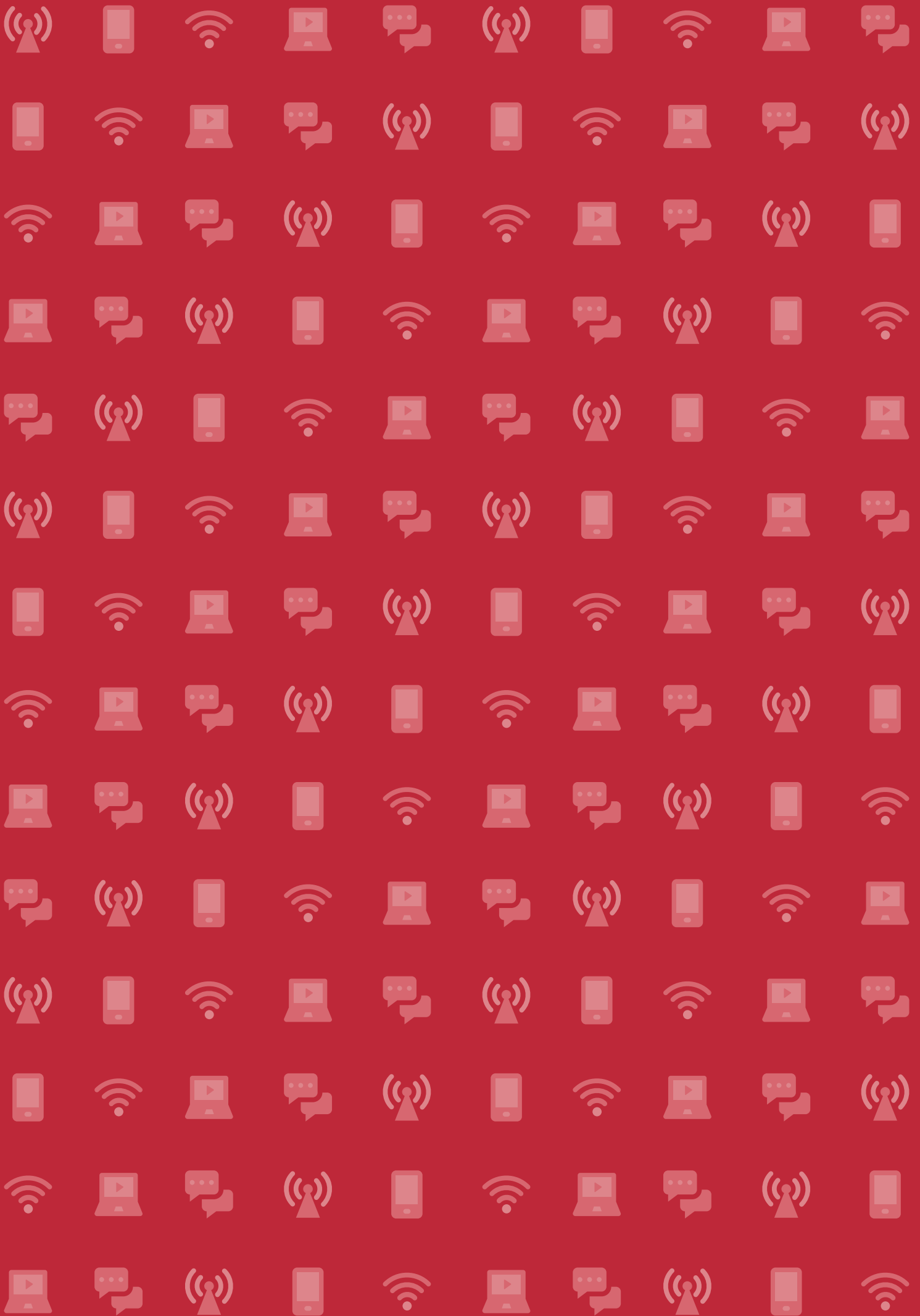


Discussion Paper No. 19

Understanding the Regulatory Environment for ICT Infrastructure in Papua New Guinea: The Integrated Government Information System (IGIS) Case Study

by Louis Budiman and Muhammad Nidhal





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TABLE OF CONTENTS

| | |
|---|----|
| Table of Contents | 5 |
| Glossary | 6 |
| Executive Summary | 8 |
| Project Overview | 10 |
| Introduction..... | 10 |
| IGIS Project Overview..... | 10 |
| IGIS Design and Implementation..... | 13 |
| Lessons learned from the IGIS project..... | 14 |
| Governance and Implementation | 16 |
| Transparency and Accountability..... | 16 |
| Security Issues..... | 20 |
| Project Financing..... | 21 |
| Conclusion and Recommendations | 23 |
| Recommendations..... | 23 |
| References | 26 |

GLOSSARY

APEC:

Asia-Pacific Economic Cooperation

ASPI:

Australian Strategic Policy Institute

BRI:

Belt and Road Initiative

CDB:

China Development Bank

CEPA:

Conservation and Environmental Protection Authority

CoST:

Construction Sector Transparency Initiative

CSO:

Civil Society Organizations

CSTB:

Central Supply and Tenders Board

DFAT:

Department of Foreign Affairs and Trade

DICT:

Department of Information and Communications Technology

Exim Bank:

China Export-Import Bank

G2G:

Government-to-Government

GDP:

Gross Domestic Products

GCL:

Government Concessional Loan

ICAC:

Independent Commission Against Corruption

ICT:

Information and Communication Technology

IDS:

Infrastructure Data Standards

IGIS:

Integrated Government Information System

INA:

Institute of National Affairs

ISP:

Internet Service Providers

ITU:

International Telecommunication Union

K:

Papua New Guinea Kina (PGK / K)

MTDP III:

Medium Term Development Plan 2018–2022

MTDP IV:

Medium Term Development Plan 2023–2027

NCSC:

National Cyber Security Centre

NEC:

National Executive Council

NICTA:

National ICT Authority

NIS:

National Integrity System

NPC:

National Procurement Commission

OGP:

Open Government Partnership

PNG:

Papua New Guinea

PPP:

Public-Private Partnership

PRC:

People's Republic of China

RDMS:

Records and Data Management Services

RMB:

Renminbi

RTI:

Right to Information

UPS:

Uninterruptible Power Supply

UN:

United Nations

US\$:

United States Dollar

EXECUTIVE SUMMARY

The Integrated Government Information System (IGIS) is a private government network comprising several components such as records and data management services, government email, civil registration, the IGIS portal, IGIS data center & disaster recovery center, IGIS network, and a project management office. The project sought to overcome the dispersed nature of government's public data across Papua New Guinea's (PNG) 47 departments. This would enable better collaboration and coordination between government agencies by facilitating a centralized platform for sharing, archiving, and storing data, thus enhancing data centralization and optimizing computing costs.

