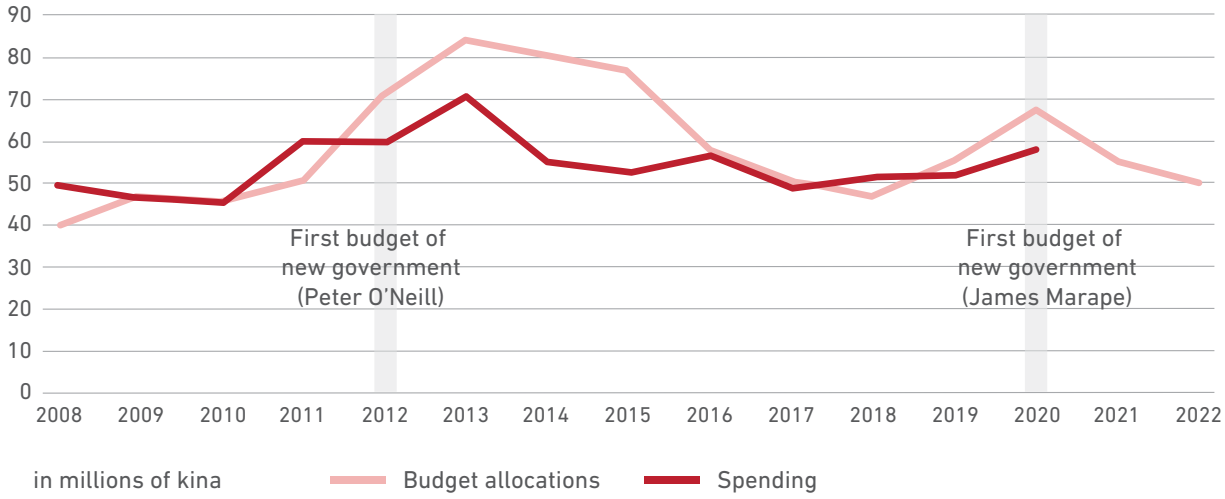
Western governments have increased their efforts to invest in global infrastructure in the 2020s. During their summit in Germany in 2022, the G7 countries agreed on a Partnership for Global Infrastructure and Investment (PGII) to facilitate public and private infrastructure investments. The Partnership aims to mobilize up to US$600 billion by 2027 for infrastructure investments that include connectivity through digital infrastructure (Ministry of Foreign Affairs, Japan, 2023). In a United States-Australia-Japan Joint Statement on Cooperation on Telecommunications Financing, the heads of the three states announced that the United States International Development Finance Corporation (DFC) and Japan Bank for International Cooperation (JBIC) plan to provide US$50 million each in credit guarantees for Export Finance Australia's (EFA) financing package in support of Telstra's above-mentioned acquisition of Digicel Pacific (The White House, 2022). While the PGII does not openly aim to counter China's Belt and Road Initiative (BRI), it is seen as providing an alternative to China's large scale investments in global infrastructure (Savoy & McKeown, 2022).

[3] Interestingly, by the middle of the 2010s, 70% of Chinese aid was reportedly given as concessional loans, while Australian aid came entirely in the form of donations (Adam, 2019).

Funding of capital-intensive projects is burdened with considerable challenges due to the rampant issue of corruption in PNG. Transparency International's Corruption Perceptions Index from 2022 (Transparency International, 2022) placed the country at position 130 out of 180 countries, scoring 30 points out of 100. In 2007, PNG ratified the United Nations Convention Against Corruption (UNCAC), making it the first country in the Pacific region to do so (UNODC, 2021). The ratification of UNCAC signified PNG's commitment to implement measures to prevent and combat corruption, both within its public sector and private sector. Its ratification of UNCAC has led to the development of National Anti-Corruption Strategies and the establishment of the Independent Commission Against Corruption (ICAC), PNG's key anti-corruption platform to investigate and prosecute corruption cases (Allens, 2014).

However, government funding for anti-corruption organisations in PNG has gone through a "boom-and-bust cycle" over the past decade (Walton & Hushang, 2020). New governments initially allocated significant funds and established new organisations to tackle corruption, but then the budgetary support waned over the years. The tenure of PNG's former prime minister, Peter O'Neill (2011 to 2019) was a case in point and also the allocated funding promised by PM Marape's government did not materialize (Figure 4) (Walton & Hushang, 2022).

Figure 4.
Total Anti-corruption Allocations and Spending (2021 prices)



Source: Walton & Hushang (2022)

Meanwhile, examining the extent of corruption in ICT-related projects in PNG meets with the scarcity of comprehensive data. Additionally, the limited transparency displayed by government agencies, such as DICT and NICTA, that are responsible for managing funds in ICT projects, exemplified by the case of the KSCN subsea-cable discussed earlier, further hinders sourcing specific and reliable information. Without a complete dataset, it becomes difficult to gain a comprehensive understanding of the corruption landscape in these projects.

When examining the transparency levels of the two projects, CS2 appears to provide more information than KSCN. The CS2 project published the contract, design specifications, environmental and social safeguards, and other relevant documents on their official website (Coral Sea Cable Company, n.d.). In contrast, the KSCN project does not have a dedicated website and has not made any of these official documents publicly accessible, making it difficult to evaluate the costs, benefits, risks, and impacts of the project. The CS2 project has set up processes to involve civil society, media, and local communities in discussions, feedback, and awareness efforts. The KSCN project has not made similar efforts to engage stakeholders, even though some local groups raised concerns about KSCN's environmental and social impacts (BRI Monitor, 2021).

"The PNG government has recognized the importance of cybersecurity in protecting critical infrastructure, securing government systems, and promoting cybersecurity awareness. This commitment goes along with the government's participation in various regional initiatives and programs related to cybersecurity."

The PNG government has recognized the importance of cybersecurity in protecting critical infrastructure[4], securing government systems, and promoting cybersecurity awareness. This commitment goes along with the government's participation in various regional initiatives and programs related to cybersecurity[5].In 2018, the Department of the Australian Prime Minister, NEC, and NICTA launched a project that included a National Cyber Security Center (NCSC) and a computer emergency response team (CERT) to offer cybersecurity services (eGov Review, 2021). Unfortunately, the Department of Finance was exposed for ignoring endpoint protection services supplied by the NCSC or using the CERT when it was hit by a ransomware attack that crippled the country's financial system (Tarabay, 2021).

Following the ransomware attack in late 2021, the DICT released the National Cyber Security Policy (NCSP) for PNG (DICT, 2021a). The Policy outlines the government's vision, goals, objectives, as well as the evolving governance and the principles to minimize cybersecurity-related risks that may adversely affect its ICT development and the overall economy of PNG. In chapter 4.1 of the NCSP, the government also sets the initial task to transition the NCSC from being under partial foreign control to total national administrative control. This is meant to be completed when the current operation capacity of the NCSC will evolve into a National Cyber Coordinating Center (N3C).

[4] ICT-related infrastructure has been included in the definition of PNG's national critical infrastructure and essential services (See National Cyber Security Policy 2021).
[5] Such as the Boe Declaration, Australian Cyber Cooperation Program, Pacific Cyber Security Operational Network (PaCSON), Cyber Safety Pasifika, Pacific Islands Law Officers Network (PILON), and Pacific Islands Forum Secretariat Cyber Assessment.

Along with the government's cybersecurity plans, the MTDP reiterates strategies to improve government ICT services while maintaining security of these systems and the cyber safety of PNG citizens. Notably, the document includes investments worth PGK 2.03 billion (about US$567 million) for national ICT-related cybersecurity programs by the year 2027. The project funding is anticipated to be largely sourced from government funds and/or in partnership with international development partners — with no explicit mention of PPP funding.

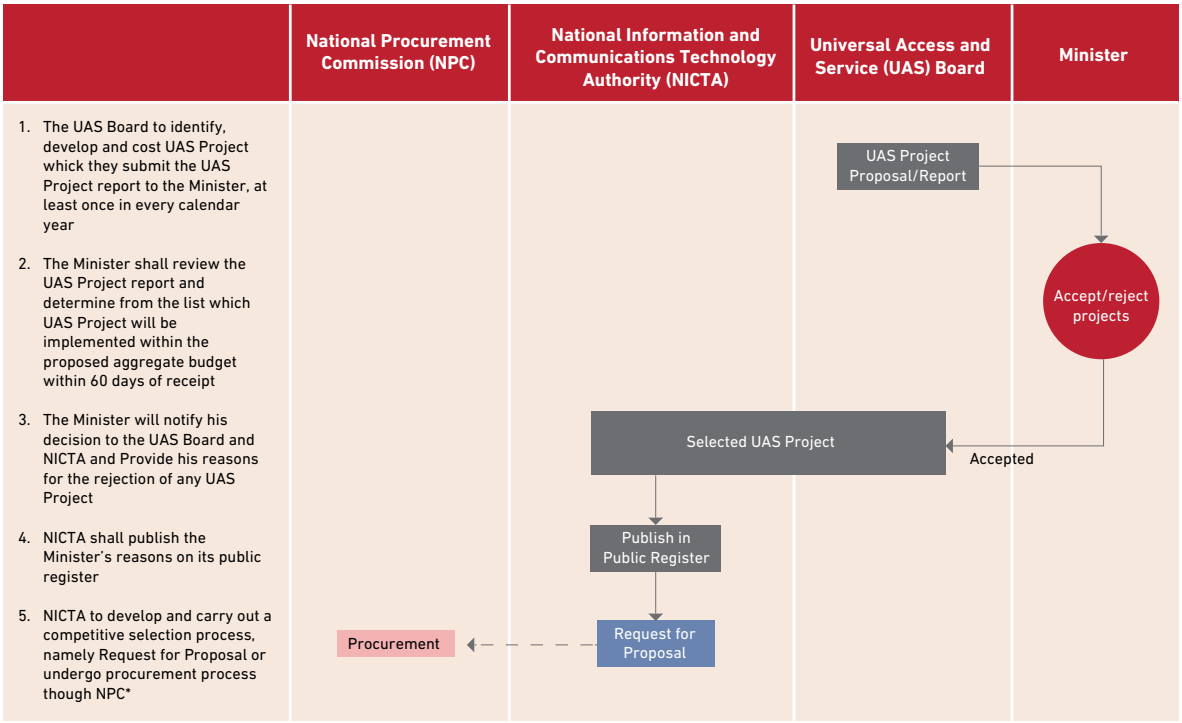
ICT Infrastructure Procurement

The PNG Government has introduced a standardized public procurement system for ICT-related projects. Agencies like the National Procurement Commission (NPC) and NICTA carry out specific functions from project approval to tender and bidding management. Key regulations underpinning the procurement system for ICT-related projects include:

- National Information and Communication Technology Act 2009 on Universal Access and Service Regime (for UAS-funded Projects);
- The National Procurement Act 2018 and The National Procurement (Amendment) Act 2021;
- Public Private Partnership Act 2014 and Public Private Partnership (Amendment) Act 2022.

Approvals of UAS projects are governed under the National Information and Communication Technology Act 2009, also known as the NICTA Act 2009. UAS project proposals are submitted by the UAS Board — consisting of NICTA's chairman, heads of NICTA's departments in charge of ICT, national planning, and financial management, as well as a member from the private sector appointed by the Head of State. The UAS Board identifies and develops a list of proposed UAS projects ranked in order of priority. Proposals must include estimates of the proposed aggregate budget for all UAS projects and shall be submitted at least once in every calendar year. Within 60 days of receipt, the minister shall review and determine which UAS Projects are accepted and will be implemented within the proposed budget. The minister must also provide justifications for rejections of any UAS projects. The decision will then be notified to the UAS Board and NICTA.

Figure 5.
UAS Project Approval



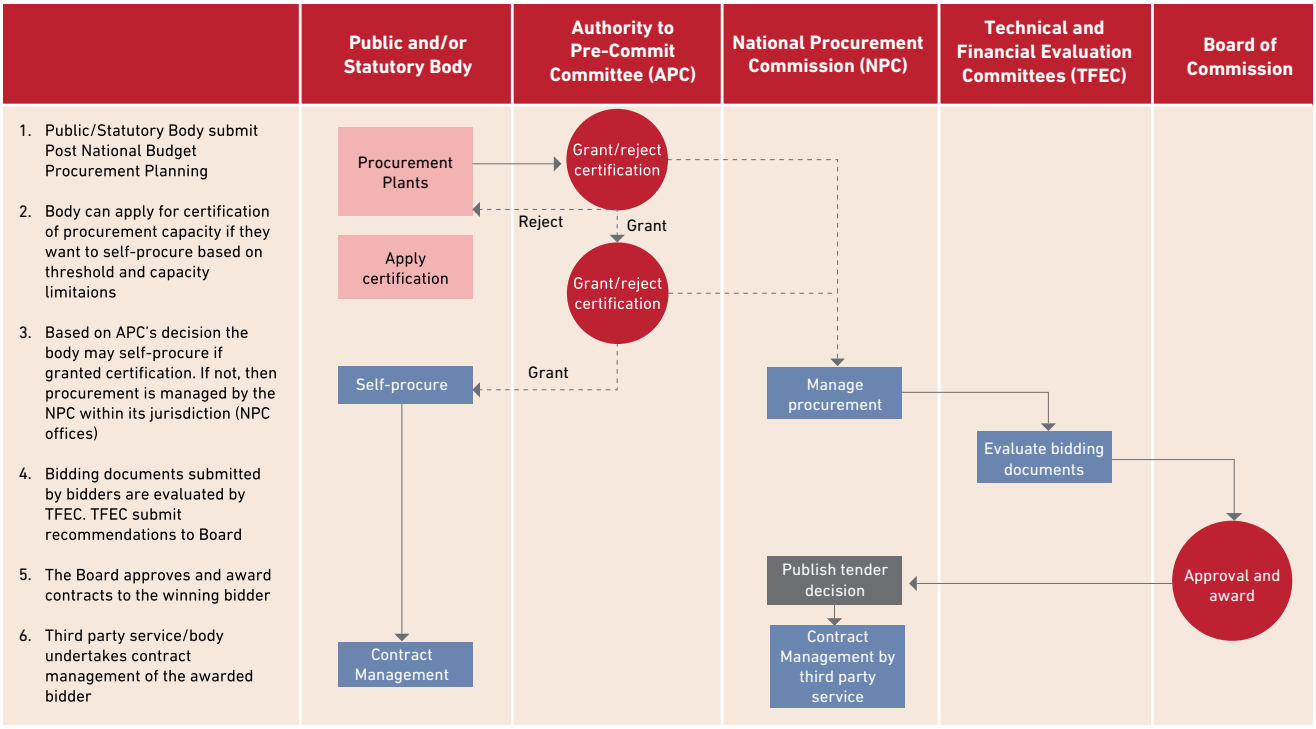
*) Procurement process as enacted through National Procurement Act 2018, post the National Information and Communication technology Act 2009

Source: The National Information and Communication Technology Act 2009, illustration created by authors

Once approved by the Minister, NICTA has to conduct a competitive process to select a winning bidder. Bidders need to demonstrate their financial, operational, and technical capacity to undertake and complete a UAS project. Requested documents include quality network design, deployment plan and subsidy amount required. Most importantly, an eligible bidder should have an operator licence, ICT licence, and any other obligations related to the operator licence. The operator's obligations then include the payment of the Universal Access and Service Levy into the UAS Fund.

While the NICTA Act 2009 authorized NICTA to undertake independent procurement processes, as a public/statutory body of PNG, NICTA also needs to abide by all procurement rules of the National Procurement Act 2018. The Act and its amendment in 2021 limit the authority of NICTA and stipulate that UAS projects worth more than PGK 50,000 (approx. US$14,000) need to follow the standardized procurement system set by the National Procurement Commission. UAS projects worth more than PGK 1 million (approx. US$280,000) need approval by the National Procurement Commission (Table 3). Section 5 subsection 1 of the Act highlights that the provision of this act applies to all procurement activities by public and/statutory bodies within the meaning of the Public Finances (Management) Act 2015. This also applies to all non-UAS projects related to ICT infrastructure.

Figure 6.
Workflow of Procurement Process administered by the National Procurement Commission



Source: The National Procurement Act 2018, illustration created by authors

In the public procurement mechanism for all ICT projects, the National Procurement Act 2018 and its amendment (the National Procurement (Amendment) Act 2021) stipulate that a public/statutory body shall submit their procurement plans to the Authority to Pre-Commit Committee (APC) after Parliament has passed the national budget (Figure 6). Public/statutory bodies in the ICT sector include the Ministry of Information and Technology, NICTA, and others involved in digital transformation initiatives. The APC shall review the procurement plans, decide on the approval and then delegate whether the procurement would be carried out by the commission or independently by the public/statutory body. The delegation is based on the procurement threshold as outlined in the National Procurement (Amendment) Act 2021 (Table 3) (Pacific Tenders, 2021).

Table 3.
Procurement Threshold According to the National Procurement (Amendment) Act 2021

Designation	Value	Notes
Public/Statutory Body	≤ K 50,000.00	• for minor procurements • using a simplified procurement system approved by the commission
Public/Statutory Body	K 50,001.00 - K 1,000,000.00	using a standardized procurement system approved by the commission
National Procurement Commission	> K 1,000,000.00	for major procurements
Provincial Committee of the Commission Board	≤ K 10,000,000.00	• using a standardized procurement system approved by the commission • Special committee of the board refers to committee of the board at the public/ statutory body
District Committee of the Commission Board	≤ K 5,000,000.00	
Special Committee of the Commission Board	≤ K 5,000,000.00	

Source: The National Procurement (Amendment) Act 2021, Pacific Tenders, 2021, table created by authors

The National Procurement Act 2018 and the establishment of the NPC in 2019 marked a significant reform of the institutional framework and management of public procurement in PNG. The effort came in response to shortcomings in institutional capacity as well as corruption and malpractice in government procurement (OECD, 2010; Esila, 2019). However, governance gaps related to ICT procurement in PNG continue to exist.

Firstly, the procurement system follows clearer standards but it still appears somewhat fragmented by two particular exceptions. The PPP Act 2014 streamlined PPP regulations that included ICT projects in terms of public financial management, land acquisition/ownership, licensing requirements, etc. The PPP (Amendment) Act 2022 addressed uncertainties regarding the coordination and shared responsibilities between the government's PPP Center and the NPC, but it also stipulated that PPP provisions do not fall under the arrangements of the National Procurement Act. Moreover, Section 7 in the Procurement Act on Application to International Agreements states that when the PNG Government enters into an agreement (includes treaty, convention, loan or negotiated grant) with one or more states or an international organisation, the conditions or obligation of the state in such agreements that are in conflict with the National Procurement Act 2018 shall prevail over the provisions of the Act. These two exceptions for PPP and international agreements undermine the national procurement system and can cause regulatory uncertainties in the public procurement process.

"The National Procurement Act 2018 and the establishment of the NPC in 2019 marked a significant reform of the institutional framework and management of public procurement in PNG. The effort came in response to shortcomings in institutional capacity as well as corruption and malpractice in government procurement."

Secondly, transparency remains a challenge in public procurement. Information regarding public procurement tenders and bids are available on NPC and NICTA websites but there are limitations in terms of clear and easily accessible documentation about procurement decisions and outcomes. This includes the disclosure of procurement information related to bid evaluations and contract awards. For instance, the Kumul Submarine Cable Network project, the number of tendering firms and project completion costs have not been made public (BRI Monitor, 2021). Similarly, in the process of PPP important documents such as tender notices, PPP assessments, and PPP contracts are not made available online (ADB, 2020; World Bank, 2020b). However, since the PPP Center was only established in 2022, more efforts might be undertaken in the future.

Regulatory gaps in the transparency of ICT procurement management in PNG persist also because of the absence of a comprehensive Right to Information (RTI) law that would enforce public access to information. Despite the mandate outlined in the National Right to Information Policy 2020-2023 for access to information concerning various public sector activities, including ICT infrastructure procurement (DICT, 2021b), the public still encounters challenges in accessing such information.

Additionally, under section 37 of the National Procurement Act 2018, the NEC may declare a procurement to be sensitive in terms of defence or national security aspects. Procurements classified as such may be subject to exceptions in which all records of the procurement are to be held secure and confidential even after a contract has been awarded and the method of procurement is determined by the board of the commission. Section 42 on Transparency and Confidentiality details caveats to transparency in which information related to the procurement may not be disclosed if this results in prejudice to the security and sovereignty of the state, breach of the law, reveal proprietary information protected by the law or international treaty, cause potential harm to the interests of any public/statutory body or put a bidder at a disadvantage in contractual commercial negotiations or the commercial competition. While the government needs to balance the need for transparency in procurement with safeguarding national security and strategic interests, concern lies in the lack of well-defined standards and clarity regarding the criteria for refusing disclosure of information. The length of this list may unduly compromise the transparency and public disclosure of information related to ICT infrastructure procurements. It remains necessary to formulate clear indicators that define infrastructure either as 'critical' and/or 'sensitive' and guide disclosure decisions by the NEC.

“Regulatory gaps in the transparency of ICT procurement management in PNG persist also because of the absence of a comprehensive Right to Information (RTI) law that would enforce public access to information.”

Besides procedural issues in the procurement of ICT infrastructure, there also remains a lack of competition among investors. Weak and ineffective competition coupled with substantial political influence within the ICT market affect the business management and service quality of SOE in PNG's ICT sector (Fallon, 2017; Howell et al., 2018; UNESCAP, 2019). The influence of the government cabinet (NEC) is particularly strong with its authority to appoint SOE directors, approve corporate plans, set remuneration levels, manage tenders, and engage consultants (U.S. Dept. of State, 2020; BTI, 2022). Section 12 of the National Procurement Act demands that contracts for procurements with a value in excess of PGK 10 million need approval of the NEC. SOE exert significant dominance in the ICT market, thus raising the concern of political interference in the awarding of procurement contracts and the competitiveness of the bidding process (UNESCAP, 2021; U.S. Dept. of Commerce, 2022b). Three major SOE in the telecommunications sector,

namely PNG DataCo, Telikom, and bmobile, operate under the umbrella of Kumul Consolidated Holdings (KCH), which owns the government's non-natural resource assets and state-owned entities (KCH, n.d.). These three SOE are the sole wholesale service providers in PNG, with DataCo having a monopoly on the international and domestic fibre cable networks (World Bank, 2020a). The presence of state-owned vertically integrated companies across the entire ICT supply chain remains a significant barrier to attracting private investment and enhancing service quality for consumers through increased competition (UNESCAP, 2021).

The PNG government aimed to foster the role of SME in ICT procurement by setting an extensive Reserves Activity List (RAL) in the PNG SME Policy. Various sectors, including information technology, are reserved for 100% domestic ownership (PNG SME, 2016; PWC, 2016). Specifically listed activities in the information technology sector include IT service businesses, computer technology repair and maintenance, website development and hosting, IT network cabling, and retailing of IT consumables. While such a policy was intended to safeguard domestic SME, it poses challenges related to investment and knowledge transfer from foreign companies (Nicholas, 2016; BTI, 2022). This level of protectionism that shields domestic SME from external competition can limit the inflow of international expertise and technologies and affect the development and diversification of SME in PNG.

"The presence of state-owned vertically integrated companies across the entire ICT supply chain remains a significant barrier to attracting private investment and enhancing service quality for consumers through increased competition."

Moreover, the government does not mandate infrastructure sharing[6] for both passive components like towers, sites, ducts and poles, and active components like spectrum and switches among telecommunication operators (ITU, 2022b). NICTA began conducting consultations regarding infrastructure sharing for passive infrastructure, and regulations concerning the sharing of telecommunication towers are still being developed (World Bank, 2020a). In practice, however, open access through infrastructure sharing has been limited due to business interests, despite the potential benefits it could bring to multiple network operators and service providers, including cost reduction and efficient resource utilization (UNESCAP, 2018).

[6] The International Telecommunications Union defines infrastructure sharing as "various kinds of arrangements by which an owner of telecommunication network facilities (including but not limited to, antennas, switches, access nodes, systems, ducts, poles, towers, premises and rights of way) agrees to share access and usage of those facilities with another legal entity, normally another network operator or service provider, subject to a commercial agreement between the parties" (ITU, 2022c). It contributes to improved competition and economies of scale, facilitating efficient network operation and more affordable access (ITU, 2018)

CONCLUSIONS

ICT infrastructure plays a pivotal role in driving digital transformation. While PNG government strategies intend to facilitate the development of digital infrastructure through several policies and regulations, challenges still persist. This report has highlighted the current regulatory environment and governance gaps in the planning, funding, and procurement of PNG's ICT infrastructure. Key lessons can be derived to enhance competition, transparency, and security of the ICT industry in the digitally emerging country.

The planning process of ICT development projects faces several governance gaps:

- There are instances where the UAS Secretariat and DICT both take the roles of executing and lead agencies and the boundaries in the responsibilities between the two bodies remain unclear. It appears relevant that NICTA and the DICT act in a coordinated manner and state publicly which agency shall take the leading role in specific ICT projects in order to avoid confusion and inefficiencies among multiple stakeholders. Inadequate capacity and lack of coordination among government bodies has resulted in program misalignment with the current MTDP and other national development goals and project poor management.

- The national government exercises control over key policy areas and, in effect, provides local communities and stakeholders with little influence on ICT policies. This creates additional risks for the private sector when making long-term investment decisions.

- PNG has limited capacity to collect and publish real-time statistical data, particularly also related to the ICT sector which hinders the planning of large-scale capital-intensive infrastructure that extends to all parts of the country. The coordination of data collection and management among government agencies and departments has been limited while the ICT regulatory bodies NICTA and DICT lack sufficient ICT project databases, performance indicators, and publicly accessible project trackers. The absence of public information regarding important data on ICT projects and lack of standardized evaluation/monitoring reports of government bodies overseeing the ICT sector undermines transparency and accountability.

- Coordination also remains a challenge between general operations of government entities. The Integrated Government Information System (IGIS) was found ineffective and never fully executed. It was followed by the PNG Digital Transformation Policy in 2020 to enhance public access to information and to accelerate the use of cloud-based applications for inter-agency information sharing. Since then, specific programs and investments have been initiated but when each elected government shifts priorities it also creates a challenge for large-scale and long-term investment decisions.

- SME face stiffer challenges than SOE which dominate the digital infrastructure. Participation of SME in PPP can help address this challenge, but the current regulatory framework and the efforts to encourage SME involvement in ICT infrastructure through PPP are still in their nascent stages in PNG. There remains a lack of implementing regulations, guidelines, and measures that can create a conducive environment for SME in PPP initiatives.

Governance gaps also burden the funding of ICT development in PNG:

- PPP are predominantly steered towards the natural and mining sectors, because these are the main sources of the country's export revenues. They are not included as one of the targeted financial sources for the ICT sector.

- Most of PNG's infrastructure projects are funded by international partners and the telecommunication sector provides opportunities for foreign investors. Subsea cable projects have raised concerns, however, about potential security implications of giving Chinese or Australian authorities access to sensitive data and communication in the region. A data center that was planned by Huawei and meant to host all information of PNG government departments was discontinued because it was deemed below expected cybersecurity standards and therefore considered a failed investment. Cybersecurity standards have yet to be clearly established from the first to the last mile of ICT infrastructure and become criteria in the procurement process. Moreover, government efforts need to concentrate on building capacity in cybersecurity expertise and providing necessary resources to conduct rigorous project evaluation. Currently, vulnerabilities within ICT supply chains, both in technical infrastructure and regulatory safeguards, remain difficult to identify and address.

- An existing vulnerability to debt distress has been further exacerbated by significant Chinese lending in the mid 2010s without proper financial scrutiny, potentially trapping these island nations in unsustainable debt. There are reports that the KSCN project was overpriced by 30-50%, creating a heavy debt load. It remains important to keep borrowing from foreign sources within generally accepted standards of fiscal management. This also applies to the foreign borrowing of SOE, since they dominate ICT infrastructure development.

- Applying standards of prudent financial management also includes the necessity to increase transparency and accountability in some large-scale infrastructure projects. The CS2 project published the contract, design specifications, environmental and social safeguards, and other relevant documents. In contrast, the KSCN project has not made any of these official documents publicly accessible, making it difficult to evaluate the costs, benefits, risks, and impacts of the project. Moreover, the CS2 project has set up processes to involve civil society, media, and local communities in discussions, feedback, and awareness efforts but the KSCN project has not made similar efforts to engage stakeholders. Stronger public participation in the ICT decision making process can be achieved through regular inclusive and board-based public-private dialogue forums, public consultations, workshops, and surveys to solicit feedback, ideas, and concerns from citizens, civil society organisations, academia, and local communities.

- Funding of capital-intensive projects is also burdened with considerable challenges due to the rampant issue of corruption in PNG. Transparency International's Corruption Perceptions Index from 2022 placed the country at position 130 out of 180 countries, scoring 30 points out of 100. The institutional capacity of PNG's anti-corruption agency ICAC needs to be strengthened.

Finally, there remains room for improvement in the governance of ICT infrastructure procurement:

- The procurement system has adopted certain standards but it remains fragmented by exceptions made for PPP and in the provision of the National Procurement Act that government agreements with one or more states or an international organisation prevail if they are found in conflict with national procurement standards. These exceptions undermine the national procurement system and can cause regulatory uncertainties in the public procurement process.

- Transparency remains a challenge in public procurement. While information regarding public procurement tenders and bids are available on NPC and NICTA websites, there is limited disclosure of procurement decisions and outcomes. In the process of PPP, important documents such as tender notices, PPP assessments, and PPP contracts have yet to be made available online. These gaps could be addressed by a comprehensive Right to Information (RTI) law that would enforce public access to information.

- Uncertainties also remain, when the NEC declares a procurement to be sensitive in terms of defence or national security aspects. All records of such procurements are to be held secure and confidential even after a contract has been awarded. Concern lies in the lack of well-defined standards and clarity regarding the criteria for refusing disclosure of information. It remains necessary to formulate indicators that define infrastructure either as 'critical' and/or 'sensitive' and guide disclosure decisions by the NEC.

- Besides procedural issues, there also remain substantive issues due to a lack of competition among investors. The presence of state-owned vertically integrated companies across the entire ICT supply chain remains a significant barrier to attracting private investment and enhancing service quality for consumers through increased competition. Weak and ineffective competition coupled with substantial political influence within the ICT market affect the business management and service quality of SOE in PNG's ICT sector. The influence of the government cabinet (NEC) is particularly strong and with SOE exerting significant dominance in the ICT market, there are concerns of political interference in the awarding of procurement contracts and the competitiveness of the bidding process. To facilitate stronger private sector participation and attract FDI, the government should proactively pursue ICT investment-friendly policies, such as tax incentives, transparent licensing and procurement processes, and efforts to reduce barriers to market entry.

- The role of SME in ICT procurement is supposed to be strengthened by setting an extensive Reserves Activity List (RAL) in the PNG SME Policy reserving information technology, for instance, for 100% domestic ownership. This policy poses challenges related to investment and knowledge transfer from foreign companies. It shields domestic SME from external competition and limit the inflow of international expertise and technologies, which in turn affects the development and diversification of SME in PNG.

- There is no government mandate for the infrastructure sharing of both passive components like towers, sites, ducts and poles, and active components like spectrum and switches among telecommunication operators. NICTA began conducting consultations regarding infrastructure sharing for passive infrastructure, and regulations concerning the sharing of telecommunication towers are still being developed. In practice, however, open access through infrastructure sharing remains limited despite the potential benefits.

It remains crucial to promote further coordination and meaningful collaboration among public and private stakeholders to foster a conducive environment for the development of PNG's ICT infrastructure. Through collaborative efforts, these stakeholders can cultivate a regulatory ecosystem that aligns all efforts in support of ICT infrastructure development and paves the way for a sustainable, secure, and resilient ICT industry for Papua New Guinea.

REFERENCES

Adam, C. (2019). *Rivalry between Australia and China in the Pacific Islands*. PAGEO Research Institute. http://www.geopolitika.hu/en/2019/04/10/rivalry-between-australia-and-china-in-the-pacific-islands/

Aiddata. (2021). *Project ID: 61213 - China Eximbank provides $229.1 million preferential buyer's credit for Kumul Submarine Cable Project*. William & Mary. https://china.aiddata.org/projects/61213/

AIFFP. (n.d.). *Loans and grants*. Australian Infrastructure Financing Facility for the Pacific. https://www.aiffp.gov.au/loans-and-grants

Al Busaidi, N. S. A., Bhuiyan, A. B., & Zulkifli, N. (2019). The critical review on the adoption of ICTs in the small and medium enterprises (SMEs) in the developing countries. *International Journal of Small and Medium Enterprises, 2*(2): 33-40. https://doi.org/10.46281/ijsmes.v2i2.437

Allens. (2014). *Recent anti-corruption developments in Papua New Guinea*. Allens.

Alliance for Affordable Internet. (2022). *2022 prices and affordability of smartphones and feature phones by country.* Alliance for Affordable Internet. https://a4ai.org/research/device-pricing-2022/

Asia-Pacific Economic Cooperation [APEC] Policy Support Unit. (2021). Final review of the APEC Supply-Chain Connectivity Framework Action Plan 2017-2020 (SCFAP-II). APEC. https://www.apec.org/docs/default-source/publications/2021/11/final-review-of-the-apec-supply-chain-connectivity-framework-action-plan-2017-2020-(scfap-ii)/221_psu_final-review-of-scfap-ii.pdf?sfvrsn=9921e935_2

Approach Paper, Country Program Evaluation - Papua New Guinea An Evaluation of World Bank Support FY08-22. (2022). *World Bank Group Approach Paper*. https://doi.org/10.1596/37753

Arnold, M., (2017, September). *IGIS lacks capacity to support IFMS*. Post Courier. https://www.postcourier.com.pg/igis-lacks-capacity-support-ifms/

Asian Development Bank [ADB]. (2020). Public–private partnership monitor: Papua New Guinea. ADB. https://www.adb.org/publications/public-private-partnership-monitor-png

ASPI. (2020). *ICT for Development in the Pacific Islands: An assessment of e-government capabilities in Fiji, Papua New Guinea, Samoa, Solomon. Australian Strategic Policy Institute*. https://s3-ap-southeast-2.amazonaws.com/ad-aspi/2020-02/ICT%20for%20development%20in%20the%20Pacific%20islands.pdf?x_oS.r8OVVfTlxxgNHI58k_VL45KC83H

BRI Monitor. (2021). *Kumul Submarine Cable Network Project (KSCNP)*. BRI Monitor. https://www.brimonitor.org/case-studies/kumul-submarine-cable-network-project-kscnp/#1614655896696-2d7fad11-0659

BTI Transformation Index. (2022). Papua New Guinea country report 2022. BTI Transformation Index. https://bti-project.org/en/reports/country-report/PNG

Business Advantage PNG. (2021, June 16). *In brief: new telecommunications project for Papua New Guinea and other business stories*. Business Advantage PNG. https://www.businessadvantagepng.com/in-brief-new-telecommunications-project-for-papua-new-guinea-and-other-business-stories/

Clark, E. (2021, July). *Undersea cables bring Pacific nations online, but there are concerns China is trying to tap in*. ABC News. https://www.abc.net.au/news/2021-07-24/china-huawei-build-png-cable-that-connects-to-sydney/100249922

Communication Department of Information and Communications Technology. (2023). *Our Mandate*. DICT. Retrieved 2023, from https://www.nicta.gov.pg/about-us/who-are-we/

Connect PNG. (2021). *Connect PNG (implementation and funding arrangements) Act 2021*. National Parliament of Papua New Guinea. https://www.parliament.gov.pg/uploads/acts/21A_18.pdf

Coral Sea Cable Company. (n.d.). Coral Sea Cable System. https://coralseacablecompany.com/

Davda, T. (2021). Working politically and adaptively in practice: The case study of 'YuTru'. Abt Associates. https://abtassocgovernancesoapbox.files.wordpress.com/2021/10/1.-yu-tru-case-study_final_davda_t_20_oct_21.pdf

Dayant, A., Keen, M., & Rajah, R. (2023, January). *Chinese aid to the Pacific: decreasing, but not disappearing*. Lowy Institute, https://www.lowyinstitute.org/the-interpreter/chinese-aid-pacific-decreasing-not-disappearing

DCI. (2018). ICT Roadmap. *Department of Communication and Information*. https://www.ict.gov.pg/Policies/ICT%20Road%20Map/ICT%20Sector%20Roadmap.pdf

Deng, J. (2022, November). *An explanation for the decline of China's aid in the Pacific*. Lowy Institute. https://www.lowyinstitute.org/the-interpreter/explanation-decline-china-s-aid-pacific

Department of Information and Communications Technology [DICT]. (2020). *PNG Digital Transformation Policy*. Department of Information & Communications Technology. https://www.ict.gov.pg/digital-transformation-policy-2020/

_____. (2021a). *Cyber Security Policy 2021*. Department of Information & Communications Technology. https://www.ict.gov.pg/cyber-security-policy-2021/

_____. (2021b). *National Right to Information Policy*. Department of Information & Communications Technology. https://www.ict.gov.pg/national-right-to-information-policy-2020-2030/#:~:text=Section%2051(1)%20of%20the,under%20ten%20(10)%20exceptions.

_____. (2023a). *Our Mandate*. Department of Information & Communications Technology. https://www.ict.gov.pg/our-mandate/

_____. (2023b). *Digital Government Plan 2023-2027*. Department of Information and Communications Technology. https://www.ict.gov.pg/draft-digital-government-plan-2023-2027/

_____. (2023c). *Public Body ICT Project Designs*. Department of Information & Communications Technology. https://www.ict.gov.pg/ict-project/

_____. (2023d, June). *DICT unveils Technology Stack 2023, paving way for digital transformation in PNG*. Department of Information & Communications Technology. https://www.ict.gov.pg/dict-unveils-technology-stack-2023-paving-way-for-digital-transformation-in-png/

Duncan, R. (2013). Telecommunications in Papua New Guinea. *Priorities and Pathways in Services Reform — Part II, 27-44*. https://doi.org/10.1142/9789814504690_0002

Esila, P. (2019, July). *Concerns over corruption*. The National. https://www.thenational.com.pg/concerns-over-corruption/

European Union Agency For Network and Information Security [ENISA]. (2018). Public private partnerships (PPP): Cooperative models. ENISA, https://www.enisa.europa.eu/publications/public-private-partnerships-ppp-cooperative-models

eGov Review. (2021, November). Bill to strengthen cyber security measures: Papua New Guinea. eGov Review. https://www.egovreview.com/article/news/81/bill-strengthen-cyber-security-measures-papua-new-guinea

Fallon, J. (2017). State Owned Enterprises in Papua New Guinea: Public Policies and Performance. The National Research Institute. https://pngnri.org/images/Publications/Discussion_Paper_152_Fallon-SOEs.pdf

Foster, R. J. (2023). Tenuous Connectivity: Time, Citizenship, and Infrastructure in a Papua New Guinea Telecommunications Network. *The Asia Pacific Journal of Anthropology, 24*(2), 91-115. https://doi.org/10.1080/14442213.2023.2177330

Global Infrastructure Hub. (2020). *Case Studies: Coral Sea Cable System*. Global Infrastructure Hub. https://www.gihub.org/connectivity-across-borders/case-studies/coral-sea-cable-system/

Government of PNG. (2019). *Government of PNG Procurement*. https://www.npc.gov.pg/

Grigg, A. (2020, August). *Debt-trap diplomacy: PNG wants Huawei loan cancelled*. Financial Review. https://www.afr.com/companies/telecommunications/debt-trap-diplomacy-png-wants-huawei-loan-cancelled-20200811-p55kmr

GSMA. (2019). *Digital Transformation: The Role of Mobile Technology in Papua New Guinea*. Mobile for Development. https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2019/03/Digital-Transformation-The-Role-of-Mobile-Technology-in-Papua-New-Guinea.pdf

GSMA Intelligence. (2023). *The Mobile Economy Pacific Islands 2023*. Mobile Operators and Networks Module. https://data.gsmaintelligence.com/research/research/research-2023/the-mobile-economy-pacific-islands-2023

Hartcher, P. (2023, August). Australia is 'cool' in Washington right now. What happens when that stops? The Sydney Morning Herald. https://www.smh.com.au/by/peter-hartcher-hve0w

Howell, B. E., Potgieter, P. H., & Sofe, R. (2018). *Regulating for Telecommunications Competition in Developing Countries: the case of Papua New Guinea*. 22nd ITS Biennial Conference. https://www.econstor.eu/handle/10419/190371

Huawei. (2017, July). *Huawei Marine Signs Submarine Cable Contract in Solomon Islands*. Huawei Technologies Co., Ltd. https://www.huawei.com/en/news/2017/7/huaweimarine-submarine-cable-solomon

InforMEA. (n.d.). *Organic Law on Provincial Governments and Local-level Governments* . United Nations Information Portal on Multilateral Environment Agreements. https://www.informea.org/en/legislation/organic-law-provincial-governments-and-local-level-governments

Institute of National Affairs. (2021). *Case Study: Kumul Submarine Cable Network Project.* https://www.brimonitor.org/wp-content/uploads/2021/07/CS_KSCNP.pdf

International Telecommunication Union [ITU]. (2002). *Policy Guidelines on Universal Access / Service for Telecommunications Services in SADC*. Telecommunications Regulatory Association of Southern Africa (TRASA). https://www.itu.int/ITU-D/projects/ITU_EC_ACP/hipssa/Activities/SA/docs/SA-2.2/SADC_Guidelines_US.pdf

_____. (2018). *Measuring the Information Society Report, 2*. https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-2-E.pdf

_____. (2021). *Digital trends in Asia and the Pacific 2021 - Information and communication technology trends and developments in the Asia-Pacific region, 2017-2020*. ITU. https://www.itu.int/pub/D-IND-DIG_TRENDS_ASP.01

_____. (2022a). *Global Connectivity Report 2022 Achieving universal and meaningful connectivity in the Decade of Action*. https://www.itu.int/itu-d/reports/statistics/global-connectivity-report-2022/

_____. (2022b). *Papua New Guinea*. ICT Regulatory Tracker. https://app.gen5.digital/tracker/country-cards/Papua%20New%20Guinea#overall-score

_____. (2022c, August). *The infrastructure sharing imperative.* Digital Regulation Platform. https://app.gen5.digital/tracker/country-cards/Papua%20New%20Guinea#overall-score

ITU DataHub. (2016). *Papua New Guinea*. ITU DataHub. https://datahub.itu.int/data/?e=PNG&i=12046

_____. (2017). *Papua New Guinea*. ITU DataHub. https://datahub.itu.int/data/?e=PNG&i=242

_____. (2021). *Papua New Guinea*. ITU DataHub. https://datahub.itu.int/data/?e=PNG

_____. (2022). *Papua New Guinea ICT prices dashboard*. ITU DataHub. https://datahub.itu.int/dashboards/?e=PNG&c=4&id=1.

James, D. (2021, February). *To build or not to build: multibillion dollar Chinese project highlights Western Province's dilemmas*. Business Advantage PNG. https://www.businessadvantagepng.com/to-build-or-not-to-build-multibillion-dollar-chinese-project-highlights-western-provinces-dilemmas/

Jiao, C., & Sihombing, G. (2023, July 3). *Indonesia Regains Upper-Middle Income Rank on Growth Rebound*. Bloomberg. https://www.bloomberg.com/news/articles/2023-07-03/indonesia-reclaims-upper-middle-income-rank-on-post-covid-growth#xj4y7vzkg

Kantika, K., Kurniasari, F., & Mulyono, M., (2022). The factors affecting digital bank services adoption using trust as mediating variable. *Journal of Business and Management Review, 3*(10): 690-704. https://doi.org/10.47153/jbmr310.4882022

KCH. (n.d.). Telecommunication. Kumul Consolidated Holdings. https://www.kch.com.pg/key-impact-projects/telecommunications/

Kotelnikov, V. (2007). *Small and Medium Enterprises and ICT*. Asia-Pacific Development Information Programme. https://wikieducator.org/images/b/b3/Eprimer-sme.pdf

Kemp, S. (2023, February). Digital 2023: *Papua New Guinea*. Data Portal. https://datareportal.com/reports/digital-2023-papua-new-guinea

Lowy Institute. (2022). *Pacific Region*. Pacific Aid Map. https://pacificaidmap.lowyinstitute.org

Layton, P. (2022, April). *Fixing Australia's failing Pacific Step-up strategy*. Lowy Institute. https://www.lowyinstitute.org/the-interpreter/fixing-australia-s-failing-pacific-step-strategy

Mishra, V. & Smyth, R. (2016). A scoping study to provide an assessment of SME policy priority areas for Papua New Guinea. The National Research Institute of Papua New Guinea, Discussion Paper No. 146. https://www.researchgate.net/publication/299596791_A_scoping_study_to_provide_an_assessment_of_SME_policy_priority_areas_for_Papua_New_Guinea

Ministry of Foreign Affairs, Japan. (2023). Factsheet on the G7 Partnership for Global Infrastructure and Investment. Ministry of Foreign Affairs, Japan. https://www.mofa.go.jp/files/100506918.pdf

Moi, C. (2020, August). *Masiu: A waste of money*. The National. https://www.thenational.com.pg/masiu-a-waste-of-money/

Moises, H. (2023, March). *China Funds Papua New Guinea to Repair Submarine Cable Network*. W.Media. https://w.media/china-funds-papua-new-guinea-to-repair-submarine-cable-network/

Moss, S. (2020, August). *Australia: Huawei's Papua New Guinea data center security "openly broken," making potential spying easy.* DCD. https://www.datacenterdynamics.com/en/news/australia-huaweis-papua-new-guinea-data-center-security-openly-broken-making-potential-spying-easy/#:~:text=Huawei%20built%20a%20data%20center,the%20facility%20up%20to%20spying

Nicholas, W. (2016). PNG's SME policy: the right aim, but dubious means. Devpolicy. https://devpolicy.org/png-sme-policy-right-aim-dubious-means-20160718/

NICTA. (2022). *Public Consultation – UAS Strategic Plan 2023-2027 and Proposed UAS Projects for 2023*. National Information And Communication Technology Authority. https://www.nicta.gov.pg/cp-0-24/

_____. (2023). *Who are we*. National Information And Communication Technology Authority. https://www.nicta.gov.pg/about-us/who-are-we/

Noone, G. (2021, June). *The (cable) war in the Pacific*. Tech Monitor. https://techmonitor.ai/policy/geopolitics/cable-war-in-pacific-china-us-subsea-internet

Nwaiwu, F., Kwarteng, M. A., Jibril, A. B., Buřita, L. (2020). Impact of security and trust as factors that influence the adoption and use of digital technologies that generate, collect and transmit user data. Proceedings of the 15th International Conference on Cyber Warfare and Security, ICCWS 2020. https://researchportal.bath.ac.uk/en/publications/impact-of-security-and-trust-as-factors-that-influence-the-adopti

OCHA. (2023). *Papua New Guinea: Medium Term Development Plan IV | 2023 - 2027 | National Prosperity Through Growing the Economy*. OCHA Services. https://reliefweb.int/report/papua-new-guinea/papua-new-guinea-medium-term-development-plan-iv-2023-2027-national-prosperity-through-growing-economy

Odhuno, F. & Ngui, D. (2018). Use and impact of ICT on SMEs in PNG: An empirical analysis and implications for policy. The National Research Institute. https://www.researchgate.net/publication/333280584_USE_AND_IMPACT_OF_ICT_ON_SMES_IN_PNG_AN_EMPIRICAL_ANALYSIS_AND_IMPLICATIONS_FOR_POLICY

Organisation for Economic Co-operation and Development [OECD], (2010). Collusion and corruption in public procurement. OECD. https://www.oecd.org/competition/cartels/46235884.pdf

OGP. (2018). *Papua New Guinea: Inter-Agency Information Sharing (PNG0002)*. Open Government Partnership. https://www.opengovpartnership.org/members/papua-new-guinea/commitments/PNG0002/#_edn32

Pacific Tenders. (2021, September). *PNG parliament amends National Procurement Act*. Pacific Tenders. https://www.pacifictenders.com/pg/png-parliament-amends-national-procurement-act

Parkes, J. (2021, April). *Australia trade figures hit by geopolitical tensions with China*. Verisk Maplecroft. https://www.maplecroft.com/insights/analysis/australia-trade-figures-hit-by-geopolitical-tensions-with-china/

PeeringDB. (2023). *The Interconnection Database*. https://www.peeringdb.com/search?q=Papua+New+Guinea

Pham, M. (2020, September 4). *Papua New Guinea sees $25 million cash injection for 4G network*. Developing Telecoms. https://developingtelecoms.com/telecom-technology/optical-fixed-networks/9955-papua-new-guinea-sees-25-million-cash-injection-for-4g-network.html

PNG Buzz. (2020, March). *Government ICT Infrastructure to be centralised under ICT Ministry | pngbuzz.com*. PNG Buzz. https://pngbuzz.com/tech/3351

PNG SME. (2016). Papua New Guinea Small and Medium Enterprise Policy 2016. Ministry of Trade and Commerce and Industry.

Pacific Private Sector Development Initiative [PSDI]. (2022). Papua New Guinea Country Overview 2022. PSDI. https://www.pacificpsdi.org/assets/Uploads/PSDI-FACT-SHEETS-22.pdf#page=22

PWC. (2016). Overview and commentary on the PNG Government's SME Policy. PWC. https://www.pwc.com/pg/en/publications/sme-bulletin/sme-bulletin-png-sme-policy-commentary.pdf

Rajah, R., Dayant, A., & Pryke, J. (2019, October). *Ocean of debt? Belt and Road and debt diplomacy in the Pacific.* Lowy Institute. https://www.lowyinstitute.org/publications/ocean-debt-belt-road-debt-diplomacy-pacific

Savoy, C. M. & McKeown, S, (2022). Future considerations for the partnership on global infrastructure and investment. Center for Strategic & International Studies. https://www.csis.org/analysis/future-considerations-partnership-global-infrastructure-and-investment

Smyth, J. (2019, November). *China aid wins influence in Pacific despite rising concerns*. Financial Times. https://www.ft.com/content/bf2cfd72-f6c1-11e9-9ef3-eca8fc8f2d65

Stakeholder Interview. (2023, July).

Submarine Cable Networks. (2019). *Coral Sea (CS2)*. Submarine Cable Networks. https://www.submarinenetworks.com/en/systems/asia-australia/coral-sea

Submarine Cable Map. (n.d.). Submarine Cable Map. https://www.submarinecablemap.com/

Suwamaru, J. K. (2020). Beneath the veil of the Kumul Submarine Cable Network. *Electronic Journal of Informatics,* 2: 1-25. https://www.dwu.ac.pg/en/images/1-Suwamaru-Beneath-the-veil-of-the-Kumul-Submarine-Cable-Network.pdf

Tarabay, J. (2021, October). Ransomware hackers freeze millions in Papua New Guinea. Bloomberg. https://www.bloomberg.com/news/articles/2021-10-27/papua-new-guinea-s-finance-department-hit-with-ransomware-attack#xj4y7vzkg

Telecompaper. (2022, September). *Papua New Guinea submarine cable damaged after earthquake*.

Telecompaper. https://www.telecompaper.com/news/papua-new-guinea-submarine-cable-damaged-after-earthquake--1437232

TeleGeography. (2023). *Submarine Cable Map*. TeleGeography. https://www.submarinecablemap.com

Tebbutt Research. (2014). *Report for SME baseline survey for the small and medium enterprise access to finance project*. Unpublished report for the PNG Department of Commerce, Trade and Industry.

The Australian. (2020, May). *China fears over cable too dear to use*. The Australian. https://www.theaustralian.com.au/nation/politics/china-fears-over-png-cable-too-dear-to-use/news-story/1e5fa444e64819c9a9030262be334419

The National. (2018, August). *China to fund cable project*. The National. https://www.thenational.com.pg/china-to-fund-cable-project/

The Straits Times. (2023, May). *Envy in Papua New Guinea as Chinese money pours in*. The Straits Times. https://www.straitstimes.com/world/envy-in-papua-new-guinea-as-chinese-money-pours-in

The White House (2022, November). *United States-Australia-Japan Joint Statement on cooperation on telecommunications financing.* The White House. https://www.whitehouse.gov/briefing-room/statements-releases/2022/11/15/united-states-australia-japan-joint-statement-on-cooperation-on-telecommunications-financing/

Trading Economics. (2022). *Papua New Guinea GDP per capita*. Trading Economics. https://tradingeconomics.com/papua-new-guinea/gdp-per-capita

_____. (2023). *Fiji - GNI per capita, PPP (current international $)*. Trading Economics. https://tradingeconomics.com/fiji/gni-per-capita-ppp-us-dollar-wb-data.html#:~:text=GNI%20per%20capita%2C%20PPP%20(current%20international%20%24)%20in%20Fiji%20was,compiled%20from%20officially%20recognized%20sources

Transparency International. (2022). *Transparency International Papua New Guinea*. Transparency International. https://www.transparency.org/en/countries/papua-new-guinea

UNCTAD. (2023). Digital Economy Report Pacific Edition 2022. *United Nations Conference on Trade and Development Report*. https://unctad.org/publication/digital-economy-report-pacific-edition-2022

UNDP. (2014). *The Development Needs of Pacific Island Countries Report*. United Nations Development Programme. https://www.undp.org/china/publications/development-needs-pacific-island-countries-report

UNESCAP. (2018). *ICT Statistics for Evidence-Based Policymaking in Pacific Island Countries*. Asia-Pacific Information Superhighway Policy Guide Series. https://www.unescap.org/sites/default/files/ICT_Statistics_Guideline_FINAL.pdf

_____. (2020). *Second Working Group on Pacific Internet Exchange Point (IXP) and capacity training workshop on IXP's operational modalities (Virtual Meeting)*. UNESCAP. https://www.unescap.org/events/second-working-group-pacific-internet-exchange-point-ixp-and-capacity-training-workshop-ixp-s

_____. (2021). *Towards meaningful connectivity: Insight from Asia Pacific Case Studies. Asia Pacific Information Superhighway.* https://www.unescap.org/kp/2021/towards-meaningful-connectivity-insights-asia-pacific-case-studies

UNESCO. (2023). *Papua New Guinea: Technology*. Education Profiles. https://education-profiles.org/oceania/papua-new-guinea/~technology

UNESCO Broadband Commission. (n.d.). *2025 Targets: Connecting the Other Half*. Broadband Commission for Sustainable Development. https://www.broadbandcommission.org/broadband-targets/

UNODC. (2021). *Papua New Guinea (PNG) Anti-Corruption Project 2021-2024*. UNODC Regional Office for Southeast Asia and the Pacific. https://www.unodc.org/roseap/en/png/anti-corruption-project.html

UN Statistics Division. (2014). *Country Profile of Papua New Guinea. United Nations Statistics Division*. https://unstats.un.org/unsd/dnss/docViewer.aspx?docID=639#start

U.S. Dept. of Commerce. (2022a). *Investment Climate Statement (ICS)*. Papua New Guinea - Country Commercial Guide. https://www.trade.gov/country-commercial-guides/papua-new-guinea-investment-climate-statement-ics

_____. (2022b). *Selling to the Public Sector*. Papua New Guinea - Country Commercial Guide. https://www.trade.gov/country-commercial-guides/papua-new-guinea-selling-public-sector

U.S. Dept. of State. (2020). *2020 Investment Climate Statements: Papua New Guinea*. Bureau of Economic and Business Affairs. https://www.state.gov/reports/2020-investment-climate-statements/papua-new-guinea/

Vats, N. (2020, October). *China's strategy towards Papua New Guinea - Engaging the nation for its resources.* Centre for Security and Strategy Studies. https://www.cescube.com/vp-china-s-strategy-towards-papua-new-guinea-engaging-the-nation-for-its-resources

Wall, J. (2020, September). *China's 'debt-trap diplomacy' is about to challenge Papua New Guinea—and Australia.* The Strategist - The Australian Strategy Policy Institute. https://www.aspistrategist.org.au/chinas-debt-trap-diplomacy-is-about-to-challenge-papua-new-guinea-and-australia/

Walton, G., & Hushang, H. (2020). Boom and bust? Political will and anti-corruption in Papua New Guinea. *Asia & The Pacific Policy Studies, 7*(2), 187-203. https://onlinelibrary.wiley.com/doi/full/10.1002/app5.306

_____. (2022). *PNG anti-corruption funding update*. Development Policy Centre, Australian National University. https://devpolicy.org/png-anti-corruption-funding-update-20220429/

Watson, A. H. A. (2021). *Telecommunication security in the Pacific region*. The Australian National University. https://pacificsecurity.net/wp-content/uploads/2021/10/DB82_Part27.pdf

Wesley, M. (2020, February). *The emerging geopolitical competition in Oceania*. The National Bureau of Asian Research. https://www.nbr.org/publication/the-emerging-geopolitical-competition-in-oceania/

Williams, P. (2019). *Connecting Papua New Guinea The Dawn of the Digital Era*. Deloitte. https://www.deloitte.com/content/dam/Deloitte/au/Documents/technology/deloitte-au-technology-connecting-papua-new-guinea-191119.pdf

World Bank. (2012). *Broadband Strategies Handbook*. International Bank for Reconstruction and Development. https://www.worldbank.org/en/topic/digitaldevelopment/brief/broadband-strategies-handbook#:~:text=Broadband%20Strategies%20Handbook%20is%20a,issues%20related%20to%20broadband%20development

_____. (2019). Papua New Guinea Country Partnership Framework FY2019 – 2023. *World Bank Group Publication*. https://documents1.worldbank.org/curated/en/986831558749746464/pdf/Papua-New-Guinea-Country-Partnership-Framework-for-the-Period-FY19-FY23.pdf

_____. (2020a). *In the Time of COVID-19: From Relief to Recovery*. Papua New Guinea Economic Update. https://documents1.worldbank.org/curated/en/964591594230524376/pdf/Papua-New-Guinea-Economic-Update-In-the-Time-of-COVID-19-From-Relief-to-Recovery.pdf

_____. (2020b). *Thematic Scores for Public-Private Partnerships in Papua New Guinea*. Benchmarking Infrastructure Development. https://bpp.worldbank.org/economy/PNG

_____. (2022a). *Approach Paper, Country Program Evaluation - Papua New Guinea*. An Evaluation of World Bank Support FY08-22. https://elibrary.worldbank.org/doi/abs/10.1596/37753

_____. (2022b). Public-private partnerships. The World Bank. https://bpp.worldbank.org/economy/PNG

ABOUT THE AUTHORS

Amira Husna Natanegara is a Researcher at Center for Indonesian Policy Studies. Prior to joining CIPS, Amira supported various public sector programs of the Indonesian government as a consultant of Deloitte and MarkPlus consultancies. This included the delivery of public services and social-impact programs.

She has also conducted research at the Institute for Economic and Social Research and the SME Center of Universitas Indonesia. Amira received a Master of Science degree in International Social and Public Policy from the London School of Economics and a Bachelor of Economics degree from the University of Indonesia

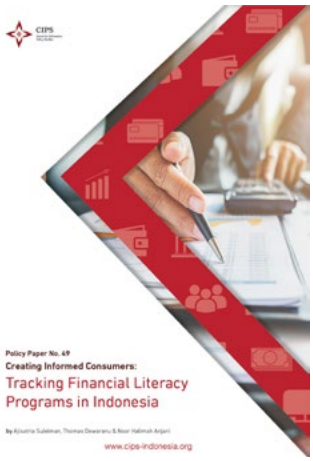
Louis Budiman is a Research Assistant at Center for Indonesian Policy Studies. He graduated with a Bachelor's degree in International Relations from Gadjah Mada University in Yogyakarta. Prior to joining CIPS, he worked as a research assistant at the Center for World Trade Studies affiliated with Gadjah Mada University. At CIPS he first completed the Emerging Policy Leaders Program in 2022 before joining as a research assistant.

Muhammad Nidhal is a Junior Researcher at Center for Indonesian Policy Studies. holds a Bachelor's degree in International Relations from Jayabaya University in Jakarta with a minor in Postcolonial Studies. Prior to joining CIPS, he worked at the Embassy of Uzbekistan in Jakarta as an assistant to the Political and Economic Section. He first joined the CIPS Emerging Policy Leaders Program in 2022.

Explore other paper published by Center for Indonesian Policy Studies

The Rise of Innovative Credit Scoring System in Indonesia: Assessing Risks and Policy Challenges

Co-Regulation in Protecting Personal Data: The Role of Industry Associations as Potential Self-Regulatory Organizations



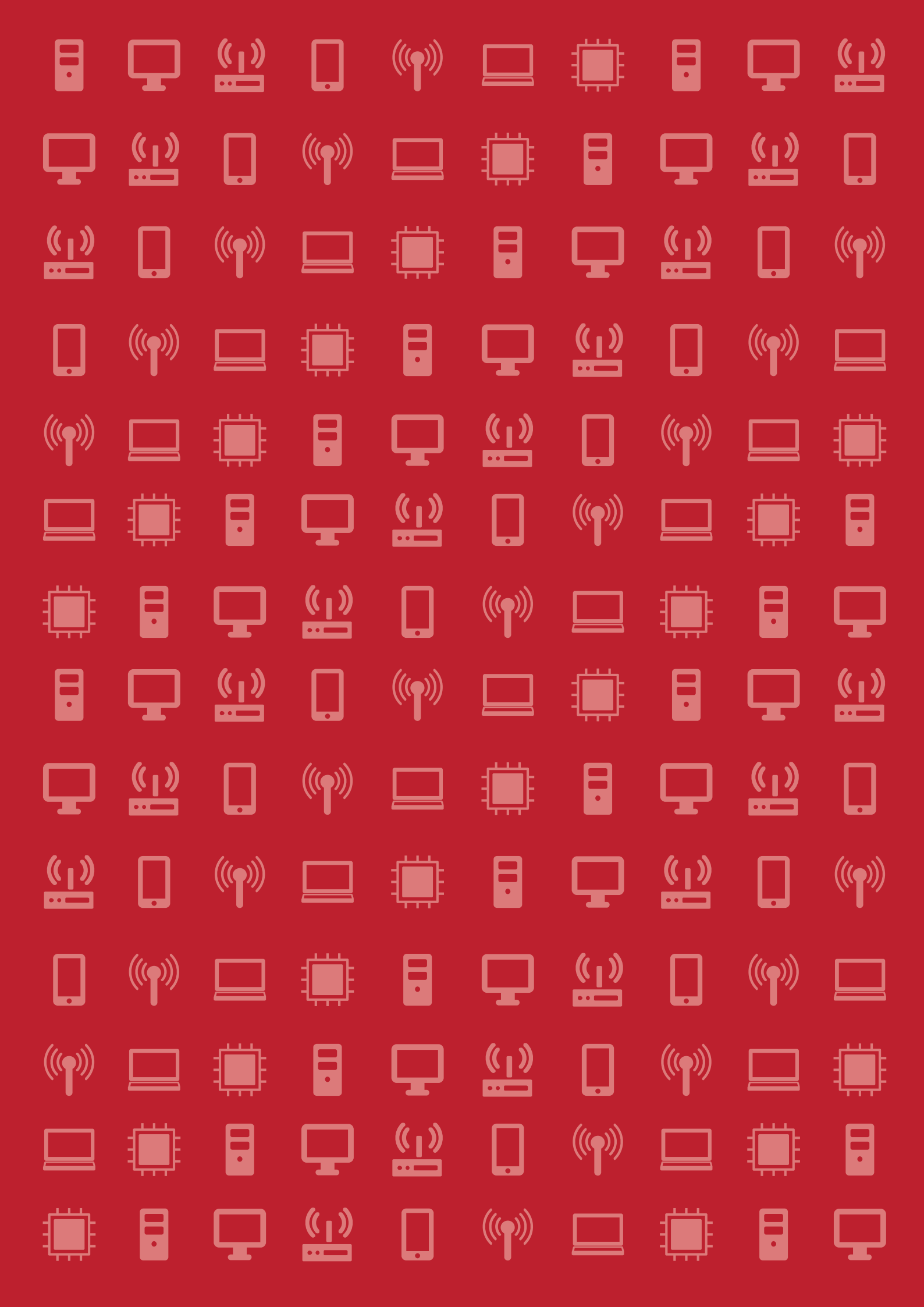
Creating Informed Consumers: Tracking Financial Literacy Programs in Indonesia

Go to our website to access more titles:
www.cips-indonesia.org/publications

The Center for Indonesian Policy Studies invites those interested to support our advocacy by joining one of our Donor Circles.

If you or your organization is interested to cooperate and engage more closely with the work of CIPS, please contact:

Anthea Haryoko
Chief Innovation and Development Officer
Anthea.haryoko@cips-indonesia.org



ABOUT THE CENTER FOR INDONESIAN POLICY STUDIES

Center for Indonesian Policy Studies (CIPS) is a strictly non-partisan and non-profit think tank providing policy analysis and practical policy recommendations to decision-makers within Indonesia's legislative and executive branches of government.

CIPS promotes social and economic reforms that are based on the belief that only civil, political, and economic freedom allows Indonesia to prosper. We are financially supported by donors and philanthropists who appreciate the independence of our analysis.

KEY FOCUS AREAS:

Food Security & Agriculture: To enable low-income Indonesian consumers to access more affordable and quality staple food items, CIPS advocates for policies that break down the barriers for the private sector to openly operate in the food and agriculture sector.

Education Policy: The future of Indonesia's human capital need to be prepared with skills and knowledge relevant to the 21st century. CIPS advocates for policies that drive a climate of healthy competition amongst education providers. Such competition will drive providers to constantly strive to innovate and improve education quality for the children and parents they serve. In particular, CIPS focuses on the improvement of operational and financial sustainability of low-cost private schools who serve the poor.

Economic Opportunities: CIPS advocates for policies that expand economic involvement and opportunities for Indonesian entrepreneurs and businesses; as well as for policies that open wider opportunities for low-income Indonesians to access decent incomes and create wealth.

www.cips-indonesia.org

facebook.com/cips.indonesia
@cips_id
@cips_id
Center for Indonesian Policy Studies
Center for Indonesian Policy Studies

Jalan Terogong Raya No. 6B
Cilandak, Jakarta Selatan 12430
Indonesia