Public Disclosure Authorized
Public Disclosure Authorized
Public Disclosure Authorized
Public Disclosure Authorized

October 2009
AAA42

Investing in the Future of Papua & West Papua

Infrastructure for Sustainable Development

THE WORLD BANK | BANK DUNIA

Australian Indonesia Partnership
Kemitraan Australia Indonesia

THE WORLD BANK OFFICE JAKARTA
Indonesia Stock Exchange Building, Tower II/12-13th Fl.
Jl. Jend. Sudirman Kav. 52-53
Jakarta 12910
Tel: (6221) 5299-3000
Fax: (6221) 5299-3111

THE WORLD BANK
1818 H Street N.W.
Washington, D.C. 20433 USA
Tel: (202) 458-1876
Fax: (202) 522-1557/1560
Email : feedback@worldbank.org
Website : www.worldbank.org

Printed in October 2009

Investing in the Future of Papua & West Papua: Infrastructure for Sustainable Development is a product of staff of the World Bank. The findings, interpretation and conclusion expressed herein do not necessarily reflect the views of the Board of Executive Directors of the World Bank or the government they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denomination and other information shown on any map in this work do not imply any judgment on the part of the World Bank concerning the legal status of any territory or the endorsement of acceptance of such boundaries.

Photos by: Haeyoung Lee, Muhammad Ryan Sanjaya and Bernard Wasow

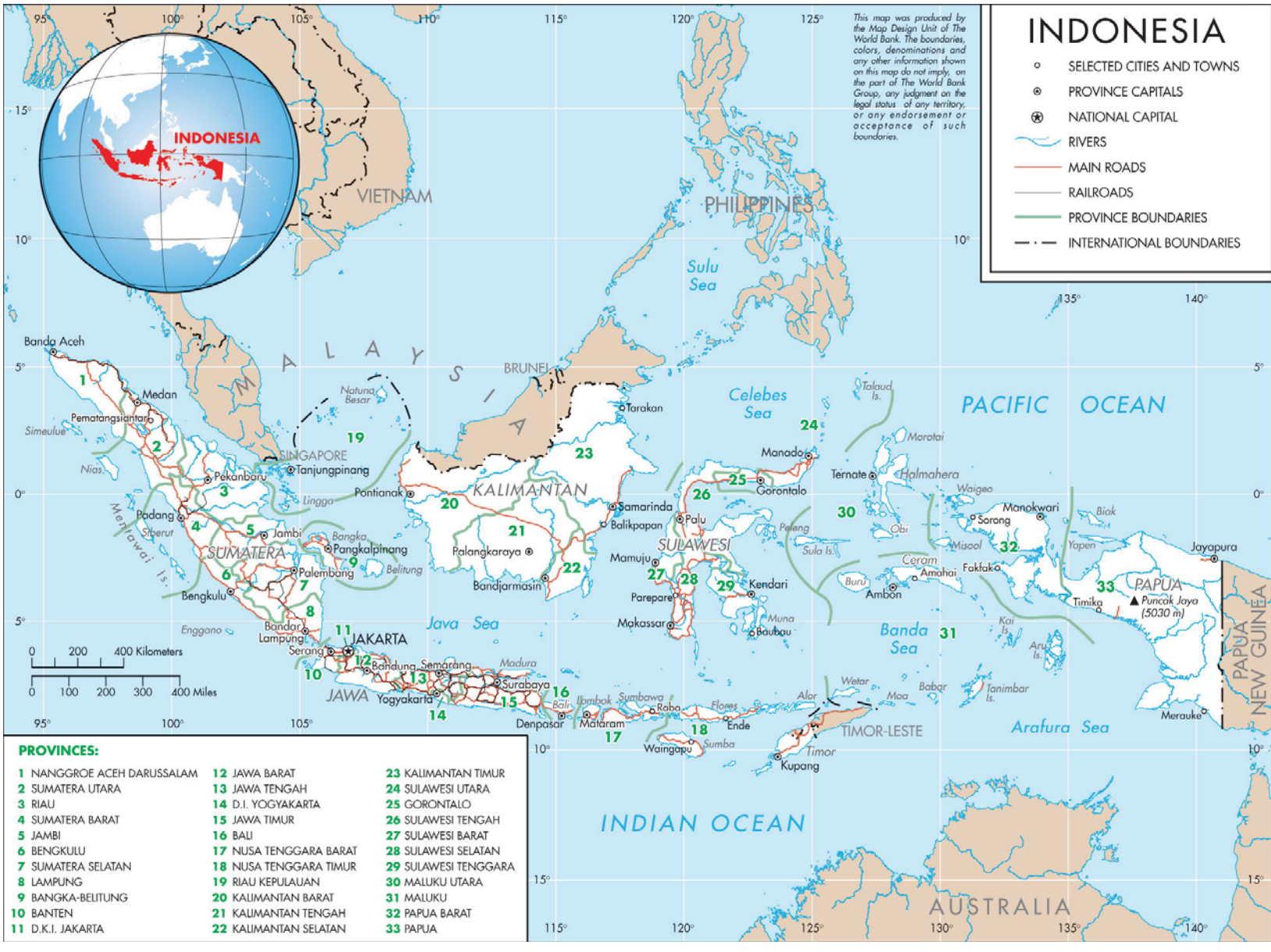
ISBN 978-979-16876-2-1
9 789791 687621

October 2009

Investing in the Future of Papua & West Papua

Infrastructure for Sustainable Development

Investing in Indonesia's Institutions
for Inclusive and Sustainable Development



PROVINCES:

1 NANGGROE ACEH DARUSSALAM	12 JAWA BARAT	23 KALIMANTAN TIMUR
2 SUMATERA UTARA	13 JAWA TENGAH	24 SULAWESI UTARA
3 RIAU	14 D.I. YOGYAKARTA	25 GORONTALO
4 SUMATERA BARAT	15 JAWA TIMUR	26 SULAWESI TENGAH
5 JAMBI	16 BALI	27 SULAWESI BARAT
6 BENGKULU	17 NUSA TENGGARA BARAT	28 SULAWESI SELATAN
7 SUMATERA SELATAN	18 NUSA TENGGARA TIMUR	29 SULAWESI TENGGARA
8 LAMPUNG	19 RIAU KEPULAUAN	30 MALUKU UTARA
9 BANGKA-BELITUNG	20 KALIMANTAN BARAT	31 MALUKU
10 BANTEN	21 KALIMANTAN TENGAH	32 PAPUA BARAT
11 D.K.I. JAKARTA	22 KALIMANTAN SELATAN	33 PAPUA

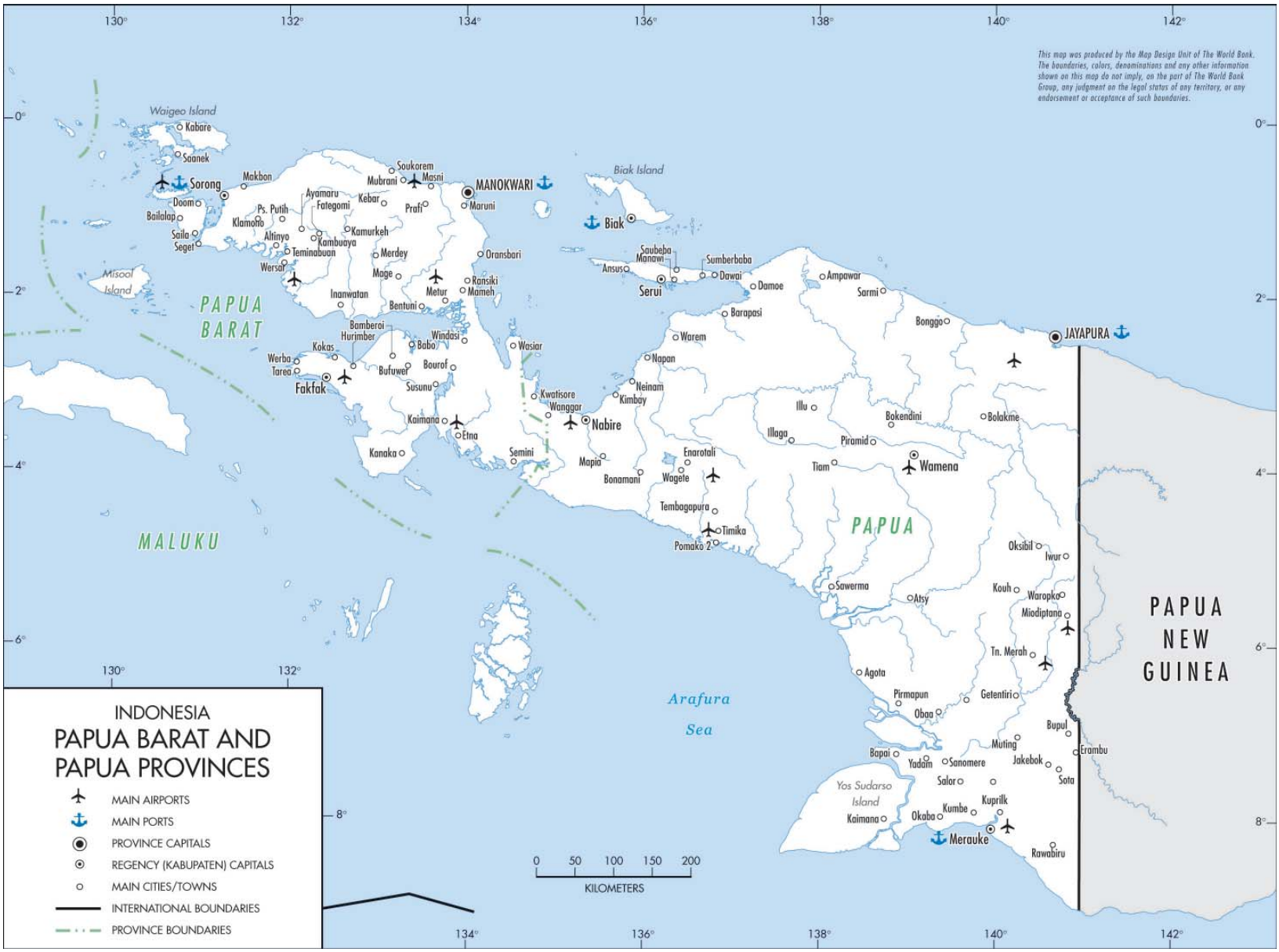

This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
130°
132°
134°
136°
138°
140°
142°
0°
2°
4°
6°
8°
Waigeo Island
Kabare
Saanek
Sorong
Makbon
Doom
Bailalap
Saila
Seget
Ps. Putih
Klamono
Altinyo
Teminabuan
Kambuaya
Kamurkeh
Ayamaru
Fategomi
Kebar
Soukorem
Mubrani
Masni
Prafi
MANOKWARI
Maruni
Biak Island
Biak
Misool Island
PAPUA BARAT
Wersar
Merdey
Mage
Oransbari
Ransiki
Mameh
Metur
Inanwatan
Bentuni
Bamberoi
Hurimber
Kokas
Werba
Tarera
Fakfak
Babo
Windasi
Bofuwer
Bourof
Susunu
Wasiar
Kwatisore
Wanggar
Nabire
Kaimana
Etna
Kanaka
Semini
Mapia
Bonamani
Enarotali
Wagete
Tembagapura
Timika
Pomako 2
Saubeba
Manawi
Ansus
Sumberbaba
Dawai
Damoe
Serui
Ampawar
Sarmi
Barapasi
Warem
Napan
Neinam
Kimbay
Illu
Illaga
Tiam
Piramid
Wamena
Bokendini
Bolakme
Bonggo
JAYAPURA
MALUKU
PAPUA
Oksibil
Iwur
Sawerma
Atsy
Kouh
Waropko
Miodiptana
Tn. Merah
Agota
Pirmapun
Obaa
Getentiri
Bupul
Muting
Erambu
Bapai
Yadam
Sanomere
Jakebok
Salor
Sota
Yos Sudarso Island
Kaimana
Okaba
Kumbe
Kuprik
Merauke
Rawabiru
PAPUA NEW GUINEA
Arafura Sea
0 50 100 150 200
KILOMETERS
INDONESIA
PAPUA BARAT AND PAPUA PROVINCES
MAIN AIRPORTS
MAIN PORTS
PROVINCE CAPITALS
REGENCY (KABUPATEN) CAPITALS
MAIN CITIES/TOWNS
INTERNATIONAL BOUNDARIES
PROVINCE BOUNDARIES

Table of contents

Figures

Tables

Boxes

Abbreviations and Acronyms

ADB	Asian Development Bank
ADSL	Asymmetric Digital Subscriber Line
APBD	Anggaran Pendapatan dan Belanjaan Daerah (Regional Budget of Revenues and Expenditures)
APBN	Anggaran Pendapatan dan Belanjaan Negara (National Budget of Revenues and Expenditures)
ASEAN	Association of South-East Asian Nation
AusAID	Australian Agency for International Development
BAPPEDA /BP3D	Badan Perencanaan [Pengendalian] Pembangunan Daerah (Regional Body for Planning, Oversight and Development)
BPDE	Provincial Electronic Data Center
BTS	Base Transceiver Station
CBD	Central Business District
CDMA	Code Division Multiple Access
DAU	Dana Alokasi Umum (General Allocation Fund)
DAK	Dana Alokasi Khusus (Special Allocation Fund)
DBH	Dana Bagi Hasil (Shared Revenue Funds)
DGAT	Directorate General of Air Transport
DGLT	Directorate General of Land Transport
DGST	Directorate General of Sea Transport
DWT	Dead-Weight Tonnage
EIRTP	Eastern Indonesia Roads Transport Project
GDP	Gross Domestic Product
GOI	Government of Indonesia
GSM	Global System for Mobile communications
gWh	Gigawatt Hours
Ha	Hectare
HIV/ AIDS	Human Immunodefiency Virus/ Acquired Immuno-Deficiency Syndrome
Hz	Hertz (Revolutions per second)
ICT	Information and Communications Technology
Inpres	Instruksi Presiden (Presidential Instruction)
IP	Internet Protocol
IPLT	Instalasi Pengolahan Lumpur Tinja (Sewage Treatment plant
IPP	Independent Power Producer
IRMS	Indonesia Roads Management System
Kab.	Kabupaten
km	Kilometer
KM	Keputusan Menteri (Ministerial Decree)
kV	Kilovolt
kWh	Kilowatt Hours
LPMAK	Lembaga Pengembangan Masyarakat Amungme dan Kamoro (Organization for the Development of the Amungme and Kamoro People)
Mbps	Megabits per second
MoEMR	Ministry of Energy and Mineral Resources
MoF	Ministry of Finance
MoPW	Ministry of Public Works
MoT	Ministry of Transport
MVA	Millivolt Amperes
MW	Megawatts
NGO	Non-Governmental Organization
O&M	Operations and Maintenance
Otsus	Otonomi Khusus (Special Autonomy)
PADU	Papua Acclerated Development Unit
PDAM	Perusahaan Daerah Air Minum
PLN	Perusahaan Listrik Negara (State-Owned Electricity Company)

PNPM-RESPEK	Program Nasional Pemberdayaan Masyarakat – Rencana Strategis Pembangunan Kampung (National Peoples' Empowerment Program – Strategic Plan for Village Development)
PODES	Statistik Potensi Desa (Village Potential Statistics)
PP	Peraturan Pemerintah (Government Regulation)
PPP	Public Private Partnership
PT	Perseroan Terbatas (Limited Liability Company)
PTFI	PT Freeport Indonesia
PV	Photovoltaic
PWP	Papua and West Papua
RONET	Road Network Evaluation Tool
RPJM	Recana Pembangunan Jangka Menengah (Medium Term Development Plan)
RPJP	Recana Pembangunan Jangka Panjang (Long-Term Development Plan)
SMA	Sekolah Menengah Atas (High School)
SMK	Sekolah Menengah Kejuruan (Technical School)
SMP	Sekolah Menegah Pertama (Junior High School)
SSB	Single Side-Band Modulation
TEU	Twenty-foot Equivalent Unit
TOR	Terms-of Reference
TSCF	Trillion Standard Cubic Feet
VSAT	Very Small Aperture Terminal
WMD	Waterleidingmaatschappij Drenthe

Currency Equivalents

Currency unit	Indonesian Rupiah (IDR)
USD	IDR 10,204 (July 1, 2009 - assumed 10,000)
IDR 10,000	USD 0.98 (July 1, 2009 - assumed 1.00)

Acknowledgements

Preparation of this report was managed by Hongjoo Hahm, Lead Infrastructure Specialist, Indonesia Sustainable Development Unit (EASIS). Analysis presented in this paper draws on inputs prepared by Bernard Wasow (Consultant, EASIS), John Holdaway (Consultant, EASIS), Dewi Wandansari (EASIS), Tamas David-Barrett (Consultant, EASIS), Leiping Wang (EASTE), Puguh Imanto (Consultant, EASIS), Natasha Beschorner (CITPO), Jan van Rees (Consultant, CITPO), Andre Oosterman (Consultant, EASPR), Adrianus Hendrawan (Consultant, EASPR), Muhammad Ryan Sanjaya (Consultant, EASPR), Francesca Lawe-Davies (Consultant, EASIS), Josef Leitmann (EASIS), Virza Sasmitawidjaja (Consultant, EASIS), Haeyoung Lee (CICRM), Achmad Rochani (Consultant, EASIS), Elina Situmorang (Consultant, EASIS), Rosita (Consultant, EASIS), Johanes Koromath (Consultant, EASIS), and Nurlela (Consultant, EASIS).

We are grateful to Michael Warlters (EASOP), Alfred Nakatsuma (USAID) and Lawrie Carlson (CSD Engineering) for peer reviewing the report. Sector Manager for EASIS is Sonia Hammam and Country Director is Joachim von Amsberg.

In particular, we would like to thank the Government of Indonesia for their support, advice and guidance provided during the preparation of this report. In particular, the team would like to thank Deputy Minister Bambang Susantono (Coordinating Ministry for Economic Affairs), Governor Barnabas Suebu, Governor Abraham Octavianus Atururi, Head of BAPPEDA Alex Rumaseb, Head of BP3D Ishak Hallatu, senior advisors Ronny Tapilatu and Agus Sumule, all of the kabupaten and kota governments that hosted our teams, and all of their staff and advisors.

The team is also grateful to PT Freeport Indonesia and, in particular Scott Hanna, for their hospitality and openness in sharing the lessons learned during their long experience in Papua. The team is also grateful to the other various private citizens and representatives of the private sector and civil society that made time to discuss their experiences.

Finally, the team is grateful for the financial, intellectual and technical support from the Australian Agency for International Development (AusAID) who funded the entire project. In particular, the inputs of Robin Taylor and Andrew Dollimore from AusAID and Mark Collins from AusAID's Indonesia Infrastructure Initiative (IndII) were invaluable.

Preface

The Province of Papua of the Republic of Indonesia was provided Special Autonomy under Law 21/2001 in recognition of the fact that "the management and use of the natural wealth of Tanah Papua has not yet been optimally utilized to enhance the living standard of the natives, causing a deep gap between the Papua Province and the other regions, and violations of the basic rights of the Papuan people." The goal of Special Autonomy was to help Papua and Papuans catch up to the rest of Indonesia in terms of living standards and opportunities.

Yet, now almost a decade later – and after the split into two provinces: Papua and West Papua – progress toward this goal has been slow. In recognition of this, the Indonesian central government issued Presidential Instruction 5/2007 (Inpres 5/2007) on the Acceleration of Development of Papua and West Papua instructing all relevant technical ministries to devote special attention to the two provinces and to coordinate their programs with the governors of both provinces.

The World Bank's involvement in infrastructure began in April 2007, prior to the issuance of Inpres 5/2007, with a small team undertaking a mission and providing a short note on the financial and technical capacity of the Papuan government to implement infrastructure projects at the request of the Papuan governor. Later that year, following the establishment of a Secretariat in the Coordinating Ministry for Economic Affairs, the team was requested by Deputy Minister for Infrastructure and Regional Development Bambang Susantono to undertake a short desk review to assist in providing infrastructure development guidance to both provinces. Both of these preliminary reports suffered from the lack of reliable data; particularly for West Papua. Following this, Deputy Minister Bambang Susantono requested that the team conduct a final comprehensive review of infrastructure covering all sectors and all potential sources of funds. This report is the result of that request.

The aim of this report is (i) to lay out the challenges that face infrastructure planners and implementers in the Central, Provincial and Kabupaten/Kota governments in a clear manner and (ii) provide those planners and implementers with recommendations – based on the best information available – on how to mitigate the effects of these challenges.

The authors of this report do not aim to set out a master plan for the development of Papua and West Papua – that must be done by the Papuans and West Papuans themselves (with donor assistance as needed). This report does, however, provide what the authors hope is useful guidance on the principles that such development must adhere to if it is to be economically, environmentally, culturally and physically sustainable.

This report is the result of numerous missions undertaken between November 2008 and August 2009 to interview stakeholders, collect data and present preliminary findings and was entirely funded by the Australian Agency for International Development (AusAID) through their Indonesia Infrastructure Initiative (IndII).

Executive Summary

The remote and sparsely populated provinces of Papua and West Papua face a time of great change. Monetary transfers from Jakarta have grown extraordinarily in recent years, by more than 600% in real terms and 1300% in nominal terms since 2000, greatly increasing demand for goods and services. The high price of imports in the interior is producing pressure to improve roads in order to lower transport costs. Pressure is mounting to open up the interior of the region to commercial interests that would like to extract resources: copper, gold, coal, petroleum, natural gas, and, above all, timber. Investment in infrastructure – especially in road transport – is seen as the means to make dreams of development a reality.

However, there are great challenges to development in Papua and West Papua. First, there is the question of sustainability. After the minerals are extracted and after forests are clear-cut, what will be the economic foundation of the local economy? And if the forests are removed rapidly, as they are being removed in the Amazon basin and elsewhere within Indonesia, what will be the costs in lost biodiversity, lost opportunities to slow climate change, and generally, lost opportunities to use resources in a way that continues to generate income and environmental services for the great grandchildren who will inherit the region? Finally, what will be the consequences of rapid economic exploitation of Papua and West Papua's non-renewable assets for indigenous Papuans? Will local people be provided in a timely way with the knowledge and skills to adapt to rapid change and benefit from it, or will most of them lose their languages, and their cultural heritage, as well as their traditional livelihoods?

Building infrastructure in Papua and West Papua also is challenging because of physical (i.e. topographical and geological) conditions. Much of the region has either poorly drained peat soils or steep slopes with thin soils subject to landslides and erosion. Most of Papua and West Papua also receive heavy seasonal rainfall. The cost of building a good, well-planned road into the highlands is IDR 6 to 10 billion per kilometer, far more than has been budgeted in the past. Combined with the low population density (a region three times the size of Java has a population smaller than that of Lombok), this means that it takes bigger networks of roads and power to serve the population. Moreover, such infrastructure has been inadequately maintained. As a result, especially outside urban areas, there is too little to show for past investments in roads, water supply systems, or power generating capacity.

On top of these challenges, the institutional capacity and human capital resources of the region make infrastructure development difficult. Rapid subdivision of administrative units – from 11 in 1999 to 38 in 2009 – means that most of the governments of kabupaten as well as the government of West Papua province are new and relatively inexperienced. Indigenous Papuans speak 250 different languages. Education in the region is limited: the average education in six of the 27 kabupaten of 2007 was less than 4 years and in another 19 kabupaten average education was between 4 and 8 years.

Financial resources available to provincial, kabupaten and kota governments for infrastructure planning and investments have increased drastically over the past decade – together, the provincial governments of Papua and West Papua received transfers from Jakarta amounting to IDR 4.8 trillion in 2008 (up from IDR 0.4 trillion in 2000), while kabupaten/kota governments received IDR 17.0 trillion (up from IDR 1.2 trillion in 2000). Local revenues added one to two trillion to the 2008 total. And yet useful infrastructure services being delivered to the Papuan and West Papuan population have increased little.

There are two main reasons for the slow infrastructure development in Papua and West Papua. The first reason for this is that expenditure planning remains heavily focused on expenditures within the annual budget cycle. This cycle typically stretches several months past the start of the budget year. Expenditure planning is made more difficult because approvals are required by the respective parliaments. These procedural barriers undermine good infrastructure planning and therefore good infrastructure investment. The second, and more important, reason for the lack of progress is a severe lack of inter-governmental coordination.

At present, coordination that happens between individual kabupaten/kota governments and the provincial governments happens mainly on an ad hoc basis. For example, kabupaten roads are being built without any plans on how they will be linked to the broader provincial and central government networks and, as a result, cannot possibly generate the traffic volumes that are required for them to be considered a productive investment.

More than any other type of spending, infrastructure investment, which will create assets that should last many years if it is maintained properly, requires comprehensive planning before projects are undertaken:

- Spatial planning based on topography, soil conditions, natural resource concentrations, and existing commercial networks and population concentrations[1];
- Master-planning that coordinates various modes of infrastructure so that there is no unnecessary duplication and so that all components – transportation, power, communication, water and sanitation – are phased to be completed in a timely way for productive use;
- Short and medium term planning that fits within the master plan and specifies intermediate targets each year for the next few years;
- Feasibility analysis that compares specific options such as road alignment and type, alternative hydropower projects, and river port development so that options can be chosen that are technically feasible and satisfy financial and economic criteria

Sectorally, the proper next step for developing infrastructure in Papua and West Papua is to develop master plans for the following:

- a multimodal transportation system that integrates development of heavy duty roads, light duty roads, sea transport, river and lake transport, and air transport,
- power development that diversifies the fuel mix away from expensive diesel, uses local resources and evaluates the immense potential for hydropower,
- piped water and sanitation development, where there appear to be many opportunities for productive smaller investments,
- the telecommunications network, where, again, existing opportunities appear to offer potentially productive investments – notably through extension of a submarine fibre-optic cable (the Palapa Ring) to Papua with landing points in the major coastal towns in Papua and West Papua, and developing the communications "backbone" or transmission network to kabupaten/kota.

All sectoral and cross-sectoral master plans listed above must have buy-in from agencies at all levels of government. This is a difficult political issue. Decisions on which remote areas will be linked with roads in the short-term, and which will have to rely on air-transport for the next 20 years will not please everybody; however this must occur for infrastructure development to proceed in Papua and West Papua

1 This has begun at the provincial level, but the process does not yet have buy-in from the kabupatens

with all parties pulling in the same direction. Donor resources are potentially available to assist in the technical aspects, but government must drive the process.

There are a number of so-called 'mega-projects' - such as the Trans-Papua highway system - frequently being talked about in the media and within government offices. Given the current state of planning, to undertake these projects with their huge budgets and profound consequences would be very unwise in the short-term.

The annual budget transfers from Jakarta are likely to resume growth after 2010. While plans are being made, these funds need to be managed carefully such that savings can be used to finance new infrastructure investments. International multilateral and bilateral donors are not currently a significant source of funds compared to the receipts from the central government and will not be so for the foreseeable future.

Private investors should not be used to finance or directly provide public infrastructure. They should provide the infrastructure that serves their own needs and pay taxes, which will finance public infrastructure planned and implemented by government in the public interest. The primary challenge to the governments of Papua and West Papua over the next decade will be to use their own income wisely and productively to operate and expand the infrastructure network.

In the short run, while master planning is being undertaken, all levels of government should immediately undertake operations and maintenance investment to rehabilitate and improve existing infrastructure. Existing roads and other transport infrastructure, water supply systems and power generation capacity require heavy investment simply to make them operate properly. This program of rehabilitation will take several years and cost trillions – our team estimates that IDR 2.2 trillion a year is needed for road maintenance and rehabilitation alone. After initial rehabilitation is done, it will be necessary to continue to spend much more on operation and maintenance of infrastructure in the future than in the past. An infrastructure development program that focuses on construction and neglects maintenance will in the end deliver less usable infrastructure than a program that takes care of operation and maintenance before budgeting for new construction. The need for an adequate operation and maintenance budget underlines the need for user fees that provide an adequate income stream.

Proper planning and project appraisal will establish many opportunities for productive investments in infrastructure in Papua and West Papua. Investment to improve waterborne and air transport, substantial expansion of delivery of piped water and sanitation services, and major expansion of the telecommunication system all can be delivered at a total cost that probably will add up to less than the cost of 500 kilometers of good new road. But infrastructure development plans cannot be locked in until the planning and evaluation process is better developed. This planning process cannot aim to solve infrastructure challenges in a few years through a few "mega projects." Rather, development will proceed from existing strengths, improving and expanding road, water, and air transport, power, telecommunication, and other infrastructure systems. Much as ink spots spread from their origin to cover a surface and merge together, infrastructure networks should grow and merge as the need for them expands. Properly planned infrastructure development will support steady growth and economic development of Papua and West Papua. A rush to do everything at once is likely to lead to a one-time plunder of resources, with devastating economic, social, and environmental consequences.

Infrastructure Strategies for Papua and West Papua

1.1. Challenges for Development in Papua and West Papua

The provinces of Papua and West Papua are immense and varied. Together, the two provinces are roughly the size of California, or twice the size of Great Britain. Although they contain abundant natural resources, economic development is unusually challenging. Barriers to development are physical – great distances, steep mountains, swampy lowlands, fragile soils, and heavy seasonal rainfall – and social -- low population density and extreme cultural fragmentation. Fewer than 3 million indigenous Papuans speak 250 different languages, and have unique, and in some cases confrontational cultures.

Papua and West Papua are rich in non-renewable resources. So far, deposits of gold, copper, silver, petroleum, natural gas, and coal have been discovered in Papua and West Papua. Nobody doubts that more deposits will be identified. Papua and West Papua also contain the third-largest expanse of remaining rainforest in the world, after the Amazon basin and the forests of central Africa. Great variety in altitude and rainfall provide conditions for remarkable ecological diversity. Moreover, and unlike the situation in neighboring PNG, Papua and West Papua's forest cover is largely intact. Nearly half of Indonesia's remaining forest is in Papua and West Papua. The surrounding sea, particularly in the north, also is exceptionally rich in species. This is truly a unique pocket of the biosphere. Indigenous people traditionally have relied heavily on local plants and animals, but with relatively little impact on the environment. Since large parts of the forest contain trees of high commercial value, including sandalwood and merbau, there is considerable interest in commercial forestry.

Yet human development indicators remain low. Surrounded by mineral and forest wealth, most of the people of Papua and West Papua remain very poor. The demand for infrastructure reflects the desire to change this. In the interior of Papua and West Papua, imports are tremendously expensive, the result of high transport costs. People want roads to lower the cost of imports. Local and international business interests also want better infrastructure in order to extract and export the non-renewable mineral and forest assets. For this reason, within Papua and West Papua, the focus in the discussion of infrastructure development has been on transport, especially on road development. But infrastructure development must also help isolated communities gain access to education, health care, water, sanitation, power, and communication technologies. The average level of education today is low and health outcomes are threatened by widespread malaria, gastro-intestinal infections, and HIV-AIDS.

Economic growth in Papua and West Papua so far has been concentrated in a few places that interact relatively little with each other. Most of these are on or very near the coast. In the interior, the mountainous highlands mostly contain scattered, small economic units centered on public administration and subsistence farming.

Papua and West Papua today stand at the threshold of enormous change. As in other parts of the world richly endowed with non-renewable resources, there is great pressure to convert these assets to cash. Every tree, every ounce of gold and ton of coal, represents new houses, automobiles, and aircraft, when it is removed and sold.

Better infrastructure means lower extraction and transportation costs, raising the returns to owners of logging and other resource extraction enterprises. Outside interests with the resources to build roads and other infrastructure stand ready to promise income and development in exchange for local permission to harvest the forest and mineral wealth of Papua and West Papua. Papuans and other Indonesians, too, stand to obtain some of the income that exploitation of resources will generate. The prospect of trading resources for income and infrastructure is hard to resist. The question is: what would such short-term gains imply for development in the long run? The basic challenge is to develop the region in a way that creates broad opportunities for future generations as well as for those who enjoy immediate income from the extraction of non-renewable resources.

1.2. The Sustainability Challenge

Looking to the long run, it is useful to consider three aspects to this challenge: economic, environmental, and cultural "sustainability." *By sustainable development we mean change that permits future generations to enjoy economic, environmental, and cultural services at least as great as what the current generation enjoys.* Change is not sustainable if some generation in the future will have fewer economic, environmental, and cultural opportunities than Papuans and West Papuans have today. Sustainability is not always achievable, but it always should be a standard against which any proposed change is measured.

1.2.1. Economic sustainability

A development strategy is economically sustainable if it generates income not simply for a few decades, but over generations. Without planning, exploitation of non-renewable resources is likely to follow a boom-bust cycle, leaving degraded opportunities behind. What will the people of Papua and West Papua do after the "gold-rush?"

Exploitation of a mineral deposit may last for decades. During this period, it is essential that investments be undertaken that will provide livelihoods after the deposit is exhausted. The Freeport mine in Papua is an interesting case study in the efforts of a private investor and the public sector to generate sustainable development out of a mining venture (see Box 5).

Forests generally are removed much faster. In contrast to mines or hydrocarbon deposits, in which a few hundred square kilometers can generate income for many years before the resource is exhausted, tens of thousands of square kilometers of forest can be clear-cut in less than a generation. Between 1982 and 2005, according to the Indonesian Ministry of Forestry, about 34 million hectares of forest were removed. Over this 23-year period, Indonesia's forests were harvested at the rate of 40 square kilometers per day (about 30 sq km/day after 2000).

Forests are not necessarily non-renewable. Sustainable forestry technologies exist, involving selective harvesting, replanting, and active management of standing forests. Unfortunately, such "low-impact forestry" is sometimes called "low-income forestry," because in the short run, clear-cutting a forest will generate far more net revenue than is possible using sustainable practices. In recent history, most forest exploitation has not been sustainable. Whether in the Amazon basin, PNG, or Kalimantan, once an area is opened up, entire forests are removed. Europe experienced deforestation centuries ago and North America is also facing the challenge of making forestry there sustainable.

We estimate that the gross value of the timber on a hectare of forested land is about USD 13,500 when the land is clear-cut[2]. Of this, on average, taxes and government revenues absorb about 16% (USD 2,160), and payments to the indigenous "customary owners" make up another 0.5% to 3.5% (USD 67.5 to USD 472.5). That leaves more than 80% (USD 10,868 to USD 11,273) of the value of the timber to be divided between extraction costs, transportation, and profit.

We calculate the Total Economic Value of an average hectare of Papuan or West Papuan forest to be on the order of USD 5,700/ha/year of which approximately USD 1,100 accrue to the direct users (the local people) and USD 4,600 accrue to indirect users (beneficiaries of watershed services in the lowlands, carbon sink services and so on)[3]. The local land users can accept a one-time payment of USD 472.5 for a hectare of their forests, or they can receive the same "value" over less than six months. Of course, this value is distributed over a large population in ways that the cash payments are sometimes not, so the temptation will always be there, but it is clear that, on average, the local people are the big losers when the forests are logged.

In some cases, deforested land can continue to generate income after the timber is removed. With clear property rights and favorable conditions, land newly cleared of a forest can be converted to cultivation of plantations, annual crops, or grazing land. Indeed, most of today's agricultural heartlands of Europe and North America once were covered with forests. But in other cases, fragile soils and steep slopes make cleared land unsuitable for agriculture. In such cases, deforestation leads to landslides, erosion, and loss of economic opportunities. Even today, generations after Maoris first cleared land with fire and Europeans cleared land for agriculture, large areas remain deforested and unproductive due to erosion, creating economic losses of USD100-150 million per year[4]

A large proportion of Papua and West Papua may be unable to generate sustainable income if forests are removed. Steeply sloping highland areas covered by thin young soils as well as marshy lowland areas with peat soils are unlikely to support sustainable economic uses if forests are removed from them. Of course, once forests are removed, those forests' services to local populations are ended and their global services in the form of carbon storage, nutrient cycling, and preservation of genetic diversity are ended too. Rapid short-term exploitation of non-renewable resources often has led to development that could not be sustained even in the medium run, so that economic opportunities for local people after only one generation end up significantly worse than at the starting point.

1.2.2. Environmental sustainability

Almost any development will damage the forests and the animal and marine life of Papua. Still, it is possible in principle, to avoid the collapse of biological diversity through creation of reserves and national parks. If access to non-renewable resources is limited, and their extraction is monitored, erosion and destruction of habitats can be limited. Unfortunately, such strategies are easier to put on paper than to put into action. As with economic sustainability, one cannot point to many successful efforts to enforce environmentally sustainable efforts to extract non-renewable resources, particularly forest resources.

2 See Appendix 1.
3 See Appendix 1.
4 For further information, see www.teara.govt.nz

The environmental challenge in Papua's development is particularly complex because the development of Papua will affect every person on earth, through the effects on climate and global biodiversity. In principle, the people throughout the world who gain from Papua's forests should pay for these benefits. The costs of preservation should not fall on the poor people who happen to live in Papua and West Papua. But again, it is easier to formulate such principles than to apply them in practice. Efforts to create schemes whereby the rest of the world pays rent for the services of tropical forests are underway, but not much has been done yet and not much money is flowing. As noted above, the indirect annual flow of benefits to humanity from a hectare of Papuan or West Papuan forest (USD 4,600) – both in close proximity through watershed services and far away through carbon storage services – is over four times the direct value to the indigenous land users (USD 1,100).

1.2.3. Cultural sustainability

The indigenous cultures of Papua and West Papua are threatened. It is inevitable that contact with the world through education, commerce, and migration will continue to change the cultures of Papua and West Papua profoundly and irreversibly. Many aspects of traditional life will disappear within a generation or two. Many languages, too, are likely to disappear.

"Cultural sustainability" in the context of Papua and West Papua should be centered on the consequences of development for indigenous Papuans and West Papuans. It is not possible to preserve all of the threatened aspects of local culture, some of which cannot survive in modern, interdependent society. But the cultures of Papua and West Papua must change through indigenous people acquiring vital knowledge and skills in a timely way, rather than through a cultural tsunami. Development in Papua and West Papua must not be viewed simply as change that increases average income, education, and life expectancy of the residents of Papua and West Papua; the welfare of indigenous Papuans must be paramount.

Alternative infrastructure development strategies can have powerful impacts on cultural change. More than any other force, new migration is likely to change cultural and economic systems. Experience – both international and domestic – suggests that new transportation infrastructure tends to generate large inflows of external migrants. Traders, business people, and transmigrants will use new transportation infrastructure to take advantage of new opportunities for themselves. Such interactions have been a source of recurrent tension. New infrastructure that leads to rapid extraction of non-renewable assets is likely to result in a forced outflow of indigenous peoples from degraded areas to urban centers. If not managed well, this easily can lead to clashes among ethnic groups and rising communal tensions. Infrastructure programs focused on community development, by contrast, help to create stability.

Infrastructure development strategy in Papua and West Papua must actively combat the threat of marginalization and exclusion of indigenous people. The governments of Indonesia and Papua and West Papua must do much better than the governments of the Americas and Australia in sustaining and respecting indigenous cultures.

1.2.4. Sustainable Infrastructure

Investment in infrastructure must be realistic within budgetary and technical limitations. There is a constant danger that investment in infrastructure will be spread too thin, with too little planning, so that the results do not survive to deliver services for future generations. Under pressure to expand road, water,

power, and other infrastructure systems, governments focus on constructing new capacity. This leads to neglect and premature loss of existing capacity. Such a construction-focused strategy ultimately delivers less usable infrastructure than if operation and maintenance had received adequate resources.

As the stock of infrastructure is expanded, proper maintenance will eat up more and more of any fixed budget. Obviously, the more existing capacity there is, the greater will be the cost of keeping it in working order. In spite of pressure to add infrastructure capacity there is a limit on the amount of infrastructure that any budget can sustain. At some level of infrastructure, all available annual spending should be devoted to maintenance. This ceiling cannot be exceeded without a larger budget that will cover both the maintenance of existing infrastructure and the new construction. For example, if proper annual and periodic maintenance costs, as well as funding for reconstruction local access roads in a kabupaten, require 10% of the initial construction cost, then once the stock of infrastructure is worth ten times the annual budget, the maximum sustainable level of infrastructure has been reached. If the annual road expenditure budget is IDR 40 billion, and this is enough to construct 40 km of single lane rural access roads to gravel standard in the first year, then with an annual maintenance and reconstruction cost of 10%, the budget is sufficient eventually to support no more than 400 km total of roads. If more than 400 km of roads are constructed from this budget – by deferring maintenance of existing roads – the rate of loss of existing roads will actually reduce the usable road system to fewer than 400 km.

1.3. The Infrastructure Development Challenge

1.3.1. Construction Costs

Difficult terrain and remote location combine to make construction costs very high in most of Papua and West Papua. In the swampy lowlands, peat soils (histosols) are common. These are tricky to drain and expensive to build on. Much of the mountainous area is covered by thin young soils on steep slopes (entisols). Soils with severe drainage problems or with serious threat of erosion and landslides make up more than 40% of Papua and West Papua. Because of the difficult geological and weather conditions and the environmental impacts of road construction in such circumstances, the construction costs of a sustainable road connection to appropriate standards are far in excess of the costs that have been incurred or assumed so far. It would cost IDR 6–10 billion/km to build a good, sustainable road into the highlands, depending on the alignment and the design standard. This is on the order of twice the cost of a good road in Java and ten times the cost often cited in Papua and West Papua.

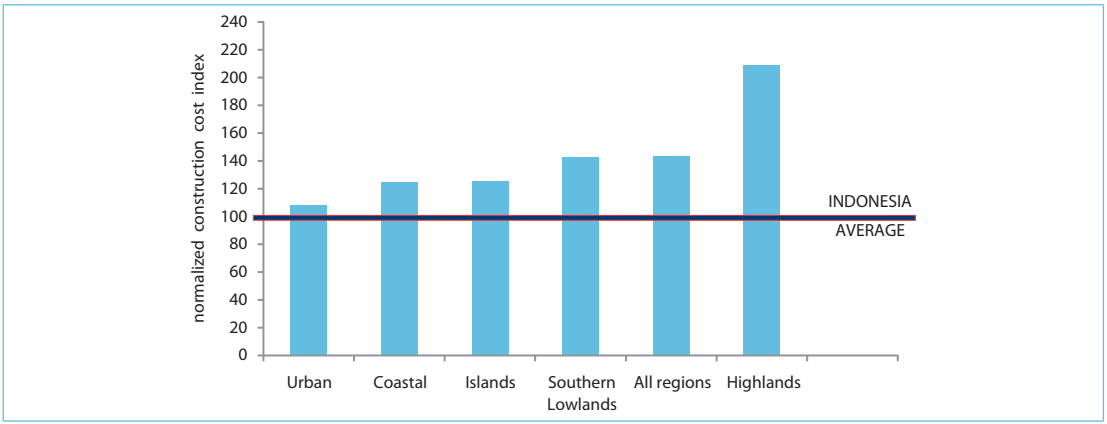
Table 1: Cost of a Bag of Cement in November 2008

City	Price per Sack (IDR)
Jakarta	50,000
Jayapura/Manokwari	75,000
Wamena	500,000
Mulia	1,300,000
Oksibil	1,500,000

Source: World Bank staff surveys

Low population density of the region means that every rupiah of infrastructure outside urban areas is likely to serve relatively few people. For example, Papua and West Papua have a road density *per capita* of roughly 7 km per 1000 people, well above the average for Indonesia (1.3) and other Asian countries. But the road density *per 1000 square kilometers*, 47, is well below the average for Indonesia (174) and other Asian countries. Low population density drives up the cost of providing infrastructure services.

Figure 1: Cost of Construction in Papua and West Papua



Source: Ministry of Finance

1.3.2. Maintenance

Maintenance of existing infrastructure is a chronic problem. The existing road network and water supply systems of Papua and West Papua are under-maintained. Power systems, too are operating well below capacity due to poor initial construction and inadequate maintenance. Many roads and water systems become inoperable only a few years after they are built, requiring expensive rehabilitation when proper construction and routine maintenance would have kept them serviceable at much lower total cost. For example:

- The Wamena – Mulia road is barely passable.
- The Jayapura – Wamena road is entirely impassible.
- Piped water systems, which serve only 25% of the population, are not maintained.
- Sewage disposal systems are in decline.
- Power supply is unreliable; output is only 60% of installed capacity.

We estimate the optimal expenditure over the next 5 years, for rehabilitation and maintenance of Papua and West Papua's roads alone is IDR 2.2 trillion per year. While we have no exact data for past spending on operation and maintenance of infrastructure, our estimate of urgent maintenance requirements is substantial compared to all spending, of all levels of government, in Papua and West Papua, which were about IDR 29 trillion in 2008.

Inadequate maintenance results in short-lived infrastructure. Optimal maintenance is like good juggling: it is possible to keep more balls in the air at one time if the juggler pays attention not only to the ball he is throwing into the air but to all the others already in the air. If maintenance is deferred, existing infrastructure will tumble down, and new construction will no longer increase the total. Optimal maintenance also reduces private costs. If roads are so bad that vehicles wear out rapidly; and if power supplies are so unreliable that businesses are forced to provide their own back-up generators, then private costs as well as public costs rise as a result of inadequate infrastructure maintenance.

1.3.3. Planning Capacity

More than any other type of spending, infrastructure development requires good planning. The high initial costs and long potential life of infrastructure means that any decision – good or bad – will have a long-lasting impact. Infrastructure development requires well-informed choices. Individual projects

must be placed within a comprehensive plan. Each project's technical details and feasibility must be analyzed carefully before any work is begun. Well-functioning infrastructure development system should have the following components:

- Spatial planning based on topography, soil conditions, natural resource concentrations, and existing commercial networks and population concentrations;
- Master-planning that coordinates various modes of infrastructure so that there is no unnecessary duplication and so that all components – transportation, power, communication, water and sanitation – are phased to be completed in a timely way for productive use;
- Short and medium term planning that fits within the master plan and specifies intermediate targets each year for the next few years;
- Feasibility analysis that compares specific options such as road alignment and type, alternative hydropower projects, and river port development so that options can be chosen that are technically feasible and satisfy financial and economic criteria;
- Trained and experienced public employees at all levels of government who can carry out these tasks in coordination with one another.

Unfortunately, the governments of Papua and West Papua are far from meeting these requirements. Spatial planning has begun at the provincial government level in Papua and West Papua but it is not yet flowing through into project planning and does not have buy-in from the kabupatens. No master plans are in place for the major types of infrastructure. While the 20 year and 5 year plans do state goals, these often are inconsistent (i) with what is feasible within budgetary and technical constraints and (ii) between different organizations operating in the sectoral area. For example, government plan for electrification of Papua calls for 75% electrification by 2015, while the electric utility, PLN, sets a goal of 38.4%. Annual spending is almost entirely detached from the 20 and 5-year plans. Instead annual spending is driven by the annual budget cycle and release of funds. There is no rolling medium term plan into which annual spending is fitted. Since annual spending often is undertaken with pressure to spend money fast, far too little project appraisal is undertaken.

The Indonesia formal planning process and cycle is rigid. The 20-year plan, which is divided into four successive 5-year plans, in principle provides a useful framework and direction for sectoral development. However, these long run plans lack sufficient detail with regard to costing and economic/financial evaluation of alternatives. Furthermore, they do not map out the requirements and elapsed time for the project preparation, approval, and procurement steps. As a result, expenditure planning remains heavily focused on expenditures within the annual budget cycle. This cycle typically stretches several months past the start of the budget year. Expenditure planning is made more difficult because approvals are required by the respective parliaments. These procedural barriers undermine good infrastructure planning. Almost all infrastructure investment requires a long-term view and considerable evaluation and preparation work. Several years of planning typically are followed by several years of implementation in a well-organized infrastructure investment project.

Resources budgeted for project and program preparation are grossly inadequate. Instead of devoting more resources to the challenge, regional governments devote too little to all types of planning. Planning for a road that will run hundreds of kilometers may have a budget smaller than the cost of a single kilometer of good road. As a result, cost-benefit studies prepared for major investments rarely examine alternative projects, technological solutions, or optimal timing options; instead project appraisals tend to focus narrowly on justifying a given investment concept without evaluating alternatives.

Box 1: Poor Planning Produces Poor Outcomes

A shortcoming of current planning, programming, and budgeting practices is that projects are chosen with the aim of spreading them over many communities simultaneously, rather than on the basis of needs and transport demand. This is compounded at the implementation stage by spreading out funding thinly over a large number of small incremental contracts, which often form part of a larger scheme. Over the long term such an allocation process seriously reduces the benefits of the investments that are implemented.

Consider a simple example of 3 projects with a 3-year implementation period, with rates of return of respectively 10 %, 12%, and 14%. If annual available funding is sufficient to implement only one project at a time and implemented sequentially, starting with the project with the highest rate of return, the aggregate rate of return is 12.5%. If on the other hand all three projects are implemented in parallel, implementation is stretched out over a nine-year period and consequently the aggregate rate of return is reduced to 8%. This less favorable outcome is mainly the result of having to wait 9 years before benefits start flowing. In contrast, under the first scenario where projects are completed sequentially, benefits start flowing after 3 years. In addition, it should be recognized that under an approach of small contracts the construction costs will be higher than with larger contracts. For example, if in this example there would be a 15% increase in construction costs because implementation is on the basis of 9 small contracts rather than 3 much larger contracts, the rate of return would fall further to less than 7%.

Box 2: Infrastructure Projects that Need More Planning and Evaluation

Three major investment projects provide examples that illustrate the risks of proceeding without proper planning and evaluation: (1) projects to improve access to the Highlands, (2) the Trans-Papua road system, and (3) infrastructure/industrial/urban schemes.

Access to the Highlands.
Proposed investments to improve access to the Highlands are an example where proper planning and evaluation of alternatives will enable Papua and West Papua to achieve its access objectives at much lower cost. Current approaches involve simultaneous development of several road connections as well as an additional air connection. The high costs of road construction into the highlands (IDR 6–10 billion /km to build a good, sustainable road) justifies a focused study that takes into account all the key factors having a bearing on the costs and benefits of different alternatives.

While road corridors and alignments are being considered, other modes of transport merit attention too. Here, the efficiency of air transport access to the highlands should continue to be improved. Air transport will remain a credible alternative to road transport for the foreseeable future. Air can provide transport at a cost in a range of IDR 10,000–25,000/ton/km depending on volume and route. In comparison, a road transport alternative, say between Jayapura and Wamena, would require road traffic volume to be at least twice the current volumes of air cargo coming into Wamena to make the road connection competitive with air transport. It is the high cost of building and maintaining the road that require this high level of traffic.

A multimodal connection to Wamena in the Highlands via Dekai involve river transport to a port situated some 20 km from Dekai, from which goods would be transported by road to an upgraded airport at Dekai and from there by air to Wamena. The advantage of this alternative is reported to be that the cost of river transport is low and the high-cost air segment from Dekai to Wamena is much shorter than say from Jayapura to Wamena. However, air transport costs are not proportional to distance traveled; they also depend on landing and takeoff costs and on the steepness and route of the climb. Flights from Dekai, which is located close to steep mountains, into Wamena might in the end cost no less than direct flights from Jayapura to Wamena. Also, transshipment through Dekai would involve: (i) two additional transshipments (water to land followed by land to air) – adding to handling costs and to the incidence of damage to goods and (ii) new issues concerning the reliability of river navigation in various seasons. Clearly, such an elaborate scheme requires careful consideration of all factors having a bearing on costs and quality of service.

Box 2: **next**

Trans-Papua Road Links

Papua and West Papua's main urban centers are located along the northern and southern coasts and are connected by shipping and by air at much lower cost than would be possible by road. This is because a proper comparison of various modes of transport should include not only the private cost of operating a truck or boat or airplane, but also the full cost of providing infrastructure support. The cost of road transport properly should include full road construction and maintenance costs over the life of the road. For example, the cost of general cargo transport by coastal shipping between Jayapura and Manokwari is estimated at IDR 875,000/ton, including the cost for shipping and transshipment at the ports. Adding in the full infrastructure cost (the value of the subsidy in the port costs), the full economic cost is estimated at about IDR 950,000/ton. Under more efficient coastal shipping operations, this cost could be reduced significantly, probably to IDR 650,000/ton. If a road alternative were available – involving a distance of 840 km – the private trucking cost is estimated to be no less than IDR 550,000/ton, not very different from the all-inclusive shipping cost. But this private cost of carrying freight by road between Jayapura and Manokwari ignores the cost of building and maintaining the road. In fact, road transport between Jayapura and Manokwari is only competitive with shipping when the cost of the road infrastructure is ignored. To justify building interregional roads suitable for long distance transport of goods and people, traffic levels on the order of 200–300 vehicles/day are required. If traffic is lower, it is not possible economically to justify the cost of building and maintaining a road. Such traffic levels are only observed today in Papua and West Papua in the immediate vicinity of the major centers of economic activity.

At this time, major investments in Trans-Papua links would provide *negative* returns for the economy. Available funds can be used to much greater effect when applied to maintenance and rehabilitation of existing roads where traffic levels are already substantial or to other infrastructure investment options.

Infrastructure/Industrial/Urban Development Schemes. The scheme for development around lake Sentani to the west of Jayapura provides a third example of investments requiring very careful master plan, feasibility, and engineering studies. Such mega-schemes require a thorough evaluation of the merits of the overall package and of the contribution of each of its components. They also require analysis of risk in case some parts of the plan fail to fall into place (for example, if a private industry decides not to proceed with its investment).

The scheme being contemplated west of Jayapura is highly complex. New power, industrial, and urban ventures are essential components of the scheme. Assuming that the urban development scheme is mainly driven by new industrial investments, the key challenge will be to stage of each of the components in coordination with the industrial development, to avoid making major investments in infrastructure before the private industrial development has been locked in. This is where careful design of the Public/Private Partnership and the associated allocation of risks will be essential. Poor timing of the investments and failure of any of the government or private parties to fulfill their respective roles and meet their responsibilities could result in an unbearable financial burden. For example, if road investments are several times overdesigned in relation to prospective traffic and taxation revenues associated with the urban investments will not materialize until far into the future, the government could end up with an unmanageable burden paying for road construction and maintenance.

These three examples underline the fact that Papua and West Papua have much to gain by devoting greater attention to master plan, feasibility and engineering studies before proceeding with major investments, which will lock in costs and returns far into the future.

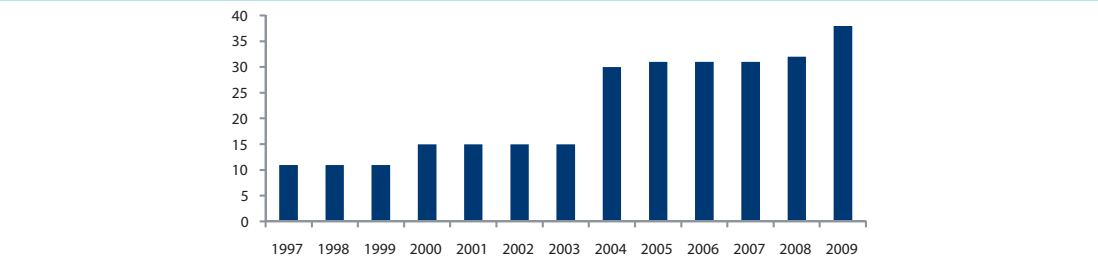
1.3.4. Decentralization

Since 2000, decentralization of Indonesian public administration has intensified the challenges to public sector capacity for planning and implementing infrastructure investment and for maintaining existing infrastructure. Much more money is flowing to Papua and West Papua from Jakarta, but the problems of intergovernmental coordination of infrastructure planning have been made much harder, too. Today Papua and West Papua receive the largest per capita transfers of resources from Jakarta of all regional governments. New financial resources and new responsibilities have been thrust on provincial and local governments. At the same time, a large number of new administrative subdivisions have

been created; a single province was split into two and ten kabupaten/kotas (local governments) were subdivided into thirty-six (see Figure 2). As a result, many of the institutions responsible for building and operating infrastructure in Papua and West Papua are very new and somewhat unsure of their powers and responsibilities. The many governments with responsibilities for infrastructure in Papua and West Papua must increase their administrative capacities and responsibilities for operation and maintenance of infrastructure need to be better aligned to effect operation and maintenance of infrastructure in Papua and West Papua.

The continuing administrative decentralization process has some advantages. Development in each administrative unit is focused heavily on its capital, so more administrative capitals means that development is spread into more corners of the region. However, administrative fragmentation of Papua and West Papua makes it harder for the limited trained personnel even to track expenditures. There is little experience nor is there training in the new governments for planning, implementing, running, and maintaining infrastructure projects. And as the number of administrative borders grows, more and more projects involve multiple jurisdictions.

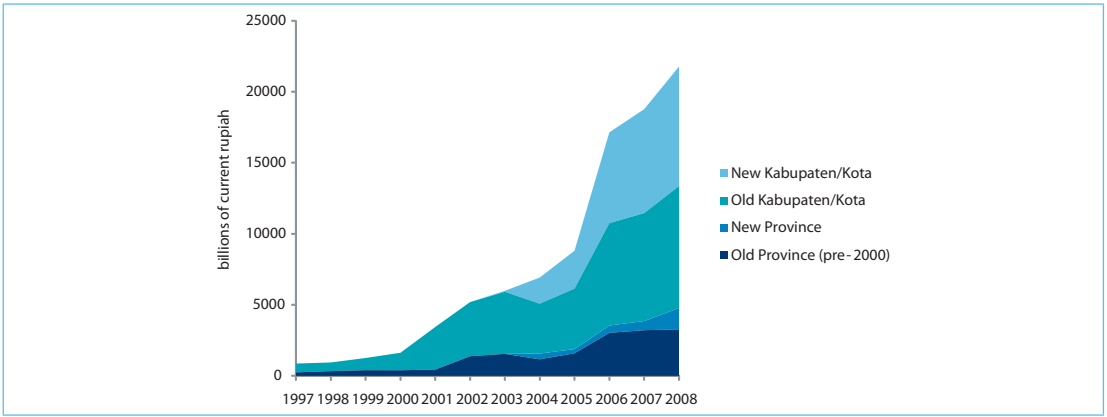
Figure 2: Number of Provincial and Local Governments in Papua and West Papua



Source: BPS (Central Statistics Bureau)

Decentralization has brought an explosion in financial transfers from the central government to provincial and local governments. These transfers have grown thirteen fold in nominal terms and six fold in real terms since 2000. Currently, financial transfers from Jakarta to provincial and kabupaten/kota governments are the major source of money income outside a few pockets where extractive industry dominates. These transfers exceed USD 2 per day per inhabitant. With the growth of commercial activity that has come with the growth of income transfers, migration of Indonesians from other parts of the country has increased.

Figure 3: Central Government Transfers to Sub-National Governments 1997-2008



Source: Ministry of Finance and World Bank staff estimates

Box 3: Allocation of Government Responsibilities

Overview. Law 32/2004 on Regional Autonomy (as well as its legal predecessor Law 22/1999) allocates responsibilities for government affairs to central, provincial, and kabupaten/kota governments. The law also stipulates that the center will provide regional governments with financial resources to implement tasks for which they are responsible ('decentralized tasks'). These resources are channeled to the regions as grants (mainly as DAU, DBH or DAK), and form part of the regional government budget. Tasks for which the center remains responsible are implemented either by central government departments or by regional government agencies. In the latter case, the center would provide the regions with financial resources from the central government budget. In practice, many issues regarding responsibility for administration and finance are not yet fully resolved.

Centralized tasks Law 32/2004 confers the responsibility for all government affairs to provinces and kabupaten / kota, with the exception of:

- Six 'core' affairs. These are: foreign affairs, defense, security, justice, fiscal and monetary policy, and religion.
- Central government affairs stipulated in PP38/2007. This is a recently issued regulation that defines, in great detail, the allocation of responsibilities among central, provincial and kabupaten/ Kota governments. In general, the central government is responsible for standard setting and affairs that affect more than one province; provincial governments are responsible for affairs affecting more than one kabupaten/kota, and kabupaten/kota governments for affairs that are confined to their jurisdictions.

To carry out its responsibilities, the central government has maintained regional offices throughout the country. Examples of such offices are: police stations, tax collection offices, and branch offices of the central bank.

Deconcentrated and co-administered tasks. Since 2001, most central government departments that are not responsible for any of the six 'core' affairs no longer have a network of regional offices. These departments are required to delegate the implementation of responsibilities in the regions to the Governor, who – as head of a province – acts as a representative of the centre. The Governor, in turn, delegates the implementation of these 'deconcentrated tasks' to the relevant provincial government agencies. The implementation of deconcentrated tasks is financed from the central government budget. Decentralized tasks consist of all tasks needed to undertake government affairs that are not explicitly defined as a Central Government responsibility. Because PP38/2007 defines a large number of tasks that are shared among various levels of government, the identification of financing responsibilities has become highly complex.

Shared responsibilities according to PP38/2007. PP38/2007 identifies 31 government affairs for which central, provincial and kabupaten/kota governments are collectively responsible. For all these 'non-core' affairs, a detailed appendix – which form an integral part of the law – show central, provincial and kabupaten/kota responsibilities. Of the 31 affairs are classified as compulsory affairs, the most important include: education, health, environment, public works, spatial planning, development planning, telecommunications and IT, social affairs, and community empowerment.

Allocation of responsibilities for selected infrastructure sectors. In principle, if a regional government is responsible for a certain infrastructure services, it should also finance the investment and operating cost for these services (with the notable exception of land, which should also be financed by kabupaten/kota governments, also for national roads and other infrastructure services otherwise under central government auspices).

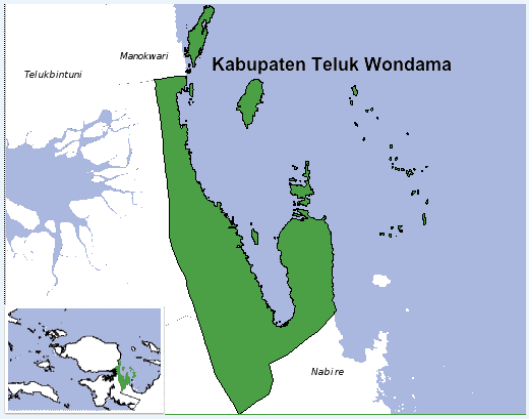
Another symptom of the "big-bang" decentralization in Papua and West Papua is the severe lack of coordination between levels of government. At present, any coordination that happens between individual kabupaten/kota governments and between those governments and the provincial governments happens mainly on an ad hoc basis. For example, kabupaten roads are being built without any plans on how they will be linked to the broader provincial and central government networks and, as a result, cannot possibly generate the traffic volumes that are required for them to be considered a productive investment.

Kabupaten/kota governments managed budgets worth IDR 17.0 trillion in aggregate in 2008, as compared to the budgets of the provincial governments: West Papua's total budget of IDR 1.5 trillion and Papua's

total budget of IDR 3.3 trillion (see Figure 3: Central Government Transfers to Sub-National Governments 1997-2008). This is far too large an amount of money to be spent in such an uncoordinated fashion.

The Provincial Government of Papua has begun the set up of what is to be known as the Papua Accelerated Development Unit (PADU). The Papuan Governor intends that this unit operate much like the BRR (*Badan Rehabilitasi dan Rekonstruksi*, or the Body for Rehabilitation and Reconstruction) operated at the level of a central government ministry to assist in planning and coordination in Aceh and Nias following the 2004 earthquake and subsequent tsunami that decimated the area. Final approval has yet to be received from the central government for this initiative, however, recruitment of staff has begun and associated institutions such as the Papua Knowledge Centre data repository are also beginning to operate. No such organization is planned for West Papua in the short-term.

Box 4: Planning and coordination raise difficult issues without clear answers



All master planning activities undertaken in Papua and West Papua must have buy-in from all agencies at all levels of government affected by the plans. As a current example, Kabupaten Teluk Wondama was split from Kabupaten Manokwari in 2002. This new kabupaten has an enormous natural endowment with the Cendrawasih Bay National Park off its coastline and the vast majority of its land allocated as protected forest under the provincial spatial plan.

The environmental services that these protected natural assets provide in the form of biodiversity maintenance, carbon sinks and so on are a wonderful thing for the rest of Indonesia, and indeed the world who have squandered their own such assets. The World Wildlife Fund refers to this area as "being the basis for the local fishing industry and hav(ing) a high potential for visitor use and research." However, not all residents of Kabupaten Teluk Wondama can be fishermen or researchers. Commercial activities are severely limited within the protected forest area as well. How is the government expected to bring economic opportunity to its people when it is not allowed to build infrastructure networks and its people are not allowed to conduct commercial activities?

Note: Map source: www.bkpm.go.id

All sectoral and cross-sectoral master plans listed above must have buy-in from all agencies at all levels of government. This will raise many difficult political issues. Decisions will have to be made that mean that certain remote areas will be linked with roads in the short-term, while others will have to rely on air-transport for the next 20 years. It will not please everybody, however prioritization process must occur for infrastructure development to proceed in Papua and West Papua with all parties pulling in the same direction. Donor resources are potentially available to assist in the technical aspects, but government must drive the process.

There is no clear answer on the best way to drive this process forward. Whether it happens through a regionally based central government body as is envisioned by the Papuan governor or through some other mechanism; this can only be worked out between the governments themselves. What is clear is that coordination must improve if these master plans are to be useful and to not simply sit on the shelf.

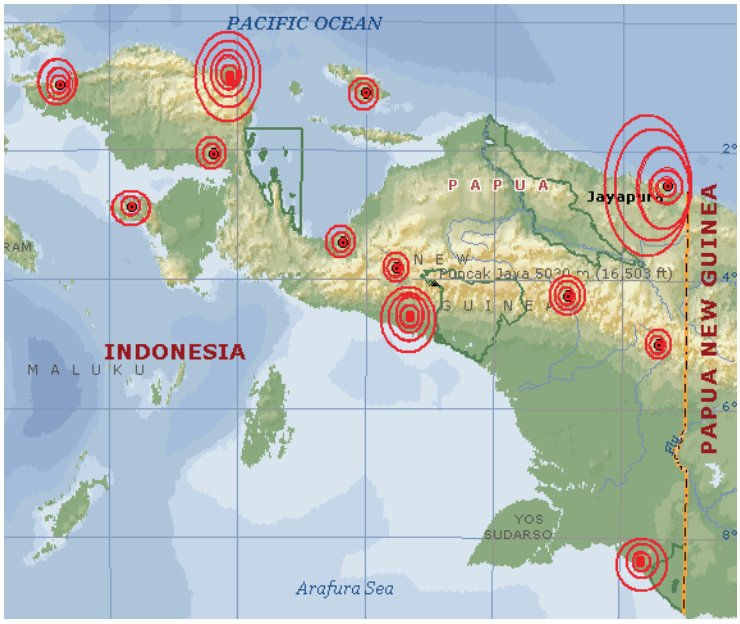
1.4. Development Vision for Papua and West Papua

Given the many challenges faced in developing infrastructure in Papua and West Papua In a sustainable manner, a development vision that foresees an inter-connected Papua – a vision that underlies the ambition to build a huge road network to connect all the major towns – is not feasible. Existing conditions make such an inter-connected road network infeasible and detrimental if pursued in earnest in the shorter run. The population density in Papua and West Papua is too low to justify such a huge grid. Moreover, the high construction and maintenance costs make this vision financially infeasible under current conditions. In addition, the risk is too great that such a grid would lead to unsustainable harvesting of Papua and West Papua's natural resources, combined with a surge of inward migration from other parts of Indonesia, leading to economic, social, and environmental calamities rather than development.

1.4.1. Ink-spot infrastructure network

Instead, policy makers in Papua and West Papua should consider an "ink-spot" vision of development that foresees growth expanding from current centers of activity. For the next several decades, Papua and West Papua's development vision must be to expand development from existing and future growth poles, by adding infrastructure that serves each area and its hinterland. Just as ink-spots spread on a page, the growth of local road systems, power grids and other infrastructure will lead naturally to increasingly strong connections among some of these growth poles.

Figure 4: **Ink-Spots Vision of Development for Papua and West Papua**



Ink-spot development will lead, one step at a time, toward full development. Development in and between ink-spots should proceed within provincial and national spatial plans. Master plans for transportation should set out the intended steps toward a final network (and they should be updated continuously to reflect new realities). At present, without master plans and without sufficient project appraisal, it is too

soon to predict when and where interconnections among ink spots will be technically and economically feasible. It is quite clear, however, that to move toward a complete grid system without the underlying planning and feasibility analysis, without the population density or economic activity to justify such grids, and without the tens of trillions of rupiahs needed every year to construct and maintain such a system, is a recipe for disaster.

Expansion of ink-spots will be based on the growth of population and economic activity outside existing and perhaps new growth poles. For example, a power grid may grow to include both Timika and Enarotali, and then Nabire; a road between Merauke and Oksibil, or between Bintuni and Manokwari, may become justified as the prospect of traffic increases; and improved river port infrastructure will enable improved services of waterborne transport and may justify the construction of a connecting road to a village near the port, or of a canal to connect rivers.

Today, around urban areas, many roads are being extended as traffic warrants. Almost all the good roads are within and near to provincial and kabupaten capitals. That makes sense because that is where the traffic is. A light duty motorcycle road might be warranted long before a road for heavy vehicles. Similarly, local power installations using solar or micro hydro will be feasible long before a province-wide power grid is complete. The highlands will be particularly dependent on such limited, self-sufficient local power sources that do not depend on fuel being shipped in by air.

Investment in road access to the highlands is unlikely to be warranted in the short run. Access to the highlands is often presented as an issue of road access. However, successful economic development and integration of the highlands does not necessarily depend on road access. This is illustrated by the examples of island nations and Alaska, which do not have road connections between the different sub-regions and yet have been able to thrive without an integrated region-wide road infrastructure. Japan developed for centuries before various islands were connected by roads. The question remains, however, where and when it will be opportune to establish road connections between various places in the highlands and various other regions of Papua and West Papua. To answer this question, it certainly makes sense to begin now with the planning process – including both master planning and feasibility studies – of future roads into the highlands.

One important grid can be established without physical connections among various growth poles: telecommunication. It is feasible to plan to connect targeted population concentrations with telephone and internet service long before the road and power grids are complete. It is possible today to install a solar power source, with a battery that is recharged from the solar appliance, connected to a satellite dish, to establish telephone communication with the rest of the world. The cost of communication satellite services is relatively expensive, but it will be possible to connect most of the provinces to the global telecommunication network at a modest cost. At the coast, telecommunication connection through fiber optic cable should be feasible in a few years, and the interior of Papua and West Papua will be able to connect to these cable access points through a combination of fibre, microwave, wireless and satellite technologies. Enhanced access to telecommunications throughout Papua and West Papua will permit distance learning, medical consultation, banking services, improve communications between government offices, reduce the cost of doing business, and provide other services that can substantially improve opportunities for isolated populations, as well as contact with family members far away.

In the long run, Papua and West Papua will build the road, water port, airport, power and telecommunications grids that knit together all the people of this huge region. But, as in every case of economic development throughout history, this will take time. After all, an economy that grows at the explosive rate of 7% per year still takes ten years to double its income (and if it starts very poor, even at double the income, it will remain poor after a decade of rapid growth). In the case of Papua and West Papua, the best overall strategy is to build from current strengths. As the ink spots grow larger – adding infrastructure every year and maintaining existing infrastructure – connections will be expanded and deepened.

The Governor's vision of development for Papua – and indeed the development of each ink-spot growth centers – is centered around a "commodity-based" development strategy and a "community-based" development strategy. These complement the ink-spot development vision, where either the commodity or the community based development can help enlarge individual ink spots. In the highlands, in particular, community-based development is key to ink-spot growth.

1.5. Commodity-based Development: The Role of Private Sector in Infrastructure

The interests of private investors and of the general public in terms of infrastructure development are not necessarily the same. The public interest is to provide infrastructure to people where they live in order to meet basic needs and alleviate poverty. Private investors want infrastructure that serves their specific needs – roads that lead directly from ports to timber or mineral concentrations, power to run their dedicated machinery, water to be used in extractive or industrial processes. What is more, private firms extracting non-renewable resources have no direct interest in building infrastructure that will survive beyond the end of their operations. In the case of logging, the required useful life of a road may be only a few years. The public, on the other hand, needs infrastructure that will promote a broad range of economic activities into the indefinite future.

Potentially divergent interests can be reconciled through a clear division of responsibilities. Large private investors that need infrastructure to enable resource extraction should build and maintain their own infrastructure dedicated to their production and distribution needs. Their taxes should provide the public sector with the resources to invest in infrastructure for the general public. The private sector should not be looked upon as a substitute for government in provision of public goods. Nor should private producers expect the public sector to build infrastructure to meet their parochial needs.

When public and private interests share infrastructure each should pay full cost for its use. If a road serves both logging trucks and the general public, the users that do most of the damage to the road should pay for building and operating it. The damage a vehicle inflicts on a road depends on its weight, with heavy vehicles (measured in tons per axel) doing more than proportional damage. If a road is heavily used by large trucks, it should be built and maintained by the firm that operates the trucks, with the public sector contributing toward the minor damage inflicted by other vehicles. Road user taxes should reflect the road damage they impose on public roads. Similarly, private users of electricity provided by PLN or the public sector should pay the full cost of producing that electricity, not a subsidized rate.

To ensure non-negative externalities of investments by mining and logging companies, investors should be required: (i) to bear the full financial responsibility for any new transport infrastructure that is needed for the scheme; and (ii) to cover their appropriate share of the cost of the use of any existing infrastructure. In the case of a new investment, this will incentivize the investors to adopt proper life cycle and total system cost minimization in the design of the infrastructure. When a private investor requires the use of existing infrastructure, it should assume the cost of strengthening the infrastructure and/or compensate for the cost of additional heavy wear and tear.

It is possible that private industry can finance infrastructure development that provides services to the broader society. For example, Freeport Indonesia runs hospitals and builds roads, some of which are available to the general public. Freeport Indonesia provides a useful case study of private-public interactions in the construction and use of infrastructure (see Box 5)

In Papua and West Papua, small market size may require public sector involvement in private provision of some infrastructure. Some services that normally are delivered by the private sector, such as waterborne transport services and telecommunications, may not be profitable in parts of Papua and West Papua where delivery costs are high and incomes and population density are low. In such cases, government support of investment and sometimes even of operating costs may be desirable. Two principles should govern the negotiations concerning such subsidies: (i) since the private provider will generate some revenues from its operation, the aim must be to provide the lowest possible subsidy that will enable service provision; and (ii) the choice of the provider of services should be determined through periodic competitive bidding. The terms of such subsidies must be transparent and open to review.

Box 5: Private Sector Participation: Lessons from Freeport

Background

PT Freeport Indonesia (PTFI) – majority owned by the American company Freeport-McMoRan Copper & Gold Inc. – began constructing its mine in Papua in 1970. Despite staggering challenges, PTFI constructed a 74-mile road across a swampy coastal plain rising into steep mountains; built the mine and processing facilities at elevations exceeding 4,000 meters; and built a 195MW coal-fired, 60 Hz power plant next to the newly completed port, with transmission lines to the mine and mill. The mill began exporting only three years after full-scale construction began. PTFI runs the largest gold mine and the second largest copper mine in the world. It is one of Indonesia's largest taxpayers, with tax, royalty and dividend payments of about $1.8 billion in 2007. Since its original Contract of Work (CoW), confirmation of nearby ore bodies have increased estimated reserves *64 fold*. While PTFI's current CoW, signed in 1991, extends to 2041, there is little doubt that the mine can be exploited profitably for decades beyond.

PTFI employs almost 12,000 people directly at its mine site and offices, 27% of whom are Papuan, and employs an additional 9,000 people through its various dedicated service companies and contractors. PTFI's operations and ancillary support services led to the establishment of the town of Timika, between its highland operations and its port. The town, nonexistent in 1970, has a population of 165,000 today.

Forty years of experience with PTFI's mining operation offers lessons to all levels of government in Indonesia. In some areas, PTFI exemplifies some corporate practices that other companies that come to Papua for its non-renewable resources should follow. In other areas, there is room for improvement.

National

Work Force Training Program. Since 2001, PTFI has run a training program for indigenous Papuans, which lasts three years and costs USD 15,000 per student. It includes literacy skills as well as work with computerized simulators and real equipment. Trainees – many of whom may initially be illiterate – are selected from seven local "tribes" on the basis of tests to determine their aptitude for acquiring the sorts of skills required to carry out their work. These skills have high market value, not the least at the PTFI mine itself: heavy equipment operation and repair and other aspects of mining technology. PTFI's training program proves that adults with no formal education can be screened for aptitude and trained to become highly productive in the modern global economy. The prospect of developing a substantial cadre of Papuans skilled in the operation and repair of heavy equipment is likely to make a permanent contribution toward the successful transition of Papua's indigenous population. PTFI's program of work force development deserves to be reproduced wherever possible.

Provincial

Potential partnerships in power. At present, PTFI runs two separate power networks: one 60 Hz network for the mine and a separate 50Hz diesel network for its lowland facilities. PTFI also has significant power needs in the coming years, for itself and for its suppliers, including a potential cement plant to meet PTFI's heightened need for cement when it moves entirely underground in about 2016. By contrast, the local PLN power network is decidedly weak. The visible disparity between the services provided by PLN and PTFI's power plants causes resentment by the local populace towards PTFI.

There is potential for development of significant hydropower capacity not far from Timika. (The site at Urumuka is receiving closest scrutiny.) Such development deserves serious attention. PTFI can help the Indonesian power authority advance the plan for hydropower and commit itself to a long-term contract to purchase its 50 Hz power needs from the project. Assuming the project continues to meet financial and environmental standards, international donors should support project development and implementation. In the event that hydropower development is not feasible, PTFI could provide their technical expertise to help the government contract and design a power plant that meets both its needs and the needs of the local populace.

Challenges of Urbanization. A major challenge to PTFI is the explosive growth of urbanization of Timika. PTFI is concerned about the total dependence of the local economy on its mine, but so far, there is essentially no other economic foundation for Timika's economy. Around Timika itself (though not in the highlands near the mine), urban growth is unconstrained. This poses the challenge to create a more diversified local economy and manage internal migration.

Box 5: next

Some employers include in their labor cost the transportation of workers to their home villages or to other dispersed and different locations. Other magnets for migrants, such as offices and training institutions, similarly could be dispersed to distant locations. Such measures taken together can become quite costly, and contractors that supply inputs would need to follow similar policies. Yet the specter of economic collapse of a large urban complex after a non-renewable resource is fully harvested is sufficiently threatening that governments and private investors should be willing to bear substantial costs to avoid this outcome.

Kabupaten

Local institutional capacity. Despite a slow start, PTFI now shares a significant portion of its substantial profits beyond the taxes it pays. In 2007, it spent $106 million on "social development - $53 million of which comes from one percent of its gross revenues that is channeled to a local NGO *Lembaga Pengembangan Masyarakat Amungme dan Kamoro* (LPMAK, sometimes also referred to as the Freeport 1% fund) building housing for local people, providing effective health care, and contributing to schools, scholarship programs, and local business development activities. PTFI also builds roads, maintains them, and provides other public goods when the local government lags in its attention to these matters.

While resources available to local governments are substantial – decentralization has delivered more than IDR 400 billion annually in additional revenue transfers from Jakarta to Mimika, the local kabupaten, since 2005 – many local government functions, such as building and maintaining local roads, financing education and delivering health care, are still being delivered in large part by PTFI. PTFI needs to work harder to help build institutions that deliver effective public services. Every extraction of non-renewable resources will come to an end. Private investors must aim to phase out smoothly, administratively as well as economically. PTFI should consider seconding selected members of its staff to provide temporary technical assistance and accepting local government personnel as counterparts in the quasi-public services PTFI offers. Even if the transfer of skills is inefficient and slow by PTFI's standards, it is important for private investors such as PTFI to transfer responsibilities to local authorities rather than simply to deliver the services expected of those authorities. PTFI should include among its corporate responsibilities the need to help build more effective public institutions rather than simply delivering public goods and services.

The Bottom Line

The ultimate test of any economic activity in Papua and West Papua is whether it contributes to *sustainable* development, and on this count the jury is still out on PTFI. In the remaining 32 years or more of its operation in Papua, Freeport must help establish an economy that will not crash after the gold and copper are gone; it must leave institutions of local management and governance that can deliver community services that PTFI itself still delivers; and it must continue to make the average Papuan of the region better equipped to meet the challenges of modern life.

1.6. Community-based Development: Village-level Infrastructure Development

Community-driven micro-infrastructure investment is increasingly significant throughout Papua and West Papua, but it is particularly important in remote highland areas. The PNPM-RESPEK program not only delivers simple infrastructure - primarily clean water supply, latrines, gravel roads between villages and connecting to main roads, wooden bridges, school buildings, health clinics and small electrification projects - but also builds the capacity of local communities to plan, build, and maintain the infrastructure.

The World Bank-supported Kecamatan Development Program (KDP) was scaled up dramatically in 2008 in response to the PNPM-RESPEK program (Strategic Plan for Village Development), an initiative of the Papuan and West Papuan provincial governments, to provide more than USD 40 million (IDR 400 billion) a year directly to communities for investment in five priority areas: (i) nutrition; (ii) basic education; (iii)

primary health care; (iv) livelihoods; and (v) village infrastructure. Between 2002 and 2006, of the nearly USD 5 million that KDP channeled to communities in Papua, 86 per cent financed village infrastructure projects, two-thirds of this to roads, water, and sanitation.

Through RESPEK, the provincial governments provide annual block grants of 100 million Rupiah (approximately USD 10,000) to all 3,923 villages in Papua and West Papua, and KDP's successor, the National Program for Community Empowerment (PNPM), provides technical assistance. Small teams of community development facilitators (a mix of social mobilization specialists and field engineers) assist communities with a participatory process that plans and then implements investment activities. Although KDP and PNPM follow an "open menu" approach (allowing communities to choose a development activity in a participatory planning process), historically the majority of activities have tended to be small infrastructure projects.

The quality of the infrastructure produced under KDP and PNPM-RESPEK is generally satisfactory to good, but it is not always well maintained. Village maintenance teams are established for all infrastructure projects built under the program, but these teams do not always have sufficient technical skills or funds to carry out proper operations and maintenance. Since PNPM-RESPEK is relatively new to most villages, the infrastructure constructed with its funds is largely still in working order. But the maintenance problem is certain to grow over time, and so far, PNPM-RESPEK appears to be in danger of reproducing at a micro level the neglect of maintenance – and the attendant short life – that plagues infrastructure at a larger level. A stronger emphasis on technical training for communities would help address this. But the key change that might solve the problem, and in the process create a bottom-up improvement in infrastructure management, would be to treat maintenance of existing infrastructure as the first item to be budgeted for each year, with new construction only undertaken with the remaining funds. Villages would learn quickly that unless they supplement PNPM-RESPEK grants with internal funds – notably from user fees for water and power – the PNPM-RESPEK money left for new construction would shrink every year as the stock of capital to maintain, and its age, increased. This is a key lesson for asset management.

PNPM-RESPEK investments must also be better coordinated with kabupaten and provincial governments. Before a project is undertaken, it must be clear whether local governments will help provide operating and maintenance funding and personnel. Such coordination should also help distant governments recruit local workers to help in the maintenance and operation of the infrastructure that they build.

Chronic shortages of technical facilitators have posed a challenge to infrastructure development in PNPM-RESPEK. The rapid scale-up of the program combined with a shortage of qualified engineers in Papua meant that only around 200 of the more than 400 field engineer positions were filled for most of 2008. The shortage was particularly acute in the highlands, where it is most difficult to attract and retain engineers from outside. This shortage is being addressed by a special engineering training program. In September 2008, 120 local senior high school graduates were selected to join a six-month intensive training course in basic civil engineering, mechanics, micro-hydro power generation, construction/ building analysis, budget planning and implementation and social facilitation skills. In March 2009, 106 successful graduates were recruited and mobilized as technical facilitators for PNPM-RESPEK. These 'Barefoot Engineers', 90 per cent of whom are indigenous Papuans, also have the advantage of speaking local languages, which has a significant impact on the quality of facilitation, and therefore community participation, in remote areas.

Another major obstacle to community-driven infrastructure development in the highlands is the high cost of materials that need to be transported by light plane. The community grants provided by the provincial governments under PNPM-RESPEK are a flat amount per village, regardless of the remoteness or the high

local cost of materials. In the central highlands, where a sack of cement can cost up to IDR 1.5 million, the sorts of projects that can be undertaken with these funds is quite limited. The provincial governments are currently discussing adjustments to the allocations that would take account of population size and remoteness, but have yet to agree on a formula. A number of kabupaten governments are beginning to allocate additional funds through PNPM-RESPEK, ranging from IDR 40 million to 300 million per village on top of the IDR 100 million provided by the provincial governments, but the highlands kabupatens -- where arguably the needs are greatest and the costs highest -- contribute the least.

PNPM-RESPEK could feasibly absorb annual grants of up to IDR 500 million per village, enabling highland communities to develop more sophisticated infrastructure such as micro-hydro electricity generation projects and larger bridges, but better systems for operations and maintenance would need to be built in. Two demonstration micro-hydro projects will be built in Papua in 2009, with full-time technical specialists based in the province to train local facilitators in design, construction and maintenance. If the schemes are able to be built at a reasonable cost, and communities provided with adequate training to operate and maintain them, the government should give serious consideration to expanding micro-hydro electricity generation within PNPM-RESPEK.

Community development through PNPM-RESPEK builds skills and understanding of project choices at the same time as it provides isolated villages with some power to shape their own future. It is important that the financial security of the program should be assured, so that it can count on a growing stream of funding in the future. One of the central lessons of the program is that planning must be for the long run. If proper attention is to be paid to coordinating investments, providing for operation and maintenance, and taking responsibility not only for the initial allocation decision but for preserving the assets created, the program requires a secure and growing source of funding, not only from the provincial governments but from all interested governments and donors.

What is more, by drawing on the skills of PNPM-RESPEK employees and of local villagers, some of the problems of managing infrastructure assets can be solved. For example, maintenance of motorcycle paths and re-aiming of communication antennae can be undertaken by unskilled workers with minimal training and supervision. Community involvement will spread understanding of asset creation and management challenges. Community development activities offer a path to help resolve one of the central barriers to successful infrastructure development in Papua and West Papua: development of planning and implementation capacity. Community involvement in investment and maintenance of infrastructure should be central to infrastructure development. It should start at the village level.

Box 6: Infrastructure for the Highlands

The first recorded contact with outsiders in the interior of New Guinea took place in the 1920s in eastern New Guinea, and not until 1938 did Europeans enter the densely populated Baliem valley in Papua. Since then, the highlands have undergone a uniquely accelerated transition in little more than two generations. From the mid-1950s, Christian missionary activity, followed by Indonesian government engagement has spread international languages, technology, and new cultural practices throughout the highlands of Papua and West Papua.

But the highlands remain an extremely isolated region. Public roads are passable only a few dozen kilometers from the coast. To enter the mountainous interior one must travel by air or on foot, traversing the high mountains and malarial swamps which separate the highlands from the coast. Remoteness applies within the region as well: the road network among highland communities is very rudimentary, indeed entirely lacking in most parts of the Papuan highlands. Heavy seasonal rainfall, steep terrain, and fragile soils have led to deterioration of interior roads, which quickly have become barely passable tracks.

This isolation of the interior of Papua and West Papua has both economic and cultural consequences. Economically, the interior remains a largely subsistence economy with an overlying cash economy fueled mostly by expenditures and transfers from the Indonesian central government. With all imports moving by air, transport costs are very high. This not only makes it difficult for the indigenous population to produce anything for export, it makes it so costly to exploit the forests and other non-renewable resources of the interior that very little mining or forestry takes place in the Highlands, to say nothing of manufacturing.

But the remoteness of the Papuan highlands has meant that indigenous communities have been exposed at a relatively slower pace to pressure for change. Local languages, cultural practices, and communities still are intact throughout most parts of the highlands, in spite of the demand for change in the form of education and higher income. Still, there are reports of significant, though largely unmeasured, back and forth migration between the coasts and the interior. Migrant workers send remittances home from the coast. This may also be an important source of cash in the economy, but no data are available.

Better education and healthcare are needed urgently in highland communities to permit the indigenous people to cope with continuing rapid change. Evidence suggests that many highland schools are functioning poorly, with high teacher absentee rates. Only very limited healthcare is available in the highlands. Physical infrastructure, too, is minimal, with few communities that have access to power or piped water. Nevertheless, mobile telephone coverage is spreading surprisingly rapidly.

Infrastructure Development

It is clear that infrastructure is a key to future developments in the highlands. Yet for all the potential benefits that infrastructure development can bring to the Papuan highlands, there are enormous potential costs as well. It will be very expensive to build good roads into and within the highlands. When high maintenance costs are included in infrastructure development plans, the need to develop highland roads carefully is more pressing. Low levels of inter-highland trade reduce potential benefits of roads to the current residents of the highlands. On top of this, the potential for profound damage – both cultural and environmental – that roads from the coast can inflict on the highlands, lead to the conclusion that building heavy-duty roads is unusually risky, as well as unusually costly, in highland Papua and West Papua. Roads will not simply bring imports into the highlands at lower cost. It also brings in new economic migrants. And roads enable the deforestation of the highlands. In addition, the steepness of Papua and West Papua's mountains and the fragility of much of the soil means that road building and attendant deforestation could leave the natural environment unable to support subsequent economic activity. As in every other country, new roads also will increase the spread of new disease, notably HIV-AIDS.

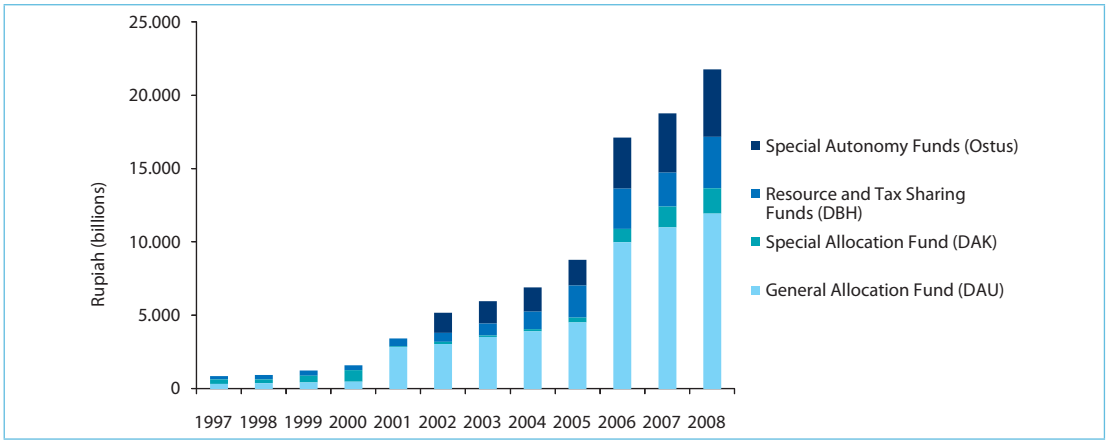
A number of the benefits of roads can be approximated, at lower risk and lower cost, through improvements in power and communication infrastructure. Small scale power, through micro-hydro or solar/battery facilities, combined with satellite-based telecommunication will permit widespread use of distance learning in education, medical consultation in health care, banking, price information, and other commercial services in even the remotest parts of the highlands.

As with all infrastructure investment, but particularly urgently in the highlands, where skills are so scarce, investment in infrastructure must be accompanied by investment in training so that the indigenous people of the highlands can manage the assets themselves.

1.7. Finance: Sources and Uses

Papua and West Papua long have been among the regions of Indonesia most favored by transfers to provincial and local governments from Jakarta. In 2002, the region (then a single province with 14 Kabupaten) received about IDR 1.7 million per capita (second only to Kalimantan Timur). In 2009, Papua and West Papua (and the 36 kabupaten/kota within them) are expected to receive IDR 7.5 and 8.9 million respectively per capita, more than any other province. This rapid growth of transfers is illustrated in Figure 5, below. Twice in a decade – in 2001 and again in 2006 – transfers roughly doubled from one year to the next. From 2000 to 2008, nominal transfers grew 1,340%. This puts a tremendous strain on the absorptive capacity of provincial, but especially the kabupaten/kota governments who, in 2008, received 78% of all central government transfers to the region. Nearly half of total transfers (45%) went to governments that did not manage a budget until 2001 or later.

Figure 5: Central Government Transfers to Sub-National Governments 1997-2008



Source: Ministry of Finance and World Bank staff estimates

Evidence does not support the idea that international aid is likely in the future to be a major source of finance for infrastructure investment. If we compare the *intra*national flows of revenue from Jakarta to Papua and West Papua with *inter*national aid flows, we get some idea not only of how large these flows are, but how much international aid might be expected to supplement domestic sources of finance in Papua and West Papua (see Table 2).

Table 2: International Aid per Capita 2007

	International aid per capita (current US$) 2007 plus transfers from Jakarta to Papua and W. Papua
Palau	$1,108
Solomon Islands	$501
Timor-Leste	$262
Lao PDR	$68
Papua New Guinea	$50
Cambodia	$46
Sub-Saharan Africa	$44
Low income	$31
Vietnam	$29
Philippines	$7
South Asia	$7
Myanmar	$4
Indonesia	$4

Domestic transfers from Central Government to PWP: US$740

Pre-existing aid flows to PWP: $17

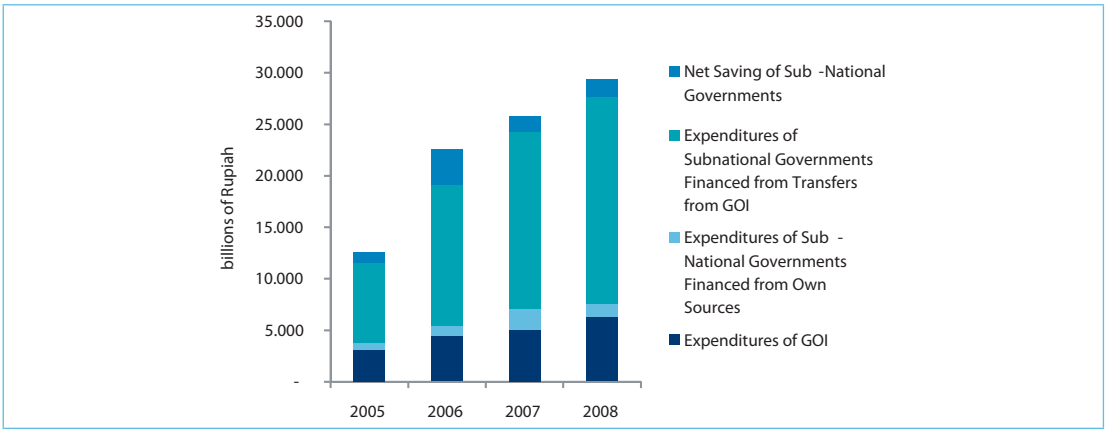
Source: World Bank, World Development Indicators

Set against the aid flows from Jakarta, international aid flows are relatively small. The international aid going to governments in Papua and West Papua in 2008 came to USD 17 per capita, relatively little in this context, though four times the Indonesian average. But per capita flows from Jakarta exceed USD 740 per year, almost three times the international flows to East Timor and more than ten times the international aid flowing to PNG. Increases in international aid are unlikely to be a large proportion of the future finance for Papua and West Papua's infrastructure.

Annual rental payments for the services of the region's standing forests may generate financial flows in the future. The best hope for international financial flows into Papua and West Papua may be not from international aid by bilateral or multilateral donors but from "carbon offsets" purchased by private sector polluters elsewhere in the world. One such idea receiving much attention is the Reduced Emissions from Deforestation and Degradation (REDD) scheme. Our estimate of USD 5,200 in annual global benefits per hectare of unharvested forest, for an area of, say, 200,000 square kilometers (roughly half of Papua and West Papua's total area) gives an annual global benefit of USD 104 billion. Current resource flows from Jakarta are less than three percent of this total, so if the rest of the world would agree to pay each year a few percent of the annual benefits the world receives from Papua and West Papua's standing forests, to the local governments, in return for measures to prevent forest destruction, large financial flows could be involved.

Accumulated savings by the governments of Papua and West Papua so far are insufficient to be a major source of infrastructure investment in the future. While spending has fallen short of income every year since 2005, the annual surpluses have been small. (See Figure 7). The accumulated surplus we estimate for the period 2005-2008 comes to roughly IDR 8 trillion. The actual balances in the bank accounts of sub-national governments in 2007 were slightly more than IDR 4 trillion. These balances can be compared to the annual flows of transfers from Jakarta, which were about IDR 22 trillion in 2008. If we view the accumulated savings of the governments of Papua and West Papua simply as precautionary reserves, they do not seem particularly large. Reserves on the order of approximately two to four months worth of flows are not excessive, particularly since many components of the annual flows are variable. These resources are small relative to annual flows as well as relative to infrastructure investment requirements. Of course, systematic efforts to save in the future could build these modest savings to substantial size.

Figure 6: Sources of Public Expenditures in Papua and West Papua 2005-2008



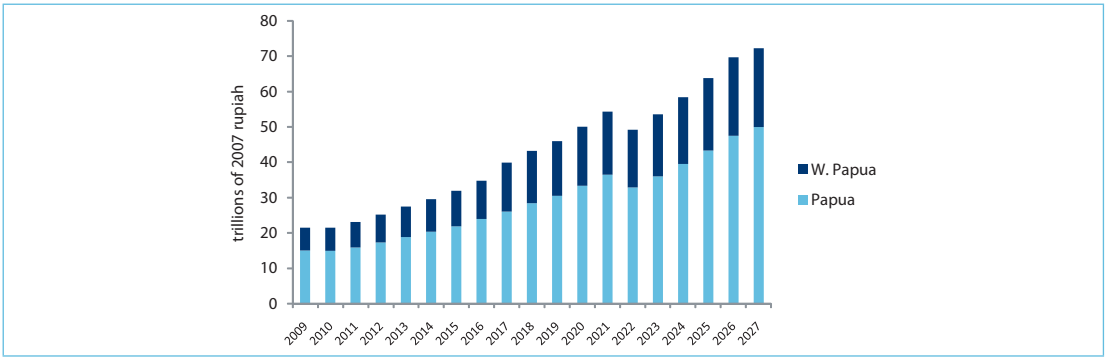
Source: Based on Ministry of Finance data with staff estimates

Looking ahead, the outlook for future transfers from Jakarta is clouded in the near term, but favorable for the long run. In the recent past, growth of transfers from Jakarta has provided substantial resources for potential infrastructure investment. Further growth is to be expected, but the next few years might be rocky. Four central events drive the forecasts of revenue transfers for the next two decades:

- Burden sharing policy will reduce transfers beginning 2009;
- The worldwide recession and the decline in commodity prices (gold excepted) will drive down revenue for the next year or two;
- Revenues from the Tangguh gas field will begin to flow to West Papua in 2010 and rise sharply in 2017;
- Otsus revenue sharing will end in 2022.

2009-2010 will see transfers from Jakarta to sub-national governments slip, but the growth in flows should resume vigorously for the subsequent decade. West Papua, especially, should experience a substantial increase in DBH flows with the increase in tax and royalty payments by BP for Tangguh. Apart from the consequences of the end of Otsus, in 2022, the long run outlook for transfer payment growth looks good. Our forecasts suggest that transfers from Jakarta should reach IDR 30 trillion by 2015 and IDR 40 trillion by 2018, from about IDR 22 trillion in 2008 (and IDR 9 trillion in 2005). (See Figure 7)

Figure 7: Projected Central Government Transfers to Papua and West Papua 2009-2027



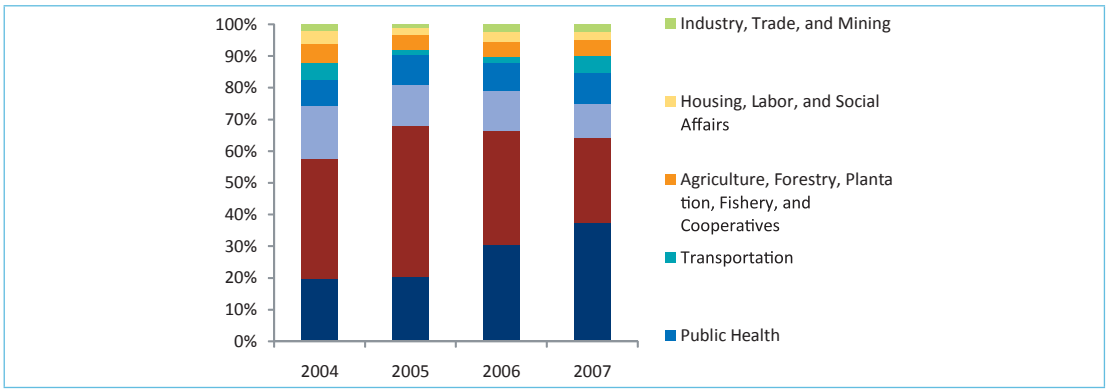
Source: Staff estimates

Financial resources for infrastructure investment will continue to be substantial. The good news regarding finance for future infrastructure investment is that growth in transfers from Jakarta should resume in a few years. The bad news is that it is not likely that growth rates over any decade in the future will match the rapid growth of transfers over the recent past. What is more, international aid is not likely to play a dominant role in the finance of future infrastructure investment. Unless there is a breakthrough in the form of new payments to Papua and West Papua for the annual global benefits of its standing forests, the existing flows of resources from Jakarta to the non-national governments of Papua and West Papua must be looked upon as the major source of finance for future infrastructure investment. Private industry may also play a role by providing infrastructure for its own use.

Over the next few years, apart from vigorous rehabilitation of existing roads, water, and power systems, a reasonable goal for provincial and local governments is to accumulate sufficient reserves to begin substantial new investment projects once transfers resume their growth and after necessary planning has been completed. Too much of the investment of recent years – in large new government office complexes, roads built to inadequate standards, and new runways for underplanned transportation hubs – is unlikely to provide many services or to generate much income in the future. While infrastructure master plans are being prepared and projects are being appraised, it is much wiser to save money than to spend it. This is particularly true of mega-projects that will require trillions of rupiah and years of construction to complete.

Spending has grown together with revenues. Figure 8 suggest how the flood of new revenues to local governments has been spent in recent years. There has been some decline in the share of development spending going to public administration and an increase in public works. It is not clear, however, how productive any of this spending has been. For example, if routine maintenance is excluded from development spending while construction of largely empty new government office buildings is public works, then it becomes problematic to evaluate spending.

Figure 8: Allocation of Development Expenditures 2004-2007



Source: Based on Ministry of Finance data with staff estimates

Infrastructure investment has been heavily skewed toward road transport. Not surprisingly, transport expenditures have received high priority in government spending. Total expenditures on all transport modes combined are estimated to have been IDR 4.6 trillion in 2007 representing almost 20% of total expenditures in the two provinces. Expenditures on transport by all levels of government combined have grown faster than other expenditures. Road expenditures accounting for almost 15% of total government expenditures and about 75% of transport sector expenditures. The heavy emphasis on road works is similar to development experiences in other regions of Indonesia and the world. But elsewhere, population

density is higher and economic activity is already spread more evenly across the territory than in Papua and West Papua. The key question is whether the transport needs of the productive sectors and improved access for remote communities cannot be better served through a different combination of investments that has a multimodal transport focus. (See Box 8: Modal Coordination and Intermodal Transport)

Table 3: Total Expenditures and Expenditures in the Transport Sector (IDR billion)

		2004	2005	2006	2007
Total Expenditures by Source of funds	APBD total	8,379	8,347	12,695	18,694
	Deconcentration	1,312	973	992	930
	Central Govt	0	2,065	3,378	4,023
	Total	9,691	11,386	17,064	23,647
Roads Expenditures	APBD Public Works Exp	520	1,115	2,737	4,031
	Share Roads[5]	0.70	0.70	0.70	0.70
	APBD Roads Exp (Estimated)	364	781	1,916	2,821
	Central Govt	241	278	418	478
	Total Roads	605	1,058	2,333	3,299
	Roads as % of total exp	6.2%	9.3%	13.7%	14.0%
Other Transport Modes Expenditures	APBD	87	114	170	637
	Central Govt	352	268	495	644
	Total Transport (MOT)	439	382	665	1,281
	Transport as % of total exp	4.5%	3.4%	3.9%	5.4%
Total roads and other modes of transport		1,044	1,440	2,998	4,580
Roads and Transport as % of total expenditures		10.8%	12.6%	17.6%	19.4%

1.8. A Phased Strategy

A number of concrete recommendations follow directly from the foregoing analysis. For the immediate future,

- focus on rehabilitation and maintenance of existing infrastructure
- produce coordinated spatial plans and master plans for transportation, power generation, water and sanitation, and telecommunication.
- resolve the division of responsibilities among various levels of government for operation and maintenance of infrastructure as well as for training the workers who are to perform these jobs.
- review the procedures for setting and enforcing user fees for those who benefit from infrastructure. Fees for power, water, sanitation, and telecommunications must at least cover operating costs and in some cases they should cover full costs, including capital costs.

Resources devoted to maintenance, planning, and project appraisal must be increased. It is not possible steadily to add to the stock of productive infrastructure without greatly increasing resources devoted to planning and maintenance. A steady source of income for operating expenses depends on a well-functioning system to collect fees from users.

5 Estimate based on the 2008 proposals by local governments for APBD expenditures on roads

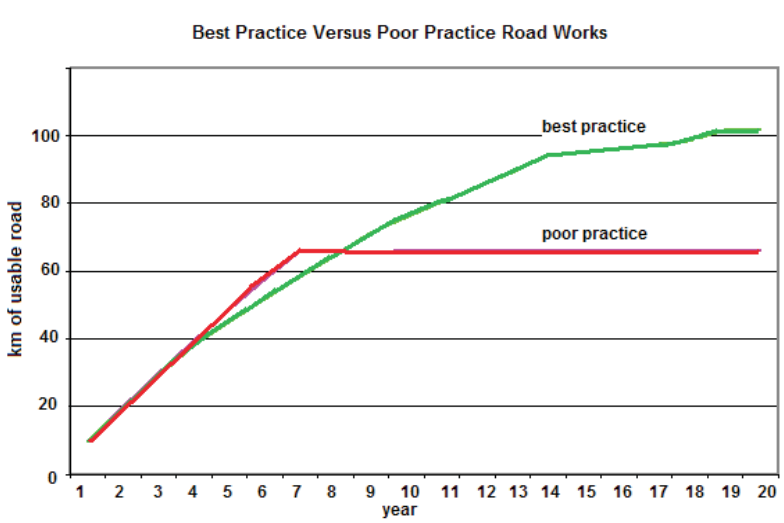
It is possible to paint a general picture of the future, but not specifics. Without information about the costs and benefits of alternative projects and how they fit into a master plan, it is not possible to make specific recommendations concerning the projects that are most promising. Nevertheless it is possible to outline the shape of infrastructure development, as it is likely to evolve.

1.8.1. Transportation

Building a road system involves financial commitments that will last decades. Before any construction activity begins, road corridors and road alignment must be chosen. Not only current and future concentrations of population and economic activity must be considered, but soil conditions, slopes, and maintenance requirements. Even the best built road, requires annual and periodic maintenance to remain productive. The cost of a road is the total expenditure over its lifetime, for planning, construction, operation and maintenance. The cost of construction depends only on this year's construction plan. But since the cost of maintenance depends on the size of the road network, that cost will grow larger and larger as more roads are built. Proper budgeting for roads begins with the maintenance cost and only uses remaining resources for new construction. Maintenance costs will take up a bigger share of the budget as the road network grows. While it is tempting to spend resources on new roads, built quickly and cheaply, such a strategy will in the end deliver a smaller usable road network than proper budgeting.

Box 7: Comparison of "Best Practice" versus "Poor Practice" Road Works Policy

Given that different road building policies and practices have different outcomes, it is instructive to explore the differences through a simulation analysis. Consider the case of a kabupaten government that wishes to open up and develop a region by building a network of local access roads and is able to allocate a fixed annual amount for this purpose. The interesting question is: what will be the outcome in terms of total number of km of roads in use and their condition after a 20 year period under alternative policies. For illustrative purposes best practice policies are contrasted with "poor practice" approaches and it is assumed that the annual budget available for the development of the new network is IDR 10 billion. It is assumed further that the terrain, availability of materials and traffic volume (10 – 30 vehicles/day) warrant construction of a single lane gravel road at a cost of IDR 1 billion/km. Thus, it will be possible to build 10 km of road during the first year of the program under both scenarios.



Scenario 1. This scenario is based on the following: designs and alignment have been selected carefully taking into account the kind of terrain and soil conditions; construction quality is of best practice standard; and routine and periodic maintenance allocations are adequate and carried out professionally. Under this scenario the roads built every year receive periodic maintenance at 6-year intervals and have a 20-year life before there is a need for reconstruction. Given the budget constraint and the commitment to proper maintenance, under this scenario, starting in year 2 and during subsequent years, the number of km that can be built will decline gradually to only 1 km at the end of the 20 year period. By that time some 102 km will have been built which are kept in good condition.

Scenario 2. This scenario is characterized by poor designs and alignment selection and poor construction quality and maintenance practices. Maintenance takes the form of ad-hoc interventions to deal with emergencies such as landslides and mud slides that engulf sections of the road; bridge failures and pavement failures; and washouts that require spot rehabilitation to keep the road open. This set of policies and practices requires emergency interventions in years 4 to 7 and shortens the life of the road to 7 years with the result that in year 8 the road needs to be reconstructed at a cost of 85 % of the original construction cost. Based on the available budget, during the first three years it is possible to build 10 km every year. However, starting in year 4 emergency maintenance in the amount of IDR 40 million is eating into the annual construction budget and the number of km that can be built declines to 7.6 km in year 7. By that time the total km built amounts to 64 km and from this point onward every year practically the full budget is needed to reconstruct roads that reach the end of their life. The useable road network will stabilize at about 64 km in the subsequent period of 7 years but it will be in very poor condition most of the time with vehicle operating costs that are substantially higher than under scenario 1.

Transportation planning should focus on multiple transport modes. Roads that carry heavy vehicles are only one of several important transportation modes. In Papua and West Papua, a large part of the transportation burden will continue to be carried most economically by other modes of transport: waterborne, airborne, and light vehicle. Even if a road were available free of cost to truckers, sea transport of people and goods still would be competitive between Jayapura and Manokwari. Along the coast and in the interior where rivers are navigable, waterborne transport is likely to be a dominant transportation mode not only in the short run but in the distant future too. The highlands will continue to depend on air transport for many years.

Air transport and light duty roads deserve attention in the highlands. Even as roads move inland from the coast, initially they will reach only a few places in the interior. Many distant, isolated villages will depend on airstrips as an alternative to walking. In the highlands, improvements in airports – expansion, instrumentation, and runway enlargement – should be a focus of transportation planning. It is likely, too, that paths for light vehicles, notably motorcycles, will be far easier and cheaper to build and maintain than heavy-duty roads. Such light duty roads will require bridges and surfaces that are passable in all seasons, but the light weight of the vehicles using them and the narrow gauge of the paths will make them far easier and cheaper to develop. Motorcycles can be adapted to facilitate movement of good and passengers. Of course, light duty roads require no less planning in the selection of road corridors and of the route location within these corridors than do heavy-duty roads. Indeed, it is likely that many light duty roads eventually will be enlarged and strengthened to support heavy vehicle traffic.

Multimodal transportation planning is needed to avoid costly duplication and transitions between modes. Multimodal transport – with heavy and light duty roads, sea, river, and air as important components – requires careful planning. It is important to avoid expensive duplication of modes: if riverine transport is effective, development should focus on improving river ports and perhaps canals rather than duplicating service with roads. Switching points between transportation mode – where people and freight move from river transport to sea transport or to road transport or to air transport or to light-duty road transport – should be made easy to use at low cost.

Box 8: Modal Coordination and Intermodal Transport

To overcome the handicap of high transport costs both externally and internally, Papua and West Papua need to develop the appropriate mode of transport that delivers the lowest cost for the economy. Where coastal shipping and river transport are available or are an option, these modes will usually be the lowest cost. For other transport needs in the interior, where flows are small, air transport usually will be the preferred mode. Given the high cost of sustainable roads, road transport will only be economical when traffic reaches certain thresholds, for paved roads on the order of 300 vehicles a day, for gravel roads on the order of 30–70 vehicles a day, and for earth roads on the order of 10 vehicles a day. An efficient, integrated transport system requires two key policy initiatives: (i) selecting and developing the most economical mode of transport for each link of the system; (ii) developing transfer points between modes so that passengers and freight can shift at lowest possible cost from one mode to the next.

Selection of the Most Economical Mode. Traditionally, road planners plan roads; port planners plan ports; and too few resources are devoted to choosing and planning intermodal transitions. In the case of land transport the focus on heavy-duty roads has led to neglect of other options, such as, light-duty paths suitable for bicycles and motorbikes. Such paths, which can be built at much lower cost than heavy-duty roads for 4-wheel vehicles, could be constructed and maintained to be usable in all seasons. Compartmentalization of transport planning seriously hampers consideration of modal options and coordination at the planning stage. Multimodal transport planning is made more difficult by a lack of good coordination within each mode between the investments funded under the central budgets and those at the provincial and kabupaten level. For most situations, proper intermodal coordination of facilities must be studied and planned at the regional/local level.

Box 8: next

For many isolated communities that can be reached by waterborne or air transport, initial access or improved access using these modes can be provided at much lower cost, through the construction of jetties or airstrips, than through new road construction. Not only is construction cost of such jetties or airstrips (in a range of IDR 100–500 million) much less than even one kilometer of road, but also these facilities will in most cases serve many more people than an average km of road. In other words, the cost effectiveness of these facilities will easily be *ten times* greater than road construction.

Efficient Intermodal Connections. Efficient connections at the modal transfer points – between sea/river ports and airports and local distribution by heavy and light duty roads - play a critical role in reducing overall transport costs. Lowering costs will often involve careful spatial planning at the local city level where the ports are located. For example in Manokwari, part of the port area that is currently being used as a makeshift container freight station is being considered to be converted into a car park. When the available land within the port area is adequate and as long as the number of containers remains manageable within the port area, it will preferable from the point of view of transport efficiency to keep the container freight station within the port area so as avoid hauling of containers in and out of the port. Such hauling not only is directly costly, but it contributes to traffic congestion and road damage in the inner city. Clearly, port planning from the point of view of transport efficiency needs to be coordinated with city master planning in order to achieve optimal development of the transportation system within the city and optimal use of scarce waterfront land.

Recommendations to Improve Intermodal Planning

- At main ports, facilitate transshipment between main line and coastal shipping, river transport and road transport.
- At airports, facilitate improvement in navigation and airport landing equipment to ensure fewer flights are cancelled last minute. This will improve aircraft utilization and reduce operating costs.
- At city level, increase connectivity at transfer stations between the various land transport (vehicles, bus, car/ taxi, motorbike, becak).

**Some planning documents mention investment in railways. Except possibly dedicated lines serving high volume mineral extraction, railway transport is not a viable option in Papua and West Papua. Railway lines carrying much higher traffic volumes are being closed all over the world because governments can no longer afford the annual subsidy payments. In the case of Java, which has among the best potential for railway transport in the world, only passenger services are financially feasible while general freight services are loss making without much prospect for becoming viable in the foreseeable future under current transport sector policies.*

1.8.2. Power

Today power in Papua and West Papua is costly to produce and unreliable. But cheap power potentially is one of Papua and West Papua's major sources of comparative advantage. In addition to large gas and coal deposits, the region has enormous potential for hydropower: more than 140 times the total of today's installed power generating capacity. Yet almost all power today is generated using old diesel generators, operating at 60% of capacity. Growth of capacity – less than 4% per year from 2002 to 2007 – has been half as fast as the growth of demand, far too slow to improve the chronic problem of inadequate power supplies.

It is essential that governments take the lead in promoting power development. More than roads, power is vital to development in the major towns of the coast. Diesel generators are far too costly to operate. Electricity tariffs cover less than a third of the cost of supplying such power. Diesel must be replaced by more efficient power sources, and tariffs must be raised to cover costs. Reliable power must be a central goal of infrastructure development and, again, institutional reform, including tariff restructuring, must be part of the program.

Hydropower is especially promising. Potential hydropower installations at Urumuka, Paniai, and Mamberamo all deserve careful scrutiny and full project appraisal. Of these, the Urumuka project, with potential demand from Freeport Indonesia, Timika town, a potential cement factory, and Enarotali and Nabire towns, appears the most promising. A power master plan, which should receive high priority, must include a survey of hydropower potential at these sites as well as others, including potential for micro hydro installations. All detailed project appraisal should include evaluation of environmental and social impacts as well as the economic consequences of each project.

Micro hydro and solar power should be evaluated for isolated locations. For years to come, power in most of the highlands must be delivered to each site, off-grid. Solar power and micro hydro should be evaluated for these places. The diesel generators now in use in many isolated villages are tremendously expensive to operate, not only because small generators are inefficient but because the cost of fuel, delivered by air, is so high. The planning of small power development must be coordinated with site choices for facilities that depend on power, such as schools and government offices (which will need computers), and small businesses that use power (such as small woodworking shops). The transmission of power generated on a small scale becomes far more costly beyond a kilometer, so buildings must be located near to power generating capacity.

1.8.3. Water and Sanitation

In most of Papua and West Papua, water is abundant, but few households have access to piped water, and none have access to piped potable water. The neglect of maintenance of installed capacity is a chronic problem, tied to failure to collect appropriate user fees for water delivery. Half of the water that enters the system is lost for technical and administrative reasons. Yet the cost of rehabilitating the existing piped water systems and expanding piped water delivery is not at all prohibitively high.

Investment in water supply is relatively low cost. The total cost of adding 95,000 urban connections and 261,000 peri-urban and rural connections (109,000 of these in the highlands) by 2020 – to reach the targets of 80% urban and 60% rural piped water service – is about USD 250 million (IDR 2.5 trillion). To put this cost in perspective, it is roughly the cost of building about 250 kilometers of good road, or about one tenth of the total transfer payments the governments of Papua and West Papua received from Jakarta in 2008.

Sanitation infrastructure is in poor shape in Papua and West Papua. Solid waste is being dumped where it threatens ground water and where it is likely to spread after heavy rains. Sewage treatment no longer is undertaken in Sorong, the only town that once had a sewage treatment facility. Building codes governing waste disposal are not enforced. In the two towns where sewage sludge is collected from septic tanks, Jayapura and Sorong, it is now dumped untreated in locations where it leaks into streams and groundwater, contributing to waterborne disease. In other locations, there are no sanitation services.

Investment in sanitation is less costly than investment in water supply. Even more so than water delivery, improvement in sanitation services can be achieved at relatively low cost. For USD 50 million (IDR 500 billion) it would be possible to provide eight towns with sewage sludge treatment plants and to install a piped sewage system in Jayapura.

Water and sanitation delivery must be better managed. More dramatically than for other infrastructure, the barrier to improved water and sanitation infrastructure is not cost and it is not technology. The key shortcomings are in maintenance and in management of the water and sanitation systems, including enforcement of user fees that cover operating costs. Water and sanitation services could be dramatically

improved; for the cost of 300 kilometers of good road, all the major towns and much of the rural area could have much improved piped water delivery and all the major towns could introduce treatment of sewage sludge. This budget includes the construction of a piped sewage system for Jayapura.

Proper operation and maintenance of the water and sanitation systems will require budgeting discipline and revenue collection. The water system should cost about USD 30 million (IDR 300 billion) per year to operate and maintain. With about 459,000 connections, the O&M cost of about USD 66 per connection per year cannot be treated lightly. Collection of user fees will be important.

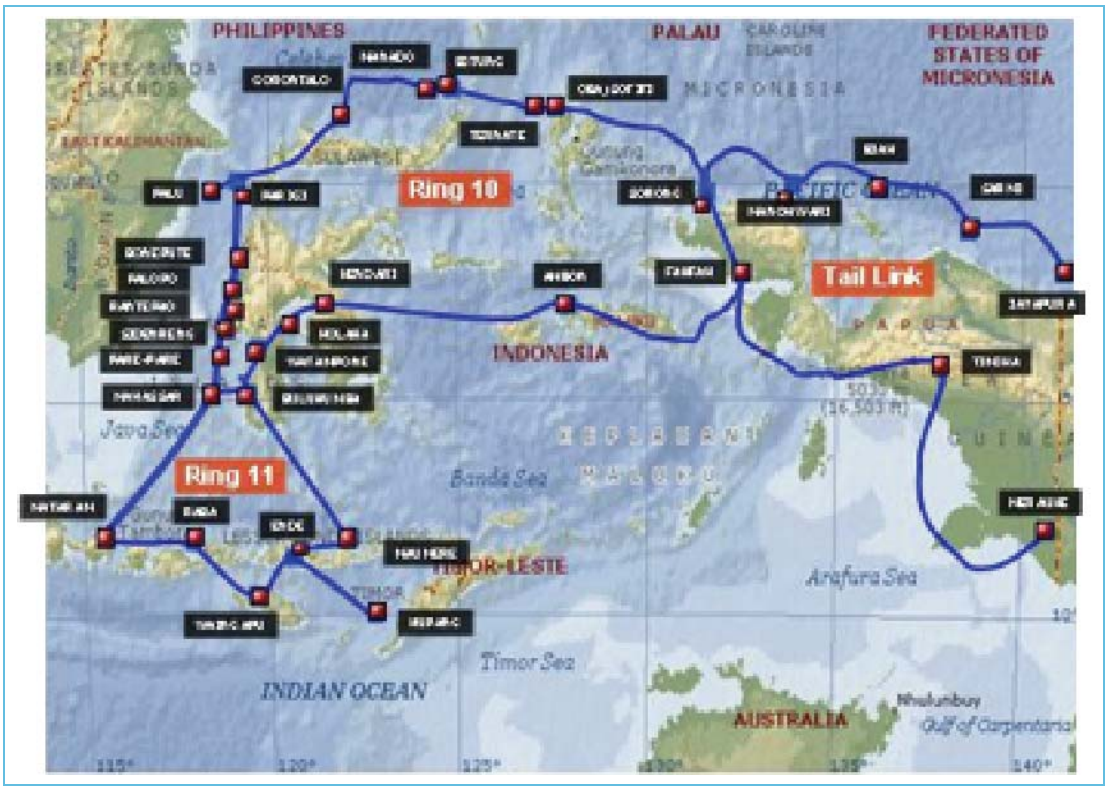
1.8.4. Telecommunications

Telecommunications provide an opportunity for rapid development. Investment in telecommunications infrastructure offers an opportunity to jump directly into some of the newest technologies on earth, better connecting Papua and West Papua internally and to the outside world. About half the population of Papua and West Papua now has access to mobile phone networks, and there is mobile coverage in all larger population centers, plus many villages. Internet usage is also rising, particularly in larger towns, both on the coast and in the highlands. However, these developments are constrained by the cost of computers and power supply, and the limited (satellite) transmission capacity. The main challenges are to increase coverage of the telecommunications network and to increase its carrying capacity, or bandwidth. This can be achieved through a combination of submarine fiber-optic cable to major coastal cities of Papua, fiber optic or microwave links to the interior (co-located with roads, pipelines or power lines if feasible) and increased deployment of new more cost-effective satellite technologies to remote locations.

Public sector support may be needed for remote locations. Investment in telecommunications comes primarily from the private sector, which is also responsible for operations and maintenance. The private sector is profit-driven, and therefore less inclined to service more remote and sparsely-populated areas. There are opportunities for partnerships. For example, provincial and kabupaten/kota governments can work with the private sector to stimulate new investments in such areas by subsidizing capital investments, preferably on a competitive basis; and by pre-purchasing telecoms/Internet capacity (for use by government offices, schools, and health centers, for example) thus guaranteeing the private investors a minimum market for telephone and/or internet services.

Important private investment is already underway. Private telecommunications companies are laying fiber optic cable to eastern Indonesia in the "Palapa Ring," which includes Sorong as one landing point and is scheduled for completion in the next few years. A "tail link" could extend this cable to Manokwari, Biak, Sarmi, Jayapura, Fakfak, Timika and Merauke for a capital cost of about USD 145 million (IDR 1.45 trillion, see Annex 7 Telecommunications for further information). Connection to the Palapa Ring deserves prompt evaluation. Participation in this fiber optic network would catapult telecommunication capacity in Papua and West Papua to top global standards. Telephone and internet carrying capacity would become for all practical purposes unlimited. Any part of the highlands that connected to a coastal hub using microwave technology would instantly become part of the same system. It may be possible to connect Wamena to Jayapura by microwave using as few as four towers, taking advantage of the high mountains of Papua's interior. The map below illustrates one version of this plan.

Figure 9: **Proposed Palapa Ring Fiber-Optic Network**



Isolated locations can use satellite connections. Even in those parts of the highlands where population is too small or terrain too challenging to justify microwave connection to the coast, telephone and limited computer connections are quite feasible using local power supplies and satellite technology. A solar/battery power supply combined with a satellite antenna can connect almost any inaccessible place to the global telecommunication system at a capital cost of USD 12,500 (IDR 125 million) per site.

To put these numbers in perspective, again, the cost of extending the Palapa ring on the north and south coasts of Papua and West Papua is equivalent to about 150 kilometers of good road, while the cost of providing 1000 villages with new satellite-based telephone connections is about 125 kilometers of good road.

1.9. Conclusion

A wise expert on infrastructure said recently "if you build infrastructure right, it will take a lot of money and a lot of time. If you cut corners, it will take more money and more time." Papua and West Papua hold great promise for development. But it would be easy to end up not with development but with plunder of the region's non-renewable resources and with irreversible harm to the Papuan people. Somebody, somewhere in the world, might become very rich. But how many pennies would local Papuans get for every dollar in banks overseas?

Infrastructure in Papua and West Papua should be developed carefully. Projects must be coordinated among all levels of government within well prepared master plans. They must be properly appraised

before they are undertaken. There are many opportunities for productive investment in transportation, power generation, water and sanitation, and telecommunication that are not mega-projects with mega price tags; there are a few large projects, as well, that are likely to pass muster. The central government of Indonesia, the provincial governments of Papua and West Papua and all of the kabupaten and kota governments in both provinces must move hand-in-hand along the road to development rapidly, but one step at a time.


SATROL
LANTAMAL X
GOLDEN BLESSINGS
DUL6544

Sectoral Annexes

Annex 1. Roads and Road Transport

1.1. Current Status of Sector

1.1.1. Major Challenges to Road Development in Papua and West Papua

Much of the soils of Papua and West Papua are difficult to build on. Almost 25% of the total land area of Papua and West Papua is covered with mangrove, swampy forest and swampy shrub; this accounts for the fact that about 22% of the land area is comprised of peat soils (also referred to as histosols). In addition, more than 25% of the land area is estimated to be made up of entisols, which are very young soils on recent alluvium or on steep slopes where soil erosion takes place, or on coastal deposits. These swampy and fragile soils are very difficult to build on, resulting in subsidence and risk of landslides in equal measure at a much higher incidence than in the rest of Indonesia and most other parts of the world. This characteristic of the soils clearly has important implications for the selection of road building corridors and on road building costs.

Construction quality is poor due, in part, to weak contracting industry. Poor construction quality is in part caused by weaknesses of the contracting industry. But the industry itself is faced by several issues which constrain its development and which among other result in significantly higher costs for road works in Papua and West Papua than in the rest of Indonesia, estimated to be on the order of 35%[6]. These issues include: (i) the high costs of inputs in general, a factor which is exacerbated in the highlands where the cost of some inputs can be a multiple of that in the coastal ports; (ii) delays in payments which affect the contractors' cash flow; and his ability to fully utilize his resources (iii) the relatively small size of most contracts which impacts the ability of the contractor to bring expensive, but more efficient, equipment to the work site.

1.1.2. Road Network and Condition

Papua and West Papua have low density per unit area but a high road density per capita. Based on provincial data, the Papua Province network was 16,899 km in length in 2006 including some 13,489 km of Kabupaten roads; while in West Papua the network was 5,184 km in length in 2007 of which 3,882 km of Kabupaten roads (Table 4 and Table 5). In addition, there are village roads which are estimated to total about half that of Kabupaten roads, or some 7,500 km. Assuming a road network of 20,000 km at end 2008, when related to population, this gives a road density of 6.7 km per 1000 people, which is well above the average for Indonesia (1.3) and other Asian countries. However, road density in terms of total land area at 47.6 km per 1000 km^2 is well below the average for Indonesia (174) and most other Asian countries.

Table 4: Road Network - Papua Province (km)

Year	Administrative Class			Surface type				Total
	National	Provincial	Kabupaten	Asphalt	Gravel	Earth	No Data	
2004	267	576	2,029					2872
2005								
2006	1848	1562	13489	3222	4457	6131	3089	16899
2007								

Source: Papua in Figures

6 Under the World Bank EIRTP project, costs of road rehabilitation works in Papua and West Papua were estimated to be 36% higher than in other parts of Eastern Indonesia, while for betterment works costs in Papua and West Papua were found to be 40% higher.

Table 5: Road Network - West Papua Province (km)

Year	Administrative Class			Surface type				Total
	National	Provincial	Kabupaten	Asphalt	Gravel	Earth	No Data	
2004								
2005	345	487	1115					1947
2006	345	488	1122					1955
2007	616	686	3882	1137	2226	1804	17	5184
2008								

Source: West Papua in Figures

Percentage of paved roads is low compared to the rest of Indonesia. Based on the provincial data some 4,350 km or 22% are paved (asphalt surface) while 15,650 km or 78 % are unpaved roads (gravel and earth surface). This indicates that the percentage of paved roads is below the average for Indonesia (55%) and most other regions of the world.

Table 6: Consolidated Road Network by Surface Type and Administrative Class (km)

Year	Administrative Class			Surface type				Total
	National	Provincial	Kabupaten	Asphalt	Gravel	Earth	No Data	
2006*	2,303	1,210	12,438					15,951
2006/2007**	2,464	2,248	17,371	4,359	6,683	7,935	3,106	22,083

** Bina Marga data[7], ** Provincial data*

Road quality in Papua and West Papua is in general poor. Available information on the condition of the Papua and West Papua road network is not conclusive. Data for a subset of 9,358 km of roads in Papua Province (Table 7) indicate that 31% of the roads are in good condition while 41% are in bad condition. For West Papua Province, condition data for a subset of 964 km of national and provincial roads indicate that 22% are in good condition and 57% in poor and bad condition. Data for 2006 prepared by Bina Program suggest that the condition of the Papua and West Papua road network is significantly below the average for Indonesia: 70 % of the roads are in poor or bad condition compared to 49% for Indonesia as a whole. Furthermore, data from the same source for national roads for the period 2000–2006 indicate that on average 15% of national roads were in poor to bad condition in the country as a whole whereas the percentage for Papua and West Papua was 55%.

Table 7: Condition of the Road Network

Road Length (km)				Condition (%)					
Data Source	National	Provincial	Kabupaten	Good	Fair	Poor	Bad	No Data	Total
IRMS[8] 2004 Indonesia	26,828	45,519		29	52	11	2	6	100
IRMS 2004 PWP	1706	1305		24	63	10	0	3	100
Papua Subset	1411	1298	6650	31		28	41		100
W Papua Subset		964		22	21	25	32		100
Bina Program Indonesia 2006	34,506	33,612	249,080	22	29	31	18		100
Bina Program PWP 2006	2,303	1,211	12,438	12	18	28	42		100

7 Some proportion of these roads, in particular Kabupaten roads, may not be in use because of impassable sections.
8 The Indonesian Road Management System (IRMS), which has a nationwide database for national and provincial roads, also provides information on road condition.

Qualitative data suggest that there is a higher incidence of early road failures than in other regions of Indonesia and most of the world. This appears to be caused by a combination of several factors including: engineering designs that are not appropriate for the difficult terrain and soil conditions; resulting cost estimates and budgets that are inadequate; poor construction quality and construction supervision the impact of which is subsequently compounded by inadequate maintenance.

Traffic volumes are very low, meaning roads have low economic rates of return. The fleet of passenger cars, trucks and buses of Papua and West Papua totaled some 59,333 units in 2006/7 (Table 8) with over half of the vehicles in the truck and bus category, which is an indication that the economy is at an early stage of development. Motorization is still low at 19.8 vehicles per 1000 of population compared to 43.9 for Indonesia as a whole. In terms of vehicles per km of road, at a level of 3, motorization is also very low compared to the average for Indonesia, which was 24.6.

Table 8: Number of Motor Vehicles by Type

	Cars	Trucks	Buses	Sub-Total	Motorcycles	Total
Papua 06	21,577	11,821	14,371	47,769	195,485	243,254
W Papua 07	5,228	4,127	2,149	11,564	58,756	70,320
Total PWP	26,865	15,948	16,520	59,333	254,241	313,574

Average traffic levels on the Papua and West Papua roads remain low compared to other regions of Indonesia. But there are huge differences between the different parts of the network. Traffic levels on the main roads in the urban and sub-urban areas of the larger cities are in a range of 5,000–10,000 vehicles/day and in a range of 1,000 to 5,000 in a second tier of cities. On roads in the rural areas traffic levels are estimated to be in a range of 10-150 vehicles/day.

Road network management is complicated by poor intra-governmental coordination and weak capacity. During the past 15 years the central and local Papua and West Papua governments have placed great emphasis on extending the size of the road networks for which they have responsibility. Data on the road network by administrative class have been in a state of flux in recent years following new construction and changes in administrative status[9]. Furthermore, the Kabupaten – the majority of which were only established within the past 10 years – are responsible for a large part of the network. This places a heavy burden on their managerial capabilities as they do not have sufficient qualified and experienced staff nor streamlined operational procedures for the task at hand.

1.1.3. Sustainability of the Road Expenditure Program.

Rapid expansion of the road network while existing road assets are poorly maintained not only raises the issue of economic viability of each section but also the financial sustainability of the endeavor as a whole.

Papua and West Papua have a high ratio of road assets to regional GDP. An indicator of sustainability is the value of road assets compared to regional GDP. Based on international comparison, a ratio in the range of 0.2-0.4 is considered the right balance between the size of the economy and the demand for road assets. For Indonesia the ratio was 0.31 in 2004. For Papua and West Papua the road asset value is estimated at IDR 29 trillion[10], which is high when compared to regional GDP at IDR 55.4 Trillion, or a ratio

9 Based on Bina Marga data, the following changes occurred in the length of the road network between 2000 and 2006: nation-wide, national roads increased from 26,271 km to 34,629 km, provincial roads decreased from 46,032 km to 33,612 km, and district roads increased from 223,318 km to 249,080 km. In Papua and West Papua national roads increased from 1,702 to 2,303 km, provincial roads decreased from 1,873 km to 1,210 km, and Kabupaten roads increased from 9,140 km to 12,438 km.

10 Maximum asset value based on optimal road condition. Using current road condition the asset value is estimated at IDR 16 trillion

of 0.53. In the case of Papua and West Papua where mining has so far been an enclave activity which does not rely on the public road network for its activities it would be appropriate to exclude mining from the GDP value for this comparison. When mining is excluded, the regional GDP is IDR 17.5 trillion and the ratio rises to 1.65.

Vehicles and population per road kilometer are also low. Road density at 6.7 km per 1000 people is already very high in Papua and West Papua (compared to an average of 1.3 for Indonesia as a whole). In addition, the vehicle fleet amounting to some 60,000 units (excluding motorcycles) is small when compared to the size of the road network again suggesting that an emphasis on network expansion as part of Trans-Papua links as opposed to consolidation of existing road assets is premature. The transport cost of cargo by road between Jayapura and Manokwari would be significantly higher than by sea if the full cost of both road infrastructure and trucking were to be charged.

These facts indicate that the existing road network in Papua and West Papua is stretching available resources. When these macro factors are considered together with the fact that a legacy of poor construction quality and insufficient maintenance is placing an additional burden on the upkeep of the assets (see Box 7: Comparison of "Best Practice" versus "Poor Practice" Road Works Policy). it is apparent that the size of the existing network will be seriously stretching the resources of Papua and West Papua and may not be sustainable.

1.2. Recent Developments

Table 9: Expenditures in Roads and Road Transport (IDR Billion)

		2004	2005	2006	2007
Total Public Works Expenditures	APBD	520	1,115	2,737	4,031
	Share Roads[11]	0.7	0.7	0.7	0.70
Roads Expenditures under Public Works	APBD	364	781	1,916	2,821
	Central Govt	241	278	418	478
	Total	605	1,058	2,333	3,299
Rd Transport & Traffic Expenditures by MoT	APBD	11	15	22	83
	Central Govt	21	21	25	56
	Total	33	35	47	138

Source: Based on MoF data

Expenditures on roads in Papua and West Papua are estimated to have sharply increased in 2006 and 2007 reaching almost IDR 3 trillion. Expenditures were mainly directed at expanding the size of the road network. The increased allocations to road works do not appear to have been matched by improvement in road condition.

Contracts are often small, not permitting economies of scale. Information at the project level indicates that road works are implemented o the basis of a large number of small contracts executed in parallel. This approach results in a significant loss in benefits compared to an alternative where projects are prioritized and then implemented sequentially through larger contracts and at a faster pace.

Maintenance budget is far below what is required and is not managed well. The available aggregate data do not permit to separate out the funds allocated to road maintenance, but information provided by staff at various levels indicates that maintenance expenditures, in particular routine maintenance, have been substantially below requirements. An average kilometer of road in Papua and West Papua

11 Estimate based on the 2008 proposals by local governments for APBD expenditures on roads

would need on the order of IDR 25 million in periodic maintenance to be maintained in a reasonable condition for its service life. Anecdotally, an allocation on the order of IDR 1 million per kilometer is far more common. In addition, the execution of routine maintenance works is generally well below good practice standards.

- **Maintenance generally has a low profile** within the activities of the central and regional road agencies, this being related to the traditional low funding levels and an image of being a "low tech" activity.
- **A curative rather than a preventative approach to maintenance** is taken.
- **An ad-hoc approach as opposed to a systematic approach** spread over the year and covering the whole network. For example, routine maintenance activities are generally included as part of periodic maintenance or betterment contracts on adjacent road sections. Under this approach, maintenance may not receive the highest attention of the contractor and supervision consultant and will cease when the main contract works are completed.
- **Late release of budgetary funds** which often results in funds lacking when the requirement is the greatest or the potential impact of timely intervention is the most significant.

1.3. Existing Plans for the Future

Due to the planning cycle, there are no current formal multi-year plans. Owing to the nature of the GOI planning cycle and planning and budgeting procedures, at this point in time there is no formal multi-year road expenditure plan covering all road networks and all categories of works. This notwithstanding, road investment plans and proposed project lists with associated indicative implementation timetables are prepared periodically. These plans, however, are not the outcome of detailed analysis and evaluation aimed at identifying the most worthwhile investments and developing well justified expenditure programs, mainly because of inadequate planning and evaluation resources, both in terms of staffing and funding,

1.3.1. Trans-Papua Links.

The proposed Trans-Papua highway include the following: road links along the northern coastline, connecting Jayapura via Sarmi and Waren to Nabire and from there on to Manokwari and Sorong; a southern loop from Sorong via Bintuni to Manokwari; road links to connect Jayapura via Nimbotong, Lereh to Wamena and from there on to Mulia, Enarotali and Nabire; a connection from Merauke to Tanah Merah, and then via Oksibil and Ubrub to Jayapura.

The technical planning basis for the Trans-Papua road network is severely lacking. Plans for the Trans-Papua road network do not, at present, extend beyond the conceptual stage. Proper selection of road corridors and of the route location within these corridors needs to take into account many aspects, including geotechnical, engineering, environmental, social, land use, and economic factors. Almost none of this information exists, yet talk continues of the Trans-Papua road network as a short- to medium-term possibility.

Outcomes affecting future generations will be very different depending on whether the planning work is done carefully and professionally, superficially, or barely at all. This road system will lock in corridors of human settlements and economic activities for the very long run. Today, and for the foreseeable future, the transport demand in most of the road corridors that these projects aim to establish will remain negligible, except for possible road use to extract timber and other natural resources. In reference to the proposals that have been received by provincial governments offering road network development in exchange for logging concessions, please see Box 9 below.

Box 9: Road Network Development in Exchange for Logging Concession

Private sector parties have made proposals to build roads in exchange for wide ranging logging concessions. This is a bad public-private partnership model and government should not entertain such proposals. Any roads built by such enterprises would be for their own purposes, linking concession areas to ports, and will not necessarily cohere with existing transport master plans. Furthermore, the requirements of roads for logging trucks are quite different from those for normal commercial and private road transport; any road assets transferred to Government would more than likely need to be rebuilt to reflect the different needs of normal road users.

If private sector parties need specific logging tracks that do not yet exist to make their concessions viable, then they should be built by the parties themselves, in compliance with prevailing safeguards, and fully depreciated by the end of their concession. Given the deterioration of public road assets that can result from continuous heavy traffic from logging trucks, in the event that concessionaires would like to use such roads for industrial purposes, then the Government should be compensated for reasonable wear-and-tear.

The private sector parties' expertise is in the conversion of natural resources into money, not in constructing infrastructure for the public good. **The private sector should extract these resources and the Government should use the taxes and royalties that these companies pay to construct infrastructure that suits the needs of their citizens.**

1.3.2. Road Links to Provide Access to the Highlands.

A road was built from Jayapura to Wamena, however, it has never been passable. It appears that very little of the planning activity that must precede a major project was in fact undertaken: this neglect included selection of road corridors and of the route location within these corridors based on geotechnical, engineering, environmental, social, land use, and economic factors. The road construction effort encountered unexpectedly difficult topographical and soil conditions. Insufficient budget and poor planning have meant that the substantial investments made in this project have resulted hundreds of kilometers of unusable road.

No inter-governmental-level plans exists for linking the highlands, thus, different levels of government are pursuing different options simultaneously. Various road links are put forward to provide access to the Highlands from the coastal centers, including: Jayapura – Nimbotong – Lereh – Wamena; Nabire – Enarotali; Oksibil – Dekai – Wamena; Timika – Enarotali; Timika – Mulia. Construction along some of these routes has already begun at the kabupaten level, with no guarantee that there will be linking roads beginning at the borders of neighboring kabupatens.

Competing plans are not an efficient way to link the highlands. The economic viability of road links is heavily dependent on traffic volumes, it is not economically justified nor financially feasible to implement several alternatives simultaneously.

1.3.3. Road Works to Improve Access to Remote Communities.

Governors, Bupatis and Walikotas are under great political pressure to link remote communities with roads for their perceived benefits in lowering transport costs to the users. Indeed, connecting remote communities is not a purely economic exercise. Because of their nature these works are seldom justified on grounds of purely traffic volumes or increased economic activity and associated economic benefits. But improved transport access for these communities has many less tangible benefits that are highly valued by society. These include in particular better access to basic services such as education, health, agricultural extension as well as to safe water and agricultural inputs. Also, evidence from around the world indicates that there is a link between transport improvement and poverty reduction.

The governor of West Papua, in particular, has proposed a very aggressive rural road expansion program. Anecdotally, from interviews with members of the BP3D and Dinas Public Works in West Papua, this situation where the road works budget being spread thinly over a large number of projects in remote areas has resulted in poor quality roads that, in some cases, need to be completely rebuilt within one year of their original construction. As in the Poor Practice" scenario described in Box 1 previously, this expansionary program is resulting in fewer road.kilometers than a more conservative program focused on maintaining existing assets and using leftover budget to expand the network.

1.4. Recommendations

Current plans do not bode well for Papua and West Papua. In broad terms, the (indicatively) planned expenditures exhibit two main issues: (i) a lack of balance in the road expenditure program between road preservation and road network expansion; and (ii) a drive for rapid expansion of the road network without the benefit of appropriate multimodal transportation master plan, network, feasibility and engineering studies. Such expenditure policies will likely result in allocation of scarce resources to heavy duty roads that do not serve transport demand nor any other clear purpose leaving future governments with high road rehabilitation and reconstruction costs. This will not only present an economic loss for the central, provinces and kabupaten/kota governments but, when pursued on a large scale, will create a financially unsustainable situation.

For the near term the aim should be to define a network that serves the growth of existing activities and to stabilize this network to a condition that is maintainable. From this base the network can be expanded in accordance with the above outlined approach.

1.4.1. Increase Resources for Planning and Evaluation.

Investments in planning and evaluation have big payoffs. When the costs of multimodal transportation and road master planning, project evaluation and engineering studies are compared to the above mentioned benefits it is clear that they have a very high rate of return.

A master plan for road must be undertaken as a priority. There are a number of very ambitious proposed road investments in Papua and West Papua, the justification and timing of which requires careful consideration. Before embarking on a major road building program it is indeed best practice to prepare early on a road master plan to guide the development of the road network and the transport system as a whole in the long term.

But road master plan must be part of a broader multi-modal strategy for both provinces. Given the need for a multimodal approach in Papua and West Papua, a road master plan study should be part of an integrated transport system development study which encompasses all modes of transport and maps out the development of the various modes as transport demand increases.

The critical inputs to such master plans are:

- the spatial or macro-zoning plan of the territory;
- the predicted development of the economy in terms of centers of economic activity and associated transport demand;
- the geographical constraints on account of areas that have been designated as protected;

- environmental and social factors both during construction and afterwards in terms of impact on forests, natural resources and the habitat; and
- geotechnical and soils conditions[12].

Master planning will help identify which links should be built, and when. The structure of the road network should be planned taking these factors into account and with the aim of achieving maximum efficiency of the transport system in serving the needs of the economy and the major settlements reserving the right of way in the corridors where roads will be built at some point in the future. Once the road master plan has been professionally designed, it will allow building individual sections on the basis of a stage construction approach by gradually filling in the priority links as these become economically justified.

Given limited resources, it is critical to build roads only as traffic warrants and should be weighed against sea and air modes. Light duty roads (suitable for two wheeled vehicles), too, should be part of the multimodal transport master plan. In the absence of such prior study work, it is inevitable that road sections will be built that will later prove not to be part of a rational network and such investments will be a drain on Papua and West Papua resources. If the main long term goal of the Trans-Papua road investments is to link major centers of activity, then it is critical that sea and air transport alternatives are carefully considered as such alternatives will in most cases provide a lower cost alternative for current cargo flows and cargo flows to be expected in the foreseeable future.

1.4.2. Undertake specific focused planning studies

In addition to an across the board increase in resources for planning and evaluation as discussed above, a number of focused planning studies merit early attention.

1.4.2.1. Trans-Papua Road Network

Given low existing demand for some of the more remote links in the proposed Trans-Papua Road Network, there is ample time to carry out vital study and preparation work. Full social costs and benefits of alternative transportation investments must be considered before any construction is undertaken. This provides a breathing space to examine the options in depth and from a broader perspective than just roads. It also provides opportunity to evaluate the proper role of the public sector in providing infrastructure that may be used mostly by private extractive industry

Papua and West Papua's main urban centers are located along the northern and southern coasts and are connected by shipping and by air at much lower cost than would be possible by road. This is because a proper comparison of various modes of transport should include not only the private cost of operating a truck or boat or airplane, but the full cost of providing infrastructure support as well. The cost of road transport properly should include full road construction and maintenance costs over the life of the road.

The total cost of road transport over great distances is in many cases much greater than the total cost of sea transport. For example, as we detail in Box 3, it is unlikely that construction of a road to transport goods and passengers between Jayapura and Manokwari will be economically justifiable for many years, given the cost of general cargo transport by coastal shipping

12 Particular caution should be exercised in areas featuring peat soils (covering about a fifth of the territory and a much higher proportion in certain regions), in mountainous terrain and in areas covered with fragile soils (also accounting for about a fifth of the territory)

Clearly, at this time, major investments in Trans-Papua links would provide negative returns for the economy. Available funds can be used to much greater effect when applied to maintenance and rehabilitation of existing roads where traffic levels are already substantial or to other infrastructure investment options. Links should be built as the traffic demand warrants, expanding from the growth poles (or "ink-spots") rather than as a one-shot mega-project.

1.4.2.2. Road Links to Provide Access to the Highlands.

While road corridors and alignments are being considered, other modes of transport merit attention too. The efficiency of air transport access to the highlands should continue to be improved. Air transport will remain a credible alternative to road transport for the foreseeable future. Air can provide transport at a cost in a range of IDR 10,000 – 25,000/ton/km depending on volume and route. The high cost of building and maintaining road link require levels of traffic that do not yet exist.

A definitive strategy to link the highlands should be undertaken before further road work proceeds. A comprehensive master plan study with buy-in from Central, Provincial and Kabupaten stakeholders should be carried out to recommend on a staged approach for providing road access to the highlands. This study would preferably also have to recommend on the location of corridors as part of the relevant regional component of a Papua and West Papua wide road master plan. Given that the cargo flows to and from the highlands can continue to be managed with air transport for the foreseeable future, there is ample time to carry out the indispensable study work. The special issues include the following:

- several route alternatives are already being pursued and it is not economically justified nor financially feasible to implement several alternatives simultaneously;
- the very high cost of building a road through mountainous terrain and generally fragile soils;
- each of these alternatives cause varying and significant environmental impacts the mitigation of which compounds the high costs,
- each alternative has different implications for the associated road network requirements to serve the main communities in the highlands region proper; and
- the alternatives have different implications for the Trans-Papua links discussed above; and
- air and river transport will continue to play a role in providing access.

It follows that the question of access to the highlands needs to be framed in terms of identifying an economically and financially viable staging of strategic road investments over the long term.

1.4.2.3. Road Works to Improve Access to Remote Communities.

There are many excellent reasons to connect remote communities to transport networks, but, in many cases, there are more appropriate modes than roads. The cost/benefit analysis of the different modes should be conducted: sea, river, air, and even light vehicle tracks. In the case of Papua and West Papua, improvement in access is not necessarily always a matter of road connections, as many communities can be better served through improvements in air connections and improvements in coastal shipping or river navigation.

When land connections are the only option, the challenge is to identify the most cost effective design and construction alternative. For access to very small communities and relatively short distances, improved paths suitable for non-motorized and light motorized vehicles will be an alternative to be considered. These have already been built under the KDP program in other parts of Indonesia. The focus of the works would be on river crossings, steep slopes, and improvements in otherwise difficult terrain conditions. For implementation priority should be given to community participation, learning from and building upon the experience in other regions with such works.

1.4.3. Development of Annual Road Works Programs.

For the near to medium term the focus should be on improving the composition of the expenditure program covering all road classes and categories of work with the aim of developing a better balance between road preservation expenditures and road expansion. This includes the following in particular:

- **Refine the estimated allocation needed for routine road maintenance** based on more accurate information on the road network and its condition and on implementation capabilities and readiness
- **Develop a detailed work program for preservation and improvement of the existing road assets** (rehabilitation, periodic maintenance, betterment) based on more accurate information on the road network and its condition using existing well established GOI tools and estimate funding requirements.
    - for roads that serve the productive sectors, prioritize in terms of economic benefits to be obtained, i.e. road works that will serve existing traffic and which will lead to reductions in vehicle operating costs
    - for roads that are aimed primarily at providing access, use cost effectiveness approach to ensure minimum level of accessibility
- **Seek a balance between roads that generate economic activity and those that provide basic access.** For remaining funds available under the road sector funding envelope, develop a balance between new roads designed to support economic activities that will translate into traffic on the one hand and roads aimed at providing access to communities on the other.
- **Establish a rolling medium term expenditure program covering all highway sector works** and expenditures on the three administrative classes to be coordinated in a first round by Bina Marga and in a second round under the provincial BAPPEDA/BP3D
- **Coordinate closely with development and refinement of the spatial plan** in an interactive way, as spatial planning requires inputs from transport. Once spatial plans have been firmed up and approved, the planning of road infrastructure should align with the approved spatial plan

Box 10: Estimate of Road Maintenance Requirements for Papua and West Papua

The analysis – based on the World Bank Network Evaluation Tool (RONET) is designed to develop an optimal mix of road works that will minimize costs for the economy over time (a 20-year period) and without any budget constraint.

Assumptions

•	Length of Road Network (km):	20,000	•	Road Pavement - % paved	
	National	2,300		National	75
	Provincial	2,100		Provincial	65
	Kabupaten	15,600		Kabupaten	8
•	Road Condition - % in good and fair condition		•	Vehicle Fleet – Units	
	National	36		Cars	27,000
	Provincial	35		Trucks	16,000
	Kabupaten	30		Buses	17,000
				Motorcycles	255,000
•	Road Utilization by Road Condition - % of vehicle km		•	Cost of Road Works - National and Provincial Paved Roads – IDR Million/km	
	Good condition	14		Periodic resurfacing (overlay)	1,100
	Fair condition	43		Rehabilitation (strengthening)	2,100
	Poor condition	29		Reconstruction	4,000
	Bad condition	14			
•	Cost of Road Works - Kabupaten Paved Roads – IDR Million/km		•	Cost of Road Works - National and Provincial Gravel Roads – IDR Million/km	
	Periodic resurfacing (overlay)	800		Periodic regravelling	250
	Rehabilitation (strengthening)	1,500		Partial reconstruction	550
	Reconstruction	3,000		Full reconstruction	800
•	Cost of Road Works - National and Provincial Earth Roads – IDR Million/km		•	Cost of Routine Maintenance Works – IDR Million/km	
	Heavy Grading	10		Asphalt pavement	10 – 30
	Partial reconstruction	150		Gravel pavement	5 – 15
	Full reconstruction	400		Earth roads	1.5 – 6

Note: The above assumptions of costs of road works are network averages and mask significant variation between costs in different regions and terrain conditions.

Findings. The main findings of the analysis can be summarized as follows:

Category of Road Works	Average Years 1 – 20	Years 1 – 5	Years 6 – 20
Rehabilitation	600	1,800	200
Periodic Maintenance	400	300	400
Routine Maintenance	100	100	100
Total	1,100	2,200	700

Source: Staff estimates

Optimal maintenance program. The estimated optimal average annual expenditure level (over 20 years) is estimated at IDR 1.1 trillion, comprising IDR 100 billion of recurrent maintenance, IDR 400 billion of periodic maintenance and IDR 600 billion of rehabilitation.

Distribution of works. Works on Kabupaten roads, at IDR 430 billion represent 40% of the total. This is understandable considering that these roads make up more than 75% of the network. From the point of view of program preparation and implementation this will pose formidable challenges for many of the local governments.

Box 10: next

Phasing of expenditures. In order to achieve the estimated benefits, expenditures under the optimal program would need to be about twice as high during the initial years to reduce the backlog of rehabilitation of roads in poor or bad condition. Total annual expenditures required during the first 5 years are estimated to be IDR 2,200 billion. This represents a dramatic increase compared to current maintenance programs. During years 6-20 required expenditures would reduce to IDR 700 billion.

1.4.4. Implementation and Management Aspects

Need for Greater Intergovernmental Collaboration on Roads. The above estimate of the average annual total funding requirements (over a 20 year period) for road maintenance and rehabilitation works of Rp. 1,100 billion comprises Rp.430 billion for Kabupaten roads, or 40% of the total. This is understandable considering that these roads make up more than 75% of the network. From the point of view of program preparation and implementation this will pose formidable challenges for many of the local governments. Furthermore, during the first five years the estimated requirement is on the order of Rp. 2,200 billion or twice the average over the 20 year period. Such a rapid ramping up of expenditures represents a formidable program preparation and implementation challenge, in particular for the Kabupaten. This underlines the need for greater intergovernmental collaboration between the various levels of government, in the form of technical assistance from central and provincial government staff to Kabupaten staff and through the development of integrated road works programs covering all levels of government.

Implement performance based contracting. For the complete cycle of routine and periodic maintenance of earth roads, explore the potential for multiyear performance based contracting, for example, based on speeds.

New works must have a solid technical basis before construction begins. For new roads/rehabilitation works, several items are critical in the Papua and West Papua context

- alignment selection, in view of the large proportion of the terrain that presents special conditions (peat soils, mountainous terrain, fragile soils, protected areas)
- design specifications appropriate to the terrain and soil conditions
- construction quality

Work with the contracting industry. With regard to construction quality, some issues affecting the contracting industry can be addressed as these are within the control of the road agencies. This includes: larger contract sizes, greater use of multiyear contracting; and developing multiyear work programs by sub-region which are made publicly available. This will give the contracting industry a better picture of the volume of work that will be available, give them a better basis for planning and financing their activities and in the process lead to greater competition, more efficient execution and ultimately to lower costs.

Involve local communities in construction, maintenance and – where possible – design. For routine road maintenance works, explore the potential for new arrangements involving, participation of local communities and tapping local knowledge about soils and erosion control. For construction of feeder and local access roads, explore the potential of new arrangements involving labor-intensive construction techniques.

Annex 2. Ports and Waterborne Transport

2.1. Current Status of the Sector

Waterborne transport is vital to the growth of Papua and West Papua. Papua and West Papua is dependent on waterborne transport (and aviation) to a much greater extent than regions that are part of a continental land mass where road transport and rail play a much more significant role. Waterborne transport comprises a variety of elements including: ports, domestic inter-island shipping, coastal shipping, ferry crossings and inland navigation. The potential of the natural and associated man-made assets, however, is insufficiently exploited.

2.1.1. Ports and Related Infrastructure

There are 21 commercial ports equipped with quay facilities in Papua and West Papua of which 10 in Papua province and 11 in West Papua. The 22 ports are relatively small with total quay length exceeding 200 m only in Jayapura, Merauke and Sorong. Traffic volumes in most of these ports remain modest in the range of 50,000 to 750,000 tons per year. Only in Jayapura is there a significant amount of container traffic on the order of 50,000 TEU/year.

Table 10: Ports in Papua and West Papua

Quay length (m)	Papua		West Papua	
	Commercial ports	Pioneer Ports	Commercial Ports	Pioneer Ports
< 50	3	8	2	
50 << 100	4	3	5	14
100 << 200	1		3	
200 <	2		1	
Total	10	11	11	14

Source: Papua Province: Dinas Perhubungan Papua
West Papua Province: Studi Transportasi Irian Jaya Barat, December 2007

Most ports in Papua and West Papua remain under the authority of DGST. 6 of the 21 commercial ports in Papua and West Papua are part of Pelindo IV (Sorong, Jayapura, Biak, Merauke, Manokwari, Fakfak) while the remaining ports are administered by the Directorate General of Sea Transport (DGST) under the Ministry of Transport (MoT).

And there are no plans to change this situation. The new Shipping Law 17/2008 law appears to reflect a reversal in the decentralization drive initiated under the autonomy laws of 1999 and 2001, which had envisaged that operational responsibility for the DGST administered public ports would over time be transferred to regional governments. No progress had been made in the implementation of this policy in large part because the local ports had little prospect of becoming financially viable in the near term even if they were free to set their tariffs and tariffs were raised substantially. In view of the time needed to adopt the relevant regulations and implement the new policy, it can be expected that for the near term the existing management arrangements as well as policies in respect of port tariffs will remain unchanged. For the longer term, however, the new law holds the potential for the introduction of different arrangements for port operations, for example through greater involvement of the private sector in stevedoring operations. Under the new law tariffs would also be set on the basis of commercial negotiation. Responsibility for navigation infrastructures outside of the port basin, such as access channels and breakwaters are the responsibility of the central government and the related harbor charges are collected by central government. This arrangement is also expected to continue in the future.

The new Shipping Law introduces the concept of landlord ports through the establishment of port authorities, which will work in collaboration with regional/local government. This potentially provides opportunities for introducing better management practices through operation on commercial principles and/or greater involvement of private sector operators and for cost recovery as tariff setting would be on the basis of commercial negotiation. Details on the management and oversight arrangements and tariff policies are being developed with the target date for effectiveness of the new regime by mid 2010.

2.1.2. Shipping

Several commercial shipping lines have regular cargo operations in Papua and West Papua. For passengers, P.T. Pelni the state owned shipping line, is by far the main player operating scheduled passenger ships serving the main Papua and West Papua ports.

Most issues pertaining to shipping in Papua and West Papua are common to the rest of Indonesia. Shipping – whether inter-island or coastal – is affected by conditions in the Indonesian shipping industry, the efficiency of which is below best practice. Key constraints are the maritime sector policies pursued in the past, for example, existing regulations on: entry and exit; routes and tariffs; on vessel age; vessel specifications and vessel sourcing. Other factors include the failure to modernize the legal (ship mortgage) and financial sector framework affecting ship finance, and ineffective policies relating to the ancillary service industries such as shipbuilding and ship repair. Indicative of the unsatisfactory state of the shipping industry is that the general cargo fleet registered in Indonesia around 2004 was composed predominantly of small and relatively old vessels with almost half of the fleet less than 1000 DWT and about two thirds being more than 25 years old.[13]

The new law makes some progress. The new shipping law is addressing some of these issues and simplifies licensing for inter-island and coastal shipping somewhat. However, in regard to liner services the law provides for continuation of the current system requiring the shipping companies to be part of a system-wide network of routes serving the whole archipelago, and to be determined jointly by DGST and the national association of shipping lines. For the category of "people's shipping", encompassing traditional sailing vessels, auxiliary sailing vessels and motor vessels of less than 175 gross tons, the new law, in recognition of regional autonomy since 1999 delegates the authority for issuing of licenses to local government.

Table 11: Indicative freight rates between major cities in Papua and West Papua

Jayapura - Surabaya	IDR 3,965,000/ton
Manokwari – Surabaya	IDR 3,090,000/ton
Jayapura – Manokwari	IDR 875,000/ton

Source: Interviews with provincial Dinas Transport representatives

Freight rates for goods are unregulated and can be agreed by shipping lines and cargo owners on a commercial basis. Economy passenger fares are regulated by MoT/DGST. PT Pelni, a state owned enterprise, is the main provider of passenger services and has been receiving government support mainly by way of equity injections in the form of vessels entered on its books at no charge to the company. A typical fare on the Pelni services for economy class travel is: Jayapura – Sorong: IDR 286,000. The new law reaffirms the current regime whereby freight rates for goods can be agreed freely between the shipping company and the shipper. For passenger fares the law reaffirms the powers given to DGST to set passenger fares for economy class passengers.

13 Indonesia Country Report: Promoting Efficient and Competitive Intra-ASEAN Shipping Services, March 2005. ASEAN Secretariat.

2.1.3. Pioneer Shipping

Subsidized Pioneer Shipping activities make significant impacts in Papua and West Papua sea transport. Indonesia has had a long standing policy of providing subsidized shipping services through a program called Pioneer Shipping with the objective of providing access and transporting essential goods to remote regions at affordable rates. Pioneer shipping is mainly concentrated in Eastern Indonesia and Papua and West Papua routes figure prominently in the program. In 2002/2003, 4 of the 21 base ports were located in Papua and West Papua and about 20 of the 49 routes were making calls in Papua and West Papua ports. The routes are reviewed periodically in relation to needs and available funds, which are provided under the APBN budget of DGST.

While the objective is worthwhile in itself, the subsidy mechanism that has been employed has not been effective. This consists of paying the shipping company operating a route the difference between (i) pro-forma calculated total operating costs plus a 10% profit margin; and (ii) the revenues as reported by the shipping company. This formula enables the companies to receive subsidies covering their total costs regardless of operating efficiency, the amount of cargo and passengers carried and the quality of service. A review of the performance of Pioneer Shipping carried out under the Stramindo Study[14] for the period 1994-2002 found that load factors were very low and that the average revenue represented not more than 11% of the subsidy received.

The service is indeed cheap, but is not an effective use of funds. Tariffs are regulated by Minister of Transport Decree, the latest having been issued in 2002 (KM 86/2002). Under this tariff schedule a 250 mile (460 km) trip would cost IDR 22,650. Cargo for the same trip would be charged IDR 20,385/ton/m3 (90% of the adult fare). This is no doubt a very affordable fare but, given the poor service provided by Pioneer shipping, it is doubtful that Papua and West Papua and the other regions in Eastern Indonesia are well served by the program in its present form. That the services are not up to expectations is evidenced by the fact that, over the 9 year period covered by the analysis, on average only 279,000 passengers and 93,000 tons were carried annually by the 37 vessels deployed with an average of 22,000 DWT in total.

The new shipping law reaffirms the commitment to Pioneer Shipping services to remote areas where commercial operations are not viable with sufficient frequency, reliability and safety. The law allows contracting out of the services on the basis of long-term contracts. This may provide an opening for introducing a more effective mechanism for awarding the contracts competitively based on minimum subsidy requested and clear performance criteria along the lines of a public service obligation. Whether these opportunities will be realized will depend in large part on how the implementing regulations will be developed and how Papua and West Papua regional and local governments will seize the new opportunities that are provided to them.

2.1.4. Ferries

Ferries represent another important element of the Papua and West Papua transport system. These are considered as land bridges connecting roads on different islands and come under the authority of the Directorate General of Land Transport (DGLT) but with DGST responsible for the licensing of the vessels. The DGLT goal is to increase the number of ferry routes providing regular services and connecting the Papua and West Papua mainland and the smaller islands along its coastline. It also has a program of subsidized Pioneer Ferry routes, which are operated by PT Angkutan Sungai Danau dan Penyeberangan (ASDP) the publicly owned ferry transport corporation. Out of a total of 106 routes in operation in 2007, 68 were Pioneer routes. The total subsidy amounted to IDR 85,900 million.

14 Study on the Development of Domestic Sea Transportation and Maritime Industry in the Republic of Indonesia, 2004.

2.1.5. Inland Navigation

In contrast to inter-island and coastal shipping, inland navigation is not well developed in Papua and West Papua, but is beginning to receive greater attention. Studies have recently been initiated to assess the situation and the scope for development of river navigation in a number of areas. At present, commercial navigation on the Digul and Mamberamo rivers is not well developed, port facilities are very rudimentary and navigation aids are practically non-existent. There is also small-scale river navigation using traditional boats and speedboats on dozens of smaller rivers all along Papua and West Papua's coastline. A first reconnaissance study on river transport in Papua and West Papua was completed in early 2009.

Tariffs for passenger transport are set by Government Decree, while freight is negotiated. For freight, tariffs are not governed by Government Decree and can be negotiated between cargo owners and transport operators. Rates are variable depending on many factors, including season of the year, navigation conditions, and type of cargo.

There is potential for expansion. There is also potential for expansion of navigation on Lake Sentani through establishment of services connecting the various communities living on the shores of the lake and introduction of better frequencies in the services. This is currently being considered by the local government.

Box 11: Small-Scale Shipping in Papua and West Papua

For people's shipping and river transport, the delegation of authority to local government for licensing opens opportunities for a proactive policy promoting this neglected component of the Papua and West Papua transport system. Not only can Papua and West Papua governments be instrumental in improving the basic elements of the infrastructure such as small coastal and river ports, anchoring places and jetties as well as land access to such infrastructures but also by playing an active role in improving the human capital through targeted training programs for owners and operators of small water craft so that the licensing conditions can begin to take into account essential competency factors.

**Note that for inland waterways and ferry transport, however, an additional license – a route permit - is still required; and inland waterway transport and ferry operators must obtain a ship operating approval*

2.2. Recent Developments

Table 12: Expenditures on Waterborne Transport - Papua and West Papua (IDR Billion)

	2004	2005	2006	2007
APBD all Transport Modes	87	114	170	637
Share Waterborne[15]	44%	44%	44%	44%
APBD Waterborne Transport	38	50	75	280
Central Govt Ports	117	119	198	196
Central Govt Ferry Transport[16]				
Central River Transport				
Central Govt Inland Waterways & Lake				
Grand Total	156	169	273	476

Source: Based on MoF data and staff estimates
Note: The above estimates do not include expenditures in the 6 ports that form part of Pelindo IV

15 Estimate based on the 2008 proposals by local governments for APBD expenditures in Transport
16 Information on Central Government expenditures in ferry, inland waterway and lake transport not available

Much of the budget increase since 2004 has been under sub-national governments, yet is proving insufficient. **C**entral government was the major source of expenditures in waterborne transport until 2007 when the level of APBD expenditures in transport increased dramatically (Table 12 above) and became the main funding source. A high proportion (between 50 – 60 %) of the central government expenditures is estimated to have been spent on staff compensation and goods with the remainder on capital expenditure. The latter comprises expenditures on: dredging works for navigation channels; navigation aids; breakwater maintenance/upgrading; minor port infrastructure/superstructure; and equipment as well as repair and maintenance works. In general, funding levels appear to have been inadequate to meet growing traffic flows and the requirements to keep existing infrastructure and facilities in good operating condition.

2.3. Existing Plans for the Future

Like in other sectors, planning resources are insufficient. As the 5-year RPJM cycle ends this year, there is currently no formal multi-year expenditure program covering the plans for the sector. This notwithstanding, investment plans and lists of proposed projects with associated indicative implementation timetables are periodically prepared. Because resources available for planning and project evaluation have been insufficient, both in terms of staffing and funding, few of the plans have benefited from proper in-depth analysis and evaluation. Such preparation work aimed at identifying the most worthwhile investments and developing well-justified expenditure programs, including detailed cost estimates, and implementation and procurement schedules is indispensable if funds are to be used to good effect. Implementation planning is also hampered in general by uncertainty regarding the level of funding that will be available.

A brief summary of existing plans is as follows:

- **For ports,** the list of investment requirements prepared in 2008 by Dinas Perhubungan of Papua Province provides for extensions of the quays in 7 ports, major upgrading in 2 ports, construction of one new port and studies for 4 new ports. For Pioneer ports it provides for construction of small berths (35mx7m) at 16 locations in the period to 2012 and some other 25 locations thereafter. Concept plans have been prepared for a new greenfield port in Depapre some 50 km to the west of Jayapura. The investment would provide an alternative to future expansion of the port at its existing location, which is constrained by the surrounding city and steep hills.
- **For river navigation**, the indicative program includes construction of 9 small wooden berths on the Mamberamo River to serve traditional wooden vessels up to a capacity of 150 tons. A concrete berth on the Yahukimo River is currently under construction.
- **For lake navigation**, there is an indicative program of construction of 9 small wooden jetties on Lake Sentani to serve water taxi operations.
- **For ferry transport**, there is an indicative program of construction of 6 movable access ramps of 500 gross ton capacity to serve ferry connections between the Papua and West Papua mainland and small islands off the coast.

Yet project preparation remains inadequate. No cost estimates are provided for these proposals; details are lacking on equipment that may be required and on the state of readiness for implementation in terms of designs and specifications, bidding documents, etc.

2.4. Recommendations

2.4.1. Maximize the Comparative Advantage of Waterborne Transport.

Waterborne transport is, in principle, the lowest cost transport mode, in particular for bulk commodities, and should therefore receive high priority along the coastline and where there are navigable rivers. To fully exploit the advantages of waterborne transport requires not only that the infrastructure facilities are available and of high quality, but also and of equal importance, that sector policies affecting shipping and other essential operators and service providers in the industry promote entrepreneurship, competency and efficient operations.

Integrate port planning into a broader multi-modal strategy. In planning of port facilities, pay particular attention to coordination of the interface between river navigation and coastal shipping and between the latter two and road infrastructure so as to facilitate multimodal transport

Bear in mind the need for auxiliary service providers around ports to support container shipping – inland container depots, warehousing operators, container consolidators, freight forwarders

Continue investigations of conditions on main rivers and of scope for development, learning from elsewhere in Indonesia and the world at large. In general, follow the these principles:

- Where communities are reliant on river transport seek to improve existing situation rather than provide alternative road access.
- Develop appropriate design and construction standards for basic quay and jetty structures learning from experience in Papua and West Papua and elsewhere in Indonesia.
- In general, identification of aspects requiring further study work.

Be aware that construction of greenfield ports is a substantial undertaking. It will be important during the remaining master planning and feasibility study phases to bear in mind the worldwide lessons of experience of such greenfield port investments. These lessons indicate long delays in getting to commissioning of the new facilities, major cost overruns, and numerous start-up difficulties. One of the major causes for the delays is the need for all the essential complementary investments in other infrastructure, such as land access, power, water and communications, to come on stream in a coordinated manner. This is not only a technical issue but often principally a financing issue, namely: who will finance the initial investment requirements in all these other sectors?

2.4.2. Focus on maintenance

Anecdotal evidence suggests that maintenance of port assets is receiving neither adequate attention nor appropriate funding. Maintenance is mainly carried out in a curative mode rather than as part of a preventative approach. There appears to be no up-to-date and accurate database of existing facilities and their condition, which is a basic requirement for effective programming and budgeting of maintenance activities.

Initiate asset management, starting with inventory of key infrastructure/facilities and their condition so as to provide the basis for developing maintenance, rehabilitation and replacement requirements

2.4.3. Ensure that Subsidies are Well-Targeted

In future a new policy on Pioneer Shipping must be sought. In regard to strategic sector policy decisions affecting the long term future of the waterborne transport industry, Papua and West Papua should take part in the debate on the appropriate policy framework for financially sustainable shipping in Eastern Indonesia and in particular on the respective roles of Pioneer shipping and People's shipping. In evaluating options decision makers should be mindful of the fact that if Pioneer shipping is provided where commercial People's shipping is viable in the context of a supportive policy framework, the subsidy under Pioneer shipping will be counterproductive in the long term.

As indicated above, under the current subsidy regime funds are not being spent cost-effectively on Pioneer shipping. It will be crucial therefore that MoT/DGST, in concert with Papua and West Papua and with the other regional governments benefiting from the program, develop alternative more effective arrangements for subsidy delivery. Papua and West Papua should participate in the debate on the future arrangements for Pioneer shipping as it is a major beneficiary of the program. One approach to consider may be to allow for a differentiation in the arrangements between the different island groups depending on the local conditions.

The expansion of Pioneer ports can be supported, however, with some caveats. The important point is to ensure that these expenditures will indeed fill a gap in the supply of affordable transport services to communities that are poorly served or not served at all. In this regard two aspects are of critical importance. First, there is a need to establish that the service will indeed require subsidy and will not undermine or pre-empt the provision of these services on a commercial and cost recovering basis. Second, there is a need for careful selection of the port site from the point of view of access from the ocean and from the land side.

2.4.4. Pursue Potential Short-Term Projects in the Sector

2.4.4.1. Invest in Waterborne Transport Human Resources

Present opportunities for human resource development are limited. A sustainable waterborne transport industry can hardly be envisaged without the full participation of the local communities dependent or affected by waterborne transport. The communities that have traditionally engaged in fishing and in coastal and riverine shipping are ideally placed to participate in the operations and workforce of a modernizing industry. This underlines the need for an aggressive human resource development initiative initially focusing on two areas: (i) improvement of the managerial and business skills, in particular basic costing and financial aspects and targeted at existing small shipping companies/ owner operators; and (ii) improvement of the technical skills of the seafarers in key relevant areas such as navigation, mechanical, communication, and basic maritime technology.

A vocational training program in the waterborne transport sector could strengthen the industry substantially. A partnering arrangement with a successful foreign vocational training institution in waterborne trades and a domestic training institution may be worth considering. The aim of the arrangement would be curriculum development and assistance in the start-up of training modules in basic concepts of business management, costing and cost control, and performance monitoring ratios as well as in the various technical aspects of the industry. The long term goal would be that following initial investment in curriculum development and in startup activities the operating costs of the training would gradually become self-financing based on the fees paid by the companies that are sending their staff for training.

2.4.4.2. Ship maintenance capacity building

Poor standards and practices for ship maintenance and repair need work. For coastal and riverine navigation to be viable and prosper it will be important that there is an effective local capacity for maintenance and repair of small to medium sized vessels and for building small craft based on efficient and economical designs. This is all the more important considering that two thirds of the Indonesian shipping fleet is over 25 years old and that the situation in this regard is unlikely to be better in Papua and West Papua.

There are opportunities for private participation. It may be worth considering the concession model as an effective approach in view of the limitations on foreign ownership in the sector. Under this approach, the government would invite qualified shipyards (possibly overseas parties in association with a domestic yard) to bid for the right to modernize and operate an existing yard (or establish a new shipyard) for a period of, say, 20 years. The agreement would provide that at the end of the concession, the yard would be privatized or alternatively that the right to the concession would be rebid under new terms. There would be no subsidies for the operation of the scheme and no protection from competition. Initial start-up assistance could be justified, but once established, the business should be able to operate without government support

2.4.4.3. Improve data management of capacity requirements

Careful diagnosis and evaluation of port capacity requirements is lacking. Port congestion or capacity issues can be the result of many factors, ranging from: adequacy of infrastructure and facilities such as berth length, berth load bearing capacity and configuration, handling equipment, port layout and storage areas to operating practices in respect of cargo handling, cargo storage or other port activities. Sometimes, investments need to be undertaken not because of fundamental capacity constraints but to accommodate changes in vessel sizes and shipping technology. Currently, planners in the sector need to base investment decisions on weak information on traffic flows and forecasts, on conditions and operating practices in each of the ports and without a thorough evaluation of alternatives to meet growth in demand.

Such data management techniques can assist in identification of bottlenecks. In the interim, when capacity issues are likely to arise, a first line of response must always be an examination of the scope for improvements in operations, starting with the most essential, such as extending port working hours. To better anticipate future expansion requirements, port operating monitoring systems may need to be upgraded and streamlined.

2.4.5. Engage in Inter-Governmental Collaboration

Dialog must begin on with central government and Pelindo. Responsibility for port infrastructure and facilities and for port management in Papua and West Papua remains largely the domain of Pelindo IV and central government. Policies affecting waterborne transport are also mainly a central government responsibility yet they have to date achieved limited success in fostering an efficient and low cost industry. Notwithstanding these constraints, decentralization and the new Shipping law provide new opportunities for targeted interventions. The waterborne infrastructure can be developed to higher standards and operations can be improved by following a two-pronged approach: (i) through close collaboration between MoT/DGST and Papua and West Papua in formulating and implementing improvement and expansion programs; and (ii) taking initiatives in those areas where the new legal framework makes this possible. Enhanced collaboration between MoT/DGST and Papua and West Papua would be based on the following principles and objectives:

- **A commitment from MoT to provide technical input** in program design and preparation while Papua and West Papua would commit to much greater cost sharing.
- **An understanding on cost sharing** would be predicated on Papua and West Papua continuing to receive the same share of central government budget allocations as in the past
- **MoT to focus on bringing the Papua and West Papua infrastructure for coastal shipping and river navigation up to appropriate standards** in terms of aids to navigation, dredging where required and basic port infrastructure using central government funds
- **Papua and West Papua regional governments assuming increased cost-sharing** for maintenance, rehabilitation and upgrading of port superstructure, facilities and equipment
- **Development with MoT of arrangements aimed at improving operational efficiency and greater involvement of the private sector in port operations**
- **Facilitation towards the establishment/development of related industries,** such as ship maintenance and repair, building of small craft and other shipping and transport related services
- **Assistance in human resource development** in respect of both government staff and the work force in the private sector

Annex 3. Air Transport

3.1. Current Status of the Sector

3.1.1. Airport Infrastructure

Papua and West Papua is heavily reliant on air transport as is evidenced by the fact that out of the 188[17] airports forming part of Indonesia's public air transport system 91, or 48 % are located in Papua and West Papua while the land area of Papua and West Papua is 22 % and the population is just over 1 % in the total. Papua and West Papua have a density of 30 airports per million people as compared to 0.8 for Indonesia as a whole. In terms of airports per land area (per 10,000 km2) the density is 2.2 whereas for Indonesia it is 1. Most of the airports, however, are small and are of the category of Pioneer Airports. This is illustrated in Table 13 and Table 14 below for Papua and West Papua Provinces

Table 13: Airports in Papua Province by Category, Runway Length and Surface - 2008

Runway Length	Airports				Pioneer Airports				
	Total	Asphalt	Penetration Macadam	Other	Total	Asphalt	Penetration Macadam	Grass	Concrete
L < 800	10	4	5	1	27	2	11	14	
800 < L < 1200	3		3		2		2		
1200 < L < 1800	4	3	1		2		1		1
1800 < L < 2400	4	4							
2400 < L < 3000									
3000 < L	1	1							
Total	**22**	**12**	**9**	**1**	**31**	**2**	**14**	**14**	**1**

Source: Dinas Perhubungan, Jayapura

Table 14: Airports in West Papua Province by Category, Runway Length and Surface - 2008

Runway Length	Airports				Pioneer Airports				
	Total	Asphalt	Penetration Macadam	Other	Total	Asphalt	Gravel	Grass	Other
L < 800					31	1	1	24	4
800 < L < 1200	1	1			2		2		1
1200 < L < 1800	1	1			1	1			
1800 < L < 2400	2	2							
2400 < L < 3000									
3000 < L									
Total	**4**	**4**			**34**	**2**	**3**	**24**	**5**

Source: Dinas Perhubungan dan Komunikasi, Manokwari

In addition there are several hundred airstrips scattered over the provinces catering for small aircraft with a carrying capacity of up to 15 passengers, which have been developed by local communities, non profit (mainly religious) organizations and recently also by local governments. These often play an essential role in providing access to small isolated communities.

17 As reported in the Master Plan Study of the Air Transport Sector in the Republic of Indonesia, 2004. This total includes Timika airport, which was developed and is operated by PT Freeport Indonesia, but is in public use.

There are four large airports in Papua and West Papua. Biak, Jayapura, Sorong and Timika have traffic volumes greater than 200,000 passengers per year, with Jayapura well in excess of 500,000. A second group of four airports – Manokwari, Nabire, Merauke, and Wamena – have traffic volumes in the range of 50,000 – 200,000 passengers per year. The remaining airports have much lower traffic; with many only a few thousand passengers per year.

With the exception of the airports of Biak and Timika all airports in Papua and West Papua are administered by the Directorate General of Air Transport (DGAT). The airport of Biak forms part of Airport Corporation II while the airport of Timika is a privately developed and operated airport, which is also in public use. These airport administration arrangements may change at some point in the future. The new Aviation Law UU No 1/2009 provides for the establishment by the Minister of Transport of Airport Authorities responsible for one or more airports in a particular geographic area. Details on the management and oversight arrangements and tariff policies under the new regime still need to be developed and specified in Government Regulations and this will likely take more than a year.

As with ports, decentralization of airports has no occurred in Papua and West Papua. With regard to devolution of responsibility for regional/local airports to the regions, the new law appears to reflect a reversal in the decentralization drive initiated under the autonomy laws of 1999 and 2001, which had envisaged that operational responsibility of the DGAT administered public airports would be transferred to regional governments (provinces and Kabupaten). No progress had been made in implementation of this policy in large part because most of the regional airports had little prospect of becoming financially viable even when free to set their tariffs. Given the time needed to develop the government and ministerial implementing regulations and then to actually implement the new policy it can be expected that in the near to medium term future, existing management arrangements as well as policies in respect of airport tariffication and airline fare setting will continue.

Central government is responsible for standards and safety. In addition to the landside and airside facilities of airports, an air transport system comprises many elements that need to function in a well coordinated and integrated manner, including: visual landing facilities, air traffic management, communications, navigation and surveillance. These are part of a national system on which regional government has no or little control. A whole range of advanced technologies, which are rapidly evolving, are used in these various elements. In addition, technologies and procedures in these areas are governed by international standards, norms and guidelines with a focus on aviation safety and these are necessarily managed at the national level. Regional governments and the users of air transport are primarily concerned with airport facilities and providers of air transport services and these will be the focus in the remainder of this chapter.

3.1.2. Airline Deregulation

The number of scheduled and charter airlines has increased rapidly following deregulation of the airline industry in 2001 (Ministerial Decree KM 11/2001 on Commercial Airlines). In 2000 there were 117 aircraft in operation and in 2006 this number had grown to 226 with 31 registered airlines. Some 15 airlines have operations in Papua and West Papua including the two airlines operated by missionary organizations. For example, in 2008, 11 airlines had operations at Wamena airport.

Deregulation of the airline industry also brought about a major reduction in fares and tariffs in the aviation sector in Indonesia. In the years following deregulation airlines started offering economy fares that were below the official tariffs promulgated by the Ministry. In the event, in February 2006 the Ministry issued a Decree with revised economy fares that were on average 46% lower than the fares indicated in the Decree of February 2002. Actual fares, however, will depend heavily on conditions in the

market and can be close to the new reference fares or much above. So, for example, while the economy return fare between Jayapura and Wamena is in the range of IDR 1,000,000 – 1,500,000[18], the reference fare based on the 2006 Decree is only IDR 358,000. For freight, the tariff between Jayapura and Wamena is on the order of IDR 9,000 kg, which in terms of ton/km is on the order of IDR 37,000. These rates could come down further judging by air cargo rates under efficient operations in other countries[19].

Yet safety standards remain low. The deregulation policy that was pursued at the national level since the late 1990s established an environment that was relatively liberal and allowed the airline industry to expand and serve the needs of a growing economy. It was not accompanied, however, with sufficient attention to aviation safety issues. This is being corrected as evidenced by enactment of a new aviation law in December 2008, which has a strong focus on aviation safety. For Papua and West Papua this is particularly important given its heavy reliance on air transport.

3.1.3. Pioneer Services.

Subsidized pioneer services are active but are planned to wind down in the future. The new aviation law provides for continuation of the long-standing policy to improve access to communities in remote areas by operating or providing support for so-called Pioneer services. These are services on routes that are not commercially viable and require a subsidy. At present these are contracted out annually to commercial airlines on the basis of a competitive selection. The current indicative plan of the Dinas Perhubungan of Papua Province expects a gradual reduction of the number of Pioneer services following annual evaluation of the routes and upgrading of some to a commercial route.

The fares for Pioneer services are set by Ministerial Decree, are heavily subsidized and are intended to be affordable for the people living in the remote locations. They are adjusted periodically to reflect inflation. Under the tariff that became effective in May 2008 the fare from Jayapura to Oksibil a distance of about 250 km, for example, is IDR 131,000 and cargo is charged at IDR 1000/kg. The fare from Wamena to Dekai is IDR 50,000 and for cargo it is IDR 400/kg.

3.2. Recent developments

Table 15: Expenditures in Aviation - Papua and West Papua (IDR Billion)

	2004	2005	2006	2007
APBD all Transport Modes	87	114	170	637
Share Aviation[20]	0.43	0.43	0.43	0.43
APBD Aviation (estimated)	38	49	73	274
Central Government	169	119	268	335
Total	207	168	341	609

Source: Based on MoF data

Both central and local government have increased expenditures on the aviation sector in recent years. Of the central government funding, about one third was spent on staff compensation and goods with the remainder being allocated for investment in new facilities and upgrading of existing facilities. Yet, available funding appears to have been insufficient to meet requirements for aviation safety investments and investments to meet growing demand

18 This fare level is comparable to fares under competitive conditions in other countries.
19 In Alaska cargo rates can be in a range of IDR 10,000 – 25,000 ton/km depending on volume and route.
20 Estimate based on the 2008 proposals by local governments for APBD expenditures in Transport

Resources are spread thinly. In general, as a response to a lack of adequate funding there has been a tendency to spread the limited funding over too large a number of projects which resulted in implementation periods that often times are stretched out far too long.

Noteworthy is that in recent years some Kabupaten governments embarked on imaginative ventures such as the acquisition of aircraft. This was no doubt in large part, motivated by the goal of improving communications and connections for the benefit of the local economy and community at large. The sudden and dramatic increase in revenues, experienced by local governments in Papua and West Papua in 2006 and 2007, would have posed a challenge for any local government in any country that is concerned with obtaining the best value for money possible from the available resources. This raises interesting practical and strategic questions some of which are discussed in Box 12.

Box 12: Aircraft acquisition by local governments

A number of kabupaten governments in Papua and West Papua have acquired planes through a variety of mechanisms over the past years. This kind of expenditure raises practical and strategic questions. At the practical level, there are the issues of legal and operational arrangements. As the local government will not be in a position to obtain an aircraft operating license, it needs to associate with a bona fide airline to take care of the operation of the aircraft. The aircraft asset will presumably be the contribution of the local government in a joint venture. The legal structure of this joint venture entity and the agreement between the two parties (or several parties if there are other investors) will determine how costs and income will be shared and ultimately determine the outcome of the fundamental question whether the venture is worthwhile for the local government.

Kabupaten governments need to ask themselves whether the risk of owning the plane outright is worth the return in leasing the plane to the operator. A more effective use of funds could be a lease, or a targeted subsidy to a private operator.

If indeed, the aircraft ownership gives a better return than investing the money in a savings account and using the interest to subsidize a private operator, then the interesting question is why this would be the case*, and in particular why the airline company would rather operate the aircraft owned by the local government than an aircraft that it can lease in the market under streamlined contractual agreements. Several factors could contribute to the outcome. For example, it is possible that the joint venture entity has a more favorable tax status than the aircraft leasing company; that there is a higher insurance risk premium attached to operating a leased aircraft in Papua and West Papua; or that the cost of the aircraft was unusually low. In regard to the latter point, however, the local government should naturally be wary of situations marked by asymmetric information where its evaluation of the remaining life of the aircraft is different from that by the market. In that case, the ex-post return will of course be different from the ex-ante evaluation, but this will only be revealed when the aircraft reaches the end of its life sooner than anticipated.

The possibility that in the short term the initiative by the local government has had some positive impact should not be dismissed. For example, it may have unlocked potential demand that was not appreciated by the airline industry and therefore not entertained. In the process, the local government may have contributed to the development of a better supply of air transport services. It can be expected, however, that with the advent of a more developed air transport industry and associated better market coverage and with concomitant improvements in aviation safety, local government's role in improving the supply of aviation services will not be through aircraft acquisition, but rather through ensuring that infrastructure facilities are adequate and operated efficiently.

** Assuming that all key parameters, such as annual and periodic maintenance costs and remaining life of the aircraft, have been properly accounted for*

3.3. Existing Plans for the Future

Planning resources remain inadequate. Owing to the nature of the GOI planning cycle and planning and budgeting procedures, at this point in time there is no formal multi-year aviation sector expenditure plan. This notwithstanding, investment plans and lists of proposed projects with associated indicative implementation timetables are periodically prepared. Because resources available for planning and project evaluation have been insufficient, both in terms of staffing and funding, few of the plans have benefited from proper in-depth analysis and evaluation. Such preparation work aimed at identifying the most worthwhile investments and developing well-justified expenditure programs, including detailed cost estimates, and implementation and procurement schedules is indispensable if funds are to be used to good effect. Implementation planning is also hampered in general by uncertainty regarding the level of funding that will be available.

The 2004 master plan study of the air transportation sector[21] reviewed requirements at 6 Papua and West Papua airports (Manokwari, Sorong, Nabire, Merauke, Wamena, and Jayapura) and made indicative recommendations for improvements related mainly to aviation safety, expansion of terminal facilities to meet traffic growth and extension of the runway of Wamena airport to 1,800 m. At the time of the study, the new airport at Sorong was to be financed with mainly GOI funds after the funding under an ADB project had been cancelled. Apart from the extension of the runway of Wamena airport, not many of the recommendations of the master plan study have been implemented.

Plans for the sector are ambitious. The list of investment requirements prepared in 2008 by Dinas Perhubungan of Papua Province provides for runway extensions at 5 existing airports, betterment/upgrading through extension and strengthening of runways at 4 existing airports and construction of 5 new airports. In addition, in respect of Pioneer airports it provides for runway extension of one airport, betterment/upgrading of 17 airports and construction of 1 new airport. The upgrading relates mostly to improvement from grass strip to asphalt.

However, proposals have not been costed, nor do they give details on the associated facilities and equipment required. Also, no indication is provided on the state of readiness for implementation in terms of designs and specifications, bidding documents, etc. In principle, however, such investments are justified on account of minimum safety standards and/or traffic requirements.

Concept plans have also been prepared for new terminal buildings at Jayapura and Manokwari and possibly other airports.

3.4. Recommendations

3.4.1. Focus on Safety and Efficiency of Aviation.

Improving safety and efficiency air transport in Papua and West Papua will have dramatic effects on costs in remote areas. In view of the critical importance of aviation in Papua and West Papua's transport sector the underlying aim of expenditure program preparation should be to enhance aviation safety and to seek improvements in facilities (navigation, landing aids, runway conditions) that will contribute to improving the efficiency of the airline industry and hence to a lowering of costs. Investments that will allow the airline industry to achieve higher operating efficiency, e.g. fewer delays or flight cancellations because of weather conditions, should receive high priority. Considering that transport volumes are still limited on most routes in Papua and West Papua, air transport will remain more economical than road transport if the cost of the road infrastructure is included in the comparison. The highlands in particular

21 The Master Plan Study on the Strategic Policy of the Air Transport Sector of the Republic of Indonesia, July 2004

will continue to be dependent on air transport for the foreseeable future, even if plans are developed and implemented for providing road access. The objective should therefore be to establish and maintain an infrastructure and an air transport system of world-class efficiency that will lead to a further lowering of air transport costs.

With continuing growth in traffic, terminal buildings at the 6 - 8 most important airports will need expansion and/or modernization and this should be addressed as soon as the above safety and airside requirements are being met. This will likely pose financing challenges, as under the current airport administration regime the funds have to come from central government. But central government's finances will remain constrained for the foreseeable future and there is unlikely to be much enthusiasm for these projects as the aviation and airport system of Papua and West Papua as a whole is far from recovering its costs, in particular in light of current charging and cost recovery policies for aviation and airport sector facilities and infrastructure. This underlines the need to formulate appropriate and streamlined cost sharing arrangements.

Asset management needs to be taken seriously. While key facilities in the aviation sector are generally better maintained than in other sectors because safety considerations require adherence to minimum standards and norms, which are established under international agreements, indications are that there is scope for improvement in maintenance operations and practices. The 2004 Air Transportation Master plan Study found that maintenance expenditures represented only about 15% of operating expenses and that there was no reliable inventory of existing infrastructure and facilities. The situation is unlikely to have been different in Papua and West Papua. This points to the need to seriously consider establishing an asset management system.

Aircraft acquisition by local governments is unlikely to be the most efficient use of funds. It is unlikely that with the advent of a safer and more efficient aviation and air transport sector and associated better market coverage by private airline operators, local government's role in improving the supply of aviation services would be through aircraft acquisition. The benefits of such investments by local government over cost sharing in airport and terminal building expenditures should be clearly demonstrated.

3.4.2. Collaboration Strategy.

Further local government cost sharing is required. Indications are that the aviation sector in Papua and West Papua has been underfunded in recent years. There are several reasons for this but important contributing factors are no doubt that available funding at DGAT level has been inadequate and that there is as yet no streamlined arrangement for cost sharing between local government and central government. This issue is compounded by the fact that expenditure program preparation requires a high level of technical expertise in a variety of fields and careful coordination of the various elements that make up the aviation system. In these circumstances a focused effort by an experienced team of staff or consultants is needed.

Kabupatens have increased revenues, but have not spent on hard infrastructure. That overall funding has been inadequate for the identified needs is all the more regrettable considering that local government revenues have dramatically increased in recent years and could have contributed to help fund critical aviation sector requirements. This is illustrated by the fact that some local governments have applied budget resources to big ticket acquisitions such as aircraft, no doubt in recognition of the important role played by aviation in the life of their communities and with the aim of improving the level of aviation services for the benefit of the local economy and community at large.

The key to meeting the challenge of improving air transport safety and increasing capacity in response to growing demand is close collaboration between MoT/DGAT and Papua and West Papua in formulating and

implementing improvement programs for the Papua and West Papua aviation sector. Such collaboration would be based on the following principles:

- **A commitment from MoT/DGAT to provide technical input in program design and preparation** while Papua and West Papua would commit to much greater cost sharing.
- **An understanding on cost sharing** would be predicated on Papua and West Papua continuing to receive the same share of central government allocations as in the past.
- **MoT/DGAT to focus on actions to bring the Papua and West Papua aviation system up to appropriate safety standards using primarily central government funds.**
- **Papua and West Papua regional governments should assume cost sharing for maintenance, rehabilitation and extensions of runways and upgrading and improvement of terminal buildings and associated facilities**.
- **Development of arrangements with MoT/DGAT for greater involvement of the private sector** in the management of passenger areas of the terminal buildings, for example through an association of franchise holders operating in and around the terminal building.

3.4.3. Implementation and Management Aspects.

Proposed airport development investments still require further project preparation. As to the indicative list of expenditures proposed for the near term future, this includes mainly: runway extensions and widening, runway upgrading in particular of Pioneer airfields, and unspecified aviation sector facilities and equipment in general. These are, in principle, well justified on account of safety standards and/or traffic requirements. There is a need, however, to have these expenditures properly costed and prioritized, and then to proceed with preparing integrated implementation and acquisition programs on an airport-by-airport basis.

Expenditure planning and programming in general:

- **Establishment of collaboration mechanism with DGAT.**
- **Identification of study requirements** to firm up components of the expenditure program and preparation of TOR and request for proposals
- **Initiation of basic asset management system** starting with condition inventory of some essential facilities

In respect of terminal building expansion, the aim should be the development of cost effective concepts and approaches. In particular, these concepts and approaches should:

- **Provide for stage construction**, incorporate local themes and building materials when competitive with materials sourced from outside Papua and West Papua and be geared towards the profile of the traveling public.
- **Seek as much private sector participation as is possible** under current laws and regulations, e.g. management and maintenance of public areas.
- **Give greater attention to facilitating multimodal transport** by improving the facilities and arrangements for intermodal connections

For the interim, minor upgrading and management of existing terminal building facilities should aim at:

- **maximizing the use of existing space** and making passenger areas more client-friendly, inter alia, by seeking the collaboration of franchise holders
- **facilitating multimodal transport**

Annex 4. Power

4.1. Current Status of the Sector

Papua and West Papua provinces have relatively rich primary energy resources for power generation, both fossil and renewable. According to the Ministry of Energy and Mineral Resources (MoEMR), Papua has 24.14 TSCF[22] natural gas resources, 153.42 million tons of coal reserves, 121.15 million barrels of oil reserves and around 50 MW of geothermal resources. In addition, Papua has very rich hydropower resources. According to MoEMR's estimates, the total hydropower potentials in Papua amount to 24,974 MW, over 140 times of the existing installed generation capacity in the provinces.

The geographical conditions, and the distributions of population and economic activities in Papua and West Papua Provinces, make the supply of electricity in the provinces extremely challenging. By the end of 2007, the per capita electricity consumption was 194 kWh, only 36 percent of the national average. The electrification ratio was only 27.5 percent, among the lowest of all the provinces in the country.

PLN is the monopolistic power suppler in the two provinces and owns and operates all the major public generation, transmission and distribution assets. A few large multinational mining and oil companies own and operate some large captive power generation facilities but exclusively for their own uses. Finally, there are a number of isolated power sources, such as solar PV panels, micro-hydropower stations, and small diesel generators to supply electricity in the remote areas. These isolated facilities were mostly financed by the government budget under a small and fragmented rural electrification program. There are no integrated large power systems in these two provinces. Electricity is supplied by a handful of isolated small urban distribution grids powered mostly by aged diesel generators.

MoEMR has set very ambitious electrification targets. The long-term energy sector development plan[23] recently published by MoEMR has set electrification targets for the Papua and West Papua provinces. According to the plan, the electrification ratios of Papua will reach 50 percent by 2010, 63 percent by 2015, 75 percent by 2020 and 90 percent by 2025. This is obviously a very ambitious development targets, especially for the period from 2009 to 2015. Significant amount of investment and project preparation and implementation efforts will be required to achieve these targets.

Yet PLN is not so ambitious. There are three principal ways of reaching the target, (i) through an expansion of the main grid to un-served areas, (ii) the establishment of isolated grids for relatively isolated areas and (iii) through individual/institutional solar PV systems, for relatively dispersed areas and very small loads where even small independent grid systems are not viable. PLN will be mainly responsible for grid extension while the government is mainly providing off-grid solutions to un-connected consumers. According to PLN's ten-year development program (2009 to 2018), the electrification ratio will reach 32.2 percent by 2010, 38.4 percent by 2015 and 43 percent by 2018.

Table 16: Electrification Targets for Papua and West Papua

	2007 (actual)	2010	2015	2020	2025
Government	27.5	50	75	90	100
PLN	27.5	32.2	38.4	43.0*	

** 2018 targets*

22 Trillion Standard Cubic Feet

23 Rencana Umum Ketenagalistrikan Nasional(RUKN) 2008-2027, Ministry of Energy and Mineral Resources – Republic of Indonesia

4.1.1 Barriers to Development of Power Sector Infrastructure

Lack of strong local government leadership. Nowhere in the world has successful electrification been achieved without strong local government ownership, leadership and coordination especially when access rates are low. Strong public sector leadership and sustained political commitment have been key factors in successful electrification programs in developing countries across the world. We have not seen this leadership and commitment from local government in Papua. While local governments have greater responsibility for electrification under the policy of decentralization, ambiguity as to their precise role and also a lack of experience in the sector is preventing them from rising to the challenge.

Failure to follow cost recovery principles. Electrification is neither viable nor sustainable without being able to cover its full costs through two sources: customer tariffs and public subsidies. Current electricity tariff level is to low to cover the supply cost of electricity and the almost fully diesel based power generation makes cost recovery tariff system almost impossible in Papua given the limited affordability of the consumers in the provinces.

Weak private sector participation. The level of private sector investment in power sector of Papua is very low as compared with other parts of the country. Although there have been some significant private investments in oil, gas and mining sectors, the perspectives of private investments in power sector infrastructure are not encouraging.

4.2. Recent Developments

Development of the power sector infrastructure in Papua is still at very early stage. Expansion of PLN's power system in the past few years focused on installing diesel generators and expanding the medium and low voltage distribution system in various PLN's small urban power systems. From 2002 to 2007, PLN's installed generation capacity increased from 137.0 MW to 165.8 MW, with an annual average growth rate of 3.9 percent. The length of its 20 kV distribution lines increased from around 2,000 km to 2,257 km.

By the end of 2007, PLN has established ten small urban electric power systems in all the major cities and towns in the two provinces. The total installed generation capacity of these systems was 165. 82 MW of which, only 4.04 MW is hydropower, the rest are diesel generators. In 2007, the total electricity generated was 604.62 GWh, of which only 18.51 GWh was generated by hydropower and diesel generators generated 586.11 GWh, representing a very expensive fuel mix.

Low tariffs mean that PLN has no incentive to expand their network. PLN field offices reported substantial pent up demand from residential and commercial users.

Facilities are in poor condition. As most of the diesel generators in the systems are aged, the total dependable capacity of the generation system was 99 MW, representing only around 60 percent of the installed capacity and leading to very lower supply reliability. Electricity consumers are suffering serious power shortages all over the provinces.

The highest voltage level of the power system is 20 kV. By the end of 2007, the total length of the 20 kV distribution lines was 2,257 kilometers and there were 1,732 20 kV transformers in the system with a total capacity of 172.37 MVA. Again, most of these small distribution systems are primitive and outage rates of the systems are high. In 2007, there were 1,331 outages of the 20 kV lines - 59 outages per 100 km, twice as high as the national average.

PLN's power generation system is almost purely diesel based. Following the rapid rising of oil prices in the international market, the removal of subsidies on petroleum products by the Government in 2005 and the Government's suspension of electricity price increases since 2004, PLN's supply costs are much higher than the regulated electricity prices, significantly hindering PLN's motivation to expand the capacity of power supply infrastructure and preventing private investments in the sector. According to PLN's statistics, in 2007, the average electricity supply cost was IDR 2,195 /kWh, while the average sale price of electricity was only IDR 624/kWh[24].

In recent years, PLN has started to diversify the fuel mix of its generation system by investing in coal fired power plants as part of the national 10,000 MW coal fired power generation expansion program, and in small and mini hydropower projects. Three small and mini hydropower projects with a total capacity of 23 MW are under construction and financed by the Asia Development Bank. The total project investment cost is estimated at USD 71 million.

Substantial privately owned captive power infrastructure exists. In addition to PLN, some large multinational companies own and operate significant amount of captive power generation facilities in Papua. For example, Freeport Corporation owns and operates a large coal fired power plant with installed capacity of 190 MW (3X65 MW) and five heavy-duty diesel generators of 25 MW (5X5MW), all operating at a frequency of 60 Hz. It also owns and operates a small 50 Hz system, comprising a number of small diesel generators with installed capacity of around 4.5 MW and supplying electricity to its auxiliary facilities, such as administrative offices, hotels, schools, etc. None of these power facilities, however, are accessible to consumers