This case study provides an analysis of the current regulatory environment in which the IGIS project was planned, funded, and implemented in PNG. While the project aimed to streamline public data management, the case study finds governance gaps in security, transparency, and financing aspects of IGIS implementation.

The IGIS project came from a plan to create a private government network for the PNG government that connects all its departments and agencies in a single system. The project aimed to build a broadband infrastructure and a main data center to enable integrated and efficient government operations. It was also intended to improve inter-governmental cooperation and information management in a secure environment. The project was implemented by the Department of Information and Communications Technology (DICT) alongside sectoral government agencies in Port Moresby, with the main data center being hosted in the Telikom Rumana building in Waigani, Port Moresby.

The first phase (2011-2014) of the IGIS project was the construction of the national data center and establishment of a secure high-speed government network within it. It was funded through a RMB 359 million (or US\$53 million) government concessional loan provided by the China Exim Bank. These funds were used to support a commercial contract between Telikom PNG Ltd—a state-owned telecommunications company in PNG—and Huawei Technologies Co., Ltd. for the project's execution. The primary contractors for the IGIS project were Huawei Technologies Co., Ltd, Telikom PNG Ltd, and PNG DataCo. However, the second phase (2018) of the IGIS project was not fully carried out and well-executed. The project began in June 2011 and concluded in July 2014, but the data center in Port Moresby did not become operational until 2018. DICT acknowledged that the IGIS project had suffered from poor management and is seen as a “failed investment.”

The project lacked transparency in its management. The public could not access key information about the project, such as contracts, loan terms, technical feasibility, and audit reports. Some information was only available on third party websites. There was no information on how the contractors were selected and whether environmental and social impact was conducted. This is mainly caused by the absence of a legal framework, such as the Right to Information (RTI) Law, that obliges government and business entities to disclose important public information. There is also no central government data storage system that can simplify data management and ensure public access through an e-government portal.

Furthermore, an unpublished report commissioned by PNG's National Cyber Security Centre (NCSC) and funded by the Australian Department of Foreign Affairs and Trade (DFAT) highlighted alleged security vulnerabilities within the national data center infrastructure and insufficient firewall settings making it vulnerable to hacking and surveillance.

In light of the above mentioned issues, the study recommends the following main policy recommendations for future projects: (1) uphold principles of good governance and transparency; (2) establish an ICT working group to strengthen inter-agency collaboration; (3) adopt and implement a Right to Information law; (4) apply effective risk management standards during the project lifecycle; and (5) improve fiscal discipline and seek sustainable financing models for ICT projects.

Finally, reflecting on the implementation challenges encountered during the IGIS project is essential as the government gears up to procure and implement future similar projects, including the newly-introduced PNG Government Technology Stack 2023. By learning from past challenges and addressing the issues that arose during the IGIS project, the government can improve the accountability and security of its digital transformation agenda.

PROJECT OVERVIEW

Introduction

Information and Communication Technology (ICT) infrastructure is a key driver for the digital ecosystem, fostering connectivity, productivity, and innovation across socio-economic dimensions. In the public sector, for instance, ICT infrastructures such as broadband networks, data centers, and digital national identification systems play an enabling role in promoting good governance practices and facilitating effective public service delivery.

In Papua New Guinea (PNG), there has been a significant improvement in ICT services, particularly through mobile broadband connectivity, aligning with the growing use of internet, mobile phones, and social media platforms (ITU, 2018; Williams, 2019). Despite these advancements, the country still faces challenges in meeting the rapidly growing digital needs, primarily due to limited ICT infrastructure access (Lawrence, 2017). As a highly capital intensive sector, ICT infrastructure development requires comprehensive planning that considers geographical contexts and local needs and demands. PNG has unique challenges due to its geographical conditions, and the development of ICT infrastructure is hindered by the lack of supporting infrastructure such as roads and rail lines (World Bank, 2022).

In the past decades, the PNG government has undertaken some strategic ICT infrastructure projects development, ranging from submarine fiber optic cables and broadband networks to critical digital government infrastructure such as data centers and e-government networks. This case study aims to examine one of the major ICT infrastructure projects in PNG, the Integrated Government Information System (IGIS). IGIS is a critical digital infrastructure for the PNG public sector, consisting of a national data center, private government network, and shared applications and services. It stands as an enabling technical component for the country's e-government ecosystem and inter-agency information sharing.

In Papua New Guinea (PNG), there has been a significant improvement in ICT services, particularly through mobile broadband connectivity, aligning with the growing use of internet, mobile phones, and social media platforms.

This case study provides an analysis of the current regulatory environment in which the IGIS project was planned, funded, and implemented in PNG. The first component of the analysis delves into how security measures were implemented to safeguard the operations of the project. The second section discusses the project's transparency and accountability, evaluating how decision-making process and information flows of the project contribute to effective and open governance. Lastly, we examine the funding mechanisms and sustainability of the project.

IGIS Project Overview

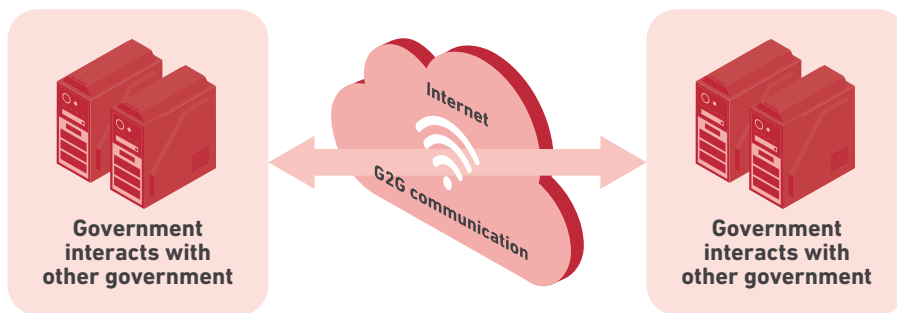
The IGIS project is a private government network where government agencies and departments of PNG would be interconnected on a common information system. The purpose of the project was to develop a broadband infrastructure to link all government departments and agencies

at the national and sub-national level, as well as to establish a main data center enabling the operations of all government departments in an integrated, cost-effective manner. This would facilitate inter-governmental collaboration and coordination for purposes of information sharing, archiving, and data storing in a centrally secured environment.

A private government network is a technical infrastructure and component within a broader concept of inter-agency information sharing—a practice of exchanging information between government agencies and departments. In this context, a private government network facilitates centralized inter-agency information sharing mechanism and is typically a critical digital infrastructure in the e-government and government-to-government (G2G) systems (see Figure 1). The IGIS project was implemented with the aim of promoting streamlined public service delivery and improving administration efficiency within the public sector in PNG. The project was expected to encourage various government agencies to computerize and integrate their data in a new centralized government network.

The IGIS project is a private government network where government agencies and departments of PNG would be interconnected on a common information system.

Figure 1.
Inter-Agency Communications in G2G Framework



Source: Daniel (2014)

Government computing costs have been steep for the PNG government's annual budgets, and the decision to implement the IGIS project was motivated not only by the objective of addressing the lack of data centralization among government departments but also by the potential for significant cost savings (DICT, 2020; Daniel, 2014). A survey (DICT, 2022) conducted by the Department of Information and Communications Technology (DICT) revealed that the PNG government spends K160 million (US\$46 million) annually on general telecommunications and internet services from internet service providers (ISPs). This breakdown includes K40 million (US\$11 million) for internet access, K100 million (US\$28 million) for telephony services, and K20 million (US\$6 million) for dedicated internet, data storage, and website hosting services. In comparison, once the transition to the IGIS and shared services was complete, the PNG government predicted that these services would incur an annual cost of K40 million (US\$11 million).

The IGIS project was implemented by the DICT in Port Moresby, with the main data center located at the Telikom Rumana building in Waigani, Port Moresby (Department of Treasury, 2011). The project comprises various essential and technical components, including records and data management services (RDMS), government email, civil registration, the IGIS portal, IGIS data center & disaster recovery center, IGIS network, and a project management office (OGP, 2018). Apart from providing the information sharing platform, the IGIS system also provides internet access and basic communication services such as email, video conferencing, and voice over internet protocol to the government offices (Arnold, 2017).

Table 1.
Integrated Government Information System Project Profile

| Project Details | Description |
|-------------------------------|--|
| Project location | National Capital District and several other provinces, including Central, Goroka, Wewak, Kimbe and Kokopo |
| Project cost | US\$53 million |
| Project announcement date | 2010 |
| Project Start | December 2010 (loan agreement date) |
| Ground-breaking ceremony | Information not available |
| Project implementation | 2011–2014 (phase 1 and 2) 2018 (reported deployment) |
| Current status of the project | Discontinued due to lack of suitable policy framework, outdated hardware, and the expiration of various licenses |

Source: AidData (2021)

In 2005, the PNG government expressed its intention to establish a private government network aimed at interconnecting government agencies (DICT, 2020). This vision was formalized through National Executive Council (NEC) Decision No. 124/2006, which endorsed a proposal to integrate government agencies via a shared information platform and mandate DICT to execute the steps outlined in the e-readiness and feasibility study of the project. Following this, in 2009, a cost-benefit analysis study was conducted to assess the viability of the IGIS project. The study affirmed its economic feasibility, predicting both cost savings and enhancements in public service delivery. Subsequently, the IGIS project received official approval from the Cabinet under NEC Decision 50/2010, with the DICT mandated to lead its implementation.

According to data from AidData’s Global Chinese Development Finance Dataset (AidData, 2021), in December 2010, an agreement was signed between China Exim Bank and the PNG government, securing an RMB 359 million or US\$53 million government concessional loan (GCL)¹ for the IGIS Project. These funds were used to support a commercial contract between Telikom PNG Ltd—a state-owned telecommunications company in PNG—and Huawei Technologies Co., Ltd. for the project’s execution. The primary contractors for the IGIS project were Huawei Technologies

¹ Concessional loan is a loan made on more favorable terms than the borrower could obtain in the marketplace. It can be in the form of an interest rate below the market place, deferred repayments, or income-contingent repayments. Concessional loans by the government are issued to support the achievement of government policy objectives, including in ICT-related projects (Australia Department of Finance, 2023).

Co Ltd, Telikom PNG Ltd, and PNG DataCo (OGP, 2018). For the project management, DICT as the leading agency was responsible for implementing the project with collaboration alongside sectoral government agencies such as National ICT Authority (NICTA), PNG ICT Cluster, Department of National Planning and Monitoring, Department of Implementation and Rural Development, National Statistics Office, Department of Provincial and Local Level Government, Department of Personnel Management, and Consultative Implementation and Monitoring Council (OGP, 2018). The first phase of the project was completed in 2014, followed by an opening ceremony held by the PNG government on July 11 2014 and attended by the PNG Prime Minister, Chinese Ambassador to PNG, and Huawei PNG General Manager (Embassy of the PRC in PNG, 2014).

IGIS Design and Implementation

The DICT is the leading agency in the planning and implementation of ICT-related projects, including the IGIS infrastructure. Originally, main responsibilities of DICT encompassed policy formulation, service delivery oversight, and coordination for communication and information-related affairs. In 2020, the NEC Decision No. 252/2020 expanded DICT's mandate to oversee PNG's digital economy transformation initiatives.

The PNG government considers the private government network infrastructure built under the IGIS project a stepping stone towards the digital government agenda in PNG, with plans for its extended deployment nationwide. The IGIS project, however, has been poorly implemented, with slow progress in the stages following phase 1.

The first phase of the IGIS project was the construction of the national data center and establishment of a secure high-speed government network within it (OGP, 2022b). Additionally, IGIS equipment was installed at various government agency sites to connect them to the new data center and IGIS shared services and applications (ASPI, 2020). This phase covered 47 government agency sites across the National Capital District and several other provinces, which include Central, Goroka, Wewak, Kimbe and Kokopo provinces (AidData, 2021). The second phase of the project involved extending the IGIS coverage to other provinces and various subnational agencies and districts, linking them with the data center and extending connectivity and basic communication services such as internet services, data backup services, and video conferencing facilities (DICT, 2018; Arnold, 2017).

However, the second phase of the IGIS project was not fully carried out and well-executed (DICT, 2020; ASPI, 2020). The project began in June 2011 and concluded in July 2014, but the data center in Port Moresby did not become operational until 2018 (AidData, 2021). In March 2020, the DICT announced and acknowledged that the IGIS project had suffered from poor management and could be considered as a "failed investment" (VanderKlippe, 2020). This has resulted in the slow progress in enabling the flow of public information and centralizing government data in PNG (OGP, 2022a), putting the country among the lowest performers in the E-Government Development Index (UN, 2022).

The PNG government considers the private government network infrastructure built under the IGIS project a stepping stone towards the digital government agenda in PNG.

Based on an extensive evaluation by the DICT, the IGIS project lacked a suitable policy framework due to the absence of comprehensive government information consolidation during the project planning process (ASPI, 2020; OGP, 2022b). Despite the installed infrastructure and its intended purpose of centralizing government data sharing and storage, most government agencies did not migrate their data, resulting in underutilization of the data center (Moss, 2020). Calls to migrate all government sites to IGIS has also received resistance from other ISPs who were hosting government websites, with concerns of potential business losses (Arnold, 2017).

The IGIS system also faced operational and maintenance issues, including expired software licenses and degraded uninterruptible power supply (UPS) batteries that were not replaced (Moss, 2020). Many critical services and applications of the IGIS were not delivered, and the national data center was dysfunctional with outdated hardware, expired licenses, and broken e-mail servers (VanderKlippe, 2020). Consequently, the IGIS project has been deemed a failure, marked by its low utilization rates and the subsequent abandonment of the data center.

Based on an extensive evaluation by the DICT, the IGIS project lacked a suitable policy framework due to the absence of comprehensive government information consolidation during the project planning process.

Lessons learned from the IGIS project

Despite the controversies surrounding the IGIS infrastructure, the PNG government remains committed to IGIS development and integration into the ongoing national digital government transformation policies and strategies, such as the PNG Digital Transformation Policy 2020, PNG Digital Government Plan 2023-2027, and PNG Government Technology Stack 2023. A newly implemented project called “Digital Government Infrastructure and Services Program” under the PNG Public Investment Program 2022-2026 will operationalize the IGIS infrastructure and other key components within these national strategies and policy frameworks to shape the PNG’s whole-of-government digital ecosystems (Department of Treasury, 2022).

Furthermore, in response to the evaluation of the IGIS project by the DICT, the PNG government announced in 2021 its intention to transition government agencies’ data storage and sharing to cloud services, as a cost-effective measure and efficient complementary to the on-premise IGIS model (Kellerton, 2021; DICT, 2023c). It is also incorporated in the current draft of the PNG Government Cloud Policy, which is still under public consultation (DICT, 2023b; DICT, 2023c). The adoption of cloud technology is a growing trend in the digital government transformation agenda

worldwide, offering optimized IT resource management and cost-efficiency (UN, 2022).

To address the limitations of the IGIS program, a technology stack approach was adopted and geared towards streamlining government service delivery, reducing costs, and avoiding redundant investments across the ICT sectors.

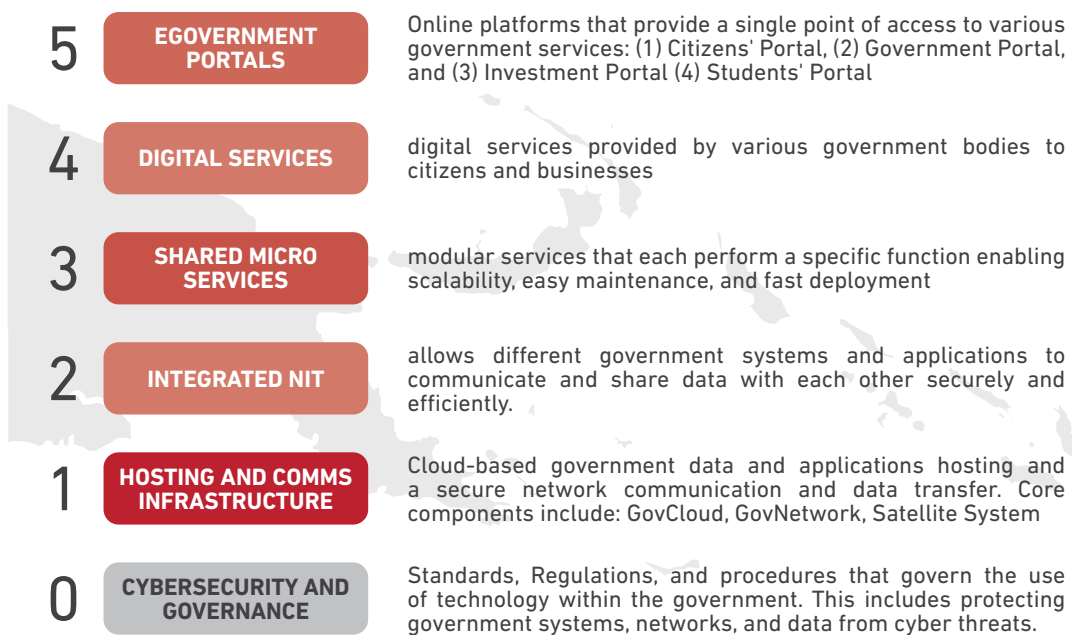
The PNG Government Technology Stack 2023 (see Figure 2), is the latest attempt to establish digital government ecosystems where private government networks form an integral part of the government hosting and communications infrastructure. The technology stack is a framework that encompasses various layers and components of digital infrastructure and digital government agenda, such as enabling technologies, applications, and user interfaces.

To address the limitations of the IGIS program, a technology stack approach was adopted and geared towards streamlining government service delivery, reducing costs, and avoiding redundant investments across the ICT sectors. As a newly implemented framework within the national digital transformation agenda, PNG Government Technology Stack 2023 is still in its nascent stages and its progress remains to be seen.

Figure 2.
Building Blocks of PNG Government Technology Stack 2023

[STRATEGY: GOVPNG TECH STACK]

OVERVIEW



Source: DICT (2023a)

GOVERNANCE AND IMPLEMENTATION

Transparency and Accountability

Despite the number of opportunities for inter-agency information sharing and e-government implementation initiatives enabled by enhanced IGIS, the project has been marked by transparency and accountability issues that could preclude the realization of the anticipated benefits. The level of transparency in the IGIS project management remains low, with most information sourced from third-party websites. Transparency challenges are further exacerbated by the absence of a legal Right to Information (RTI) Law and the limited proactive disclosure of procurement information and fragmented procurement mechanisms.

As mentioned, the project lacked transparency in its management. The public could not access key information about the project, such as contracts, loan terms, technical feasibility, and audit reports. Some information was only available on third party websites. There was no information on how the contractors were selected or what the environmental and social impacts were. This is mainly caused by the absence of a legal framework, such as the RTI Law, that obliges government and business entities to disclose important public information. There is also no central government data storage system that can simplify data management and ensure public availability through an e-government portal.

Enabling policies are already in place within PNG's public finance and project management governance system (see Table 2). The funding structure for infrastructure projects in PNG is regulated by the Public Finances (Management) Act 1995, which dictates that projects can be financed either wholly or partially by the PNG government, depending upon the scale and jurisdiction of the project. For national-scale projects, funding is allocated from the National Budget, while those falling under provincial or local jurisdiction draw funding from the respective provincial budget. Within each fiscal year, the national budget of PNG is structured to allocate resources for approved development projects. The makeup of the budget is raised through taxation and authorized loans as per parliamentary directives.

The project has been marked by transparency and accountability issues that could preclude the realization of the anticipated benefits.

Additionally, the procurement process for publicly funded projects adheres to the standardized framework overseen by the National Procurement Commission (NPC), as governed by the National Procurement Act 2018. This applies to all PNG public and statutory bodies at the national and regional levels. The main function of the NPC is to conduct procurements on behalf of the PNG government, ensuring timeliness, transparency, and non-discrimination throughout the process. The NPC is responsible for approving and awarding contracts based on the procurement value thresholds outlined by the National Procurement Act.

Table 2.
Infrastructure Development Policy Framework in PNG

| Aspect | Policies/Regulations |
|---|--|
| Infrastructure development plan and strategy | <ul style="list-style-type: none"> National ICT Roadmap 2018 Digital Transformation Policy 2020 Digital Government Plan 2023-2027 Medium Term Development Plan (MTDP) III 2018-2022 and MTDP IV 2023-2027 Connect PNG (Implementation and Funding Arrangements) Act 2021 Long Term Development Strategy 2010-2030 PNG Vision 2050 |
| National budgeting system | <ul style="list-style-type: none"> Public Finances (Management) Act 1995 National Procurement Act 2018 Medium Term Development Plan (MTDP) 2023-2027 PNG Annual Budgets |
| Legal framework for public procurement | <ul style="list-style-type: none"> Public Finances (Management) Act 1995 National Procurement Act 2018 |
| Open data on infrastructure project financing and procuring documents | <ul style="list-style-type: none"> Department of Treasury website National Procurement Commission (NPC) website |
| Openness to private investment | <ul style="list-style-type: none"> Investment Promotion Act 1992 Public-Private Partnership (PPP) Act 2014 |
| Measures to prevent fraud and corruption | <ul style="list-style-type: none"> Public Finances (Management) Act 1995 National Procurement Act 2018 Organic Law on the Independent Commission against Corruption (ICAC) 2019 |
| Environmental impact study of infrastructure project | <ul style="list-style-type: none"> Environment Act 2000 Conservation and Environmental Protection Authority (CEPA) |
| Social impact study of infrastructure project | N/A |

Source: Compiled from APEC (2021), World Bank (2020), and authors' analysis

Despite the established procedures, the level of transparency in the IGIS project management is low. This is evident in the limited availability of the IGIS project information to the public at the project preparation, completion, procurement, and implementation phases following the framework of the Infrastructure Data Standards (IDS) for proactive disclosure developed by the Construction Sector Transparency Initiative (CoST) (see Table 3). While budget appropriations for the projects are listed in the PNG government's annual budgets, key information such as the project contracts, the loan agreement and borrowing terms of the loan, technical feasibility and evaluation, audit and financial closeout reports are not readily available in public or government websites. Some information is partially available but can be found on third party websites such as the Open Government Partnership and AidData. This indicates a lack of transparency and difficulty in accessing information on the project.

It should be noted that the IGIS data center project was carried out before the 2018 National Procurement Act was issued and the establishment of the National Procurement Commission. This study did not find any information about procurement processes leading to the appointment of Huawei Technologies Co Ltd, Telikom PNG Ltd, and PNG DataCo as contractors. Environmental and social impact documents also cannot be found in publicly accessible websites. See table 3 below for the list of transparency and feasibility assessment of the project.

Despite the established procedures, the level of transparency in the IGIS project management is low.

Table 3.
Integrated Government Information System Transparency and Feasibility Assessment

| Project Phase | Project Information | Disclosure of Information |
|------------------------|---|---|
| Project Identification | <ul style="list-style-type: none"> Project owner Sector, subsector Project name Project location Purpose Project description | <p>Fully available at:</p> <ul style="list-style-type: none"> www.treasury.gov.pg/wp-content/uploads/2023/05/2014-Vol3_PIP-2014-2018.pdf www.opengovpartnership.org/documents/papua-new-guinea-action-plan-2018-2020/ |
| Project Preparation | <ul style="list-style-type: none"> Project scope (main output) Environmental impact Land and settlement impact Contact details Funding sources Project budget Project budget approval date | <p>Partially available in publicly available websites at:</p> <ul style="list-style-type: none"> www.opengovpartnership.org/documents/papua-new-guinea-action-plan-2018-2020/ china.aiddata.org/projects/39381/ <p>Environmental impact as well as land and settlement impact are not readily available in publicly accessible websites.</p> |
| Project Completion | <ul style="list-style-type: none"> Project status (current) Completion cost (projected) Completion date (projected) Scope at completion (projected) Reasons for project changes Reference to audit and evaluation reports | <p>Partially available in publicly accessible websites at:</p> <ul style="list-style-type: none"> www.treasury.gov.pg/wp-content/uploads/2023/05/2014-Vol3_PIP-2014-2018.pdf www.treasury.gov.pg/wp-content/uploads/2023/05/budget-2023-Volume-3A.pdf www.opengovpartnership.org/members/papua-new-guinea/commitments/PNG0002/ <p>Reference to audit and evaluation reports are not readily available in publicly accessible websites.</p> |
| Procurement | <ul style="list-style-type: none"> Procuring entity Procuring entity contact details Procurement process Contract type Contract status (current) Number of firms tendering Cost estimate Contract administration entity Contract title Contract firm(s) Contract price Contract scope of work Contract start date and duration | <p>Partially available in publicly accessible websites at:</p> <ul style="list-style-type: none"> www.opengovpartnership.org/documents/papua-new-guinea-action-plan-2018-2020/ china.aiddata.org/projects/39381/ <p>Information on the procurement process (procurement rules based on China's borrowing terms) and contract type (design and supervision framework) are not readily available in publicly accessible websites.</p> |
| Implementation | <ul style="list-style-type: none"> Variation to contract price Escalation of contract price Variation to contract duration Variation to contract scope Reasons for price changes Reasons for scope & duration changes | <ul style="list-style-type: none"> Information on list of variations, changes, and amendments are not readily available in publicly accessible websites. |

Source: Construction Sector Transparency Initiative (2013) and Yusuf et al. (2021), processed by authors

PNG has been a member of the Open Government Partnership² (OGP) since October 2015. Based on the PNG OGP National Action Plan 2022-2024 (OGP, 2022a), there are several issues that remain to be addressed across OGP's six areas. Firstly, the flow of public information is weak in PNG due

² OGP is a global partnership with over 80 member countries participating, 104 local governments, and thousands of civil society organizations (CSOs) to push for more open, transparent, and accountable governance (OGP, 2023). Through this partnership, governments alongside CSOs work together to formulate two-year action plans with steps and commitments across six main sectors: freedom of information, public participation, fiscal transparency, extractive resource transparency, government integrity, and open data.

to administrative restrictions. There is no legal umbrella, such as the Right to Information (RTI) Law, that requires government and business entities to share vital public information. These entities tend to be overly protective of information, limiting its accessibility for public consumption, evidence-based policy formulation, and investment purposes. Secondly, there is a lack of a centralized government data repository system needed to streamline data management and ensure public accessibility through an e-government portal. This leads to scattered and uncoordinated information dissemination to the public. Another pressing issue is public access availability of government expenditure reporting. The financial expenditures of government agencies have not been disclosed optimally for public access, and this lack of transparency has allowed for potential misuse of funds and eroding trust in the public finance management.

Overall, the aforementioned governance issues indicate that the legislative reforms in the infrastructure development in PNG have not been accompanied by structural and institutional reforms.

In the public procurement sector, under the National Procurement Act 2018, the NPC was established in 2019 to replace the previous national procurement body, the Central Supply and Tenders Board (CSTB). The establishment of NPC marked a significant reform for a more accessible, efficient, and transparent procurement system in PNG (Natanegara et al., 2023; OGP, 2022a). However, challenges persist, as there still exists political interference in the procurement process and limited e-procurement capacity (Transparency International PNG, 2021a). Despite the legislative reform, transparency remains an area of concern in the PNG's procurement system, indicated by limited proactive disclosure of procurement information and fragmented procurement mechanisms (Transparency international PNG, 2021b). This is particularly relevant to the procurement for infrastructure projects involving international agreements and partners such as the IGIS project. For instance, Section 7 in the National Procurement Act specifies that in cases where the PNG government enters into agreements such as treaties, conventions, loans, or grants with other states or international organizations, any conditions or obligations outlined in those agreements that clash or are not aligned with the National Procurement Act will take precedence over the Act's provisions. This exception for public procurement involving international agreements effectively means that the tendering process for the IGIS projects was unlikely to follow an open and competitive process.

Overall, the aforementioned governance issues indicate that the legislative reforms in the infrastructure development in PNG have not been accompanied by structural and institutional reforms. This situation has been analyzed in the National Integrity System (NIS) assessment conducted by the Transparency International PNG (2021b). NIS assesses both the legislative framework and the practical institutional operations across various sectors in PNG, including public administration, finance, and procurement activities. It evaluates them based on governance indicators like transparency, accountability, and integrity. The assessment shows that, although these sectors tend to perform relatively well on these indicators in terms of legal frameworks, there are still weaknesses in practice, highlighting a disparity between legal provisions and their enforcement in PNG.

Security Issues

The IGIS project became a subject of international controversy when an Australian media outlet leaked a report commissioned by PNG's National Cyber Security Centre (NCSC) and funded by the Australian Department of Foreign Affairs and Trade (DFAT) (AidData, 2021; Grigg, 2020). The report, conducted by the Australian Strategic Policy Institute (ASPI), highlighted security vulnerabilities in the project, particularly within the national data center infrastructure which was primarily constructed by Huawei Technologies Co. (Horst & Foster, 2023; Burkitt-Gray, 2020). It identified concerns about the data center's layout which did not align with the intended design and potential security risks such as hacking and government surveillance (Grigg, 2020).

As a technical review of the infrastructure, the report claims that the data center's major security risks stemmed from its encryption algorithm considered broken and outdated since 2016, two years prior to the data center's operational commencement in 2018 (VanderKlippe, 2020). Additionally, it highlighted the infrastructure's insufficient firewall settings, leaving the data center more vulnerable to hacking and surveillance (Grigg, 2020).

The report has not been disclosed to the public to date. Huawei also refrained from providing an official response towards the issue. However, they stated to the Australian Financial Review that the project "complies with appropriate industry standards and the requirements of the customer" (Moss, 2020). Meanwhile, the Chinese government through its foreign ministry emphasized that "Chinese government always requires Chinese companies, in their overseas operations, to strictly follow international regulations", while firmly opposing the discussions about the data center by certain international media (VanderKlippe, 2020).

Despite the controversy and opposing views between stakeholders regarding the concerns over security, the issue of functionality and disrepair of the data center seems to be more prominent for the PNG government. According to the report, there was a lack of funding for maintenance and operations of the data center. Additionally, the Australian government engaged the ASPI to conduct the study after the PNG government approached them for financial assistance to support the data center's operations (Burkitt-Gray, 2020). However, the Australian government did not provide the requested assistance, as the report assesses that a comprehensive rebuild is necessary for the data center to function properly (Grigg, 2020).

“Despite the controversy and opposing views between stakeholders regarding the concerns over security, the issue of functionality and disrepair of the data center seems to be more prominent for the PNG government.”

Baseline security for e-government and data centers includes a combination of physical and digital security measures. Addressing these challenges, the government introduced the National Cyber Security Policy (NCSP) in 2021. This policy articulates the government's vision, goals, and objectives, outlining evolving governance principles to minimize cybersecurity risks that could adversely impact ICT development and the broader economy of PNG. Aligning with these security initiatives, the latest national mid-term development plan or MTDP IV emphasizes strategies to enhance government ICT services while ensuring the security of these systems and the cyber safety of PNG citizens. Investments totaling K2.03 billion (approximately US\$567 million) will be allocated for national

ICT-related cybersecurity programs by 2027, with funding anticipated from both government sources and potential international development partners (Natanegara et al., 2023).

Another important component that forms a baseline for security in data center ecosystems is resilient data governance and data protection. Currently, PNG lacks a comprehensive and dedicated data protection policy and corresponding legislation. Recent development in this area includes the drafting of the National Data Governance and Protection Policy, which has been in development since 2021 (DICT, 2023). One of the key objectives of this draft policy is the formulation and implementation of specific laws for data privacy, protection, and governance. The proposed policy also calls for the creation of an independent national authority to oversee and enforce regulatory compliance and establish cross border data sharing mechanisms. The realization of such a framework is critical for PNG's growing digital status.

Importantly, given that a significant portion of PNG's infrastructure projects relies on funding from international partners—presenting opportunities for foreign investors—it is imperative for the PNG Government to thoroughly identify, assess, and mitigate risks associated with third-party involvement in government data management and data security within ICT infrastructure projects. As part of this risk mitigation, foreign third parties should be required to provide assurances that their home Government will not have access to the data they store or manage, whether through legal means or other methods such as backdoors. This measure is essential to safeguard critical government data and ensure compliance with existing international standard on data protection laws and cybersecurity.

Project Financing

The US\$53 million IGIS project was financed by a government concessional loan from the China Exim Bank which presents public financial exposure to PNG as it led to increase in the country's public debt. In 2017, PNG's debt to China amounted to approximately US\$588 million, constituting 23.7% of the country's total external debt (O'Dowd, 2021). The Minister of DICT made a public statement in 2020 that the PNG government should not repay the loan to China Exim Bank due to the dysfunctional data center built under the IGIS project. However, the status of the loan remains unclear as most loan financing contracts with China remain unreported and are difficult to track (INA, 2022; O'Dowd, 2021).

It should be noted that governance risks also originate from high levels of public finance mismanagement and domestic fiscal policies as well as possible corruption by the PNG government (INA, 2022; O'Dowd, 2021). While there isn't concrete evidence of the latter, the lack of transparency, accountability, and self-reporting, along with the absence of essential information like procurement processes and contract types (as shown in table 3 in the previous section), points to the possibility. Indeed, there is substantial uncertainty regarding PNG's financial reliance on China due to confusion between Chinese investment and debt in PNG as well as a lack of year-on-year official data (O'Dowd, 2021).

China's involvement in the development financing of the IGIS infrastructure can be attributed to the context of geopolitical dynamics and competition in the Pacific region. China has emerged

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as the third-largest source of development finance to the Pacific Island countries from 2008 to 2021, establishing itself as a significant development partner in the infrastructure sector (Lowy Institute, 2023). Many countries in the region, including PNG, have received critical infrastructure financing from China as part of its Belt and Road Initiative (BRI). While there is no explicit confirmation that the IGIS project falls under the BRI umbrella, the timeline alignment and the involvement of the China Exim Bank suggest a potential indirect association. Projects under the BRI scheme are financed by two main development finance institutions: China Development Bank (CDB) and China Export-Import Bank (Exim Bank) (OECD, 2018). After the Asia-Pacific Economic Cooperation (APEC) Summit in 2018, many Pacific Island countries had signed Memorandum of Understandings (MoUs) with China for the BRI, including PNG (OBOReuropa, 2018; Wroe, 2018).

Increasingly, there also been growing concerns over the sustainability of loan financing for infrastructure developments in the PNG. The country's budget position and relatively underdeveloped markets for infrastructure services pose major challenges that affect funding of ongoing infrastructure operations (Lawrence, 2017). As observed in many other Pacific Island countries, investment in the infrastructure sector in PNG has the largest proportion of loan financing compared to other sectors (Lowy Institute, 2023). Without proper financial scrutiny, there is potential vulnerability to debt distress. It remains crucial, however, to adhere to generally accepted standards of fiscal management when borrowing from foreign sources. This also applies to the foreign borrowing of SOE—especially as they play a dominant role in ICT infrastructure development.

The rapid increase in capital investment, including in the ICT infrastructure sector, has contributed to employment opportunities and economic growth in PNG but has also led to significant growth in budget deficit and public debt. Between 2006 and 2020, capital investment expenditure increased from US\$487 million to US\$2 billion, leading to a shift from a national budget surplus of US\$131 million to a deficit of US\$2.1 billion during the same period (Chand & Sanida, 2022).

CONCLUSION AND RECOMMENDATIONS

The Integrated Government Information System (IGIS) is deemed a critical digital infrastructure for the delivery of public sector services in Papua New Guinea (PNG), comprising a national data center, private government network, and shared applications and services. By analyzing the current regulatory environment in which the IGIS project was planned, funded, and implemented in PNG, the study examined the risks and challenges that impede the successful implementation of the project. While the IGIS aimed to streamline public data management, the case study finds governance gaps in security, transparency, and financing aspects of IGIS sustainable implementation. As in the case in many other developing countries, PNG faces challenges in the implementation of inter-agency information sharing and data centralization, which do not only surround technical components, but also organizational and policy components, particularly related to bureaucratic structure and alignment of sectoral interests (Sayogo & Gil-Garcia, 2015; Daniel, 2014; Dekker, 2004).

As a result, the IGIS project has been deemed a failure with low utilization rates and the data center has today largely been abandoned. This raises questions about the proper project planning, preparation and design of the project, which is hard to assess due to the lack of transparency and publicly accessible information on the project. The significant transparency and governance gaps are further exacerbated by the lack of information provided by contractors and absence of laws that mandates public access to information. The lack of transparency also heightens the potential for mismanagement and corruption of the project which will ultimately burden the people of PNG considering that the project is financed through a loan and generates public debt. Aside from the transparency issues, the IGIS project also had data security and protection problems with security vulnerabilities identified within the data center infrastructure.

Recommendations

- 1. Uphold principles of good governance and transparency.** It is imperative for the PNG government to uphold best practices in the governance and implementation of ICT projects, grounded in transparency and accountability principles. While information regarding public procurement tenders and bids are available on NPC and NICTA websites, there is limited disclosure of procurement decisions and outcomes. Important documents such as tender notices, project assessments, and contracts have yet to be made available online. These gaps could be addressed by a comprehensive Right to Information law that would enforce public access to information requiring government and business entities to disclose vital public information. Additionally, the participation and engagement of civil society, media, and citizens in the monitoring and evaluation of public projects and services should be promoted and supported. This would enhance the demand for transparency and accountability, and foster a culture of openness and trust.
- 2. Establish an ICT working group to strengthen inter-agency collaboration.** To undergo an effective implementation of critical ICT projects emphasizing on transparency, accountability, and good governance, an organized and formal ICT working group between DICT, NICTA, ICT-related industry players and/or associations, and local governments should be established.

The working group could be both a network and a form of collaborative public-private policy dialogue to foster collaboration among government and non-government agencies to address challenges related to information sharing and data centralization as well as attract sustainable investment and eliminate ease-of-doing business barriers.

- 3. Adopt and implement a Right to Information law.** With the absence of a comprehensive Right to Information law, donors or financiers of infrastructure development projects should include transparency requirements by asking the recipient government and project contractors to publish relevant information to the public. Simultaneously, the government itself bears the responsibility to enforce transparency requirements in project agreements. Such requirements for transparency will enhance the accountability of involved stakeholders and help mitigate governance and corruption risks, while ensuring that the project is appropriately planned, considers environmental and social impacts, and is successfully implemented.
- 4. Apply effective risk management standards during the project lifecycle.** The PNG Government should identify, assess, and mitigate risks related to third-party involvement in government data management and data security in ICT infrastructure projects, considering that foreign third parties and service providers are usually involved. These risks should be mitigated in the form of safeguards and guarantees by the third party as part of the project's scope of work, contractual requirements, and publicly accessible procurement selection process. Among others, foreign third parties must guarantee that their home Government will not have access to data they store or manage either by legal means or by using other means such as backdoors. This shall ensure that critical government data are adequately protected by the third parties involved, in line with prevailing data protection laws and policies. As the PNG government is embracing the growing trend of cloud technology adoption, it must establish and enhance baseline requirements for cybersecurity in the forthcoming model under the national digital transformation and government cloud policies. Security and data protection risks remain particularly relevant to cloud technologies, as governments essentially give control of data management to third-party cloud service providers (UN, 2022).
- 5. Improve fiscal discipline and seek sustainable financing models for ICT projects.** The PNG Government should improve fiscal discipline measures to control public expenditure and reduce reliance on debt financing. This could involve the establishment of clear criteria for expenditure prioritization and the adoption of performance-based budgeting to ensure that funds are allocated efficiently. Regular debt sustainability analysis is also crucial to assess debt obligations, identify potential risk, and inform debt management strategies. This analysis should consider factors such as debt-to-GDP ratio, debt service costs, and the impact of debt on the country's overall financial health. Furthermore, the oversight and accountability mechanisms for public finance management should be strengthened to ensure that the government spending is audited, reported, and investigated in a timely and transparent manner. This can be achieved through the establishment of clear guidelines for auditing government spending, ensuring that reports are made public in a timely manner, and establishing mechanisms for investigating any irregularities or discrepancies.



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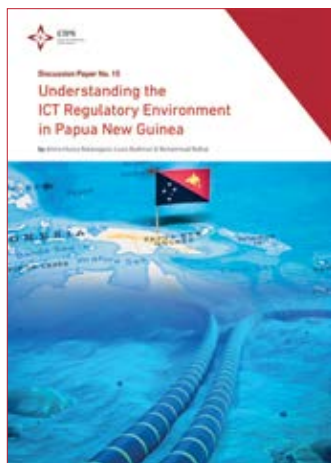
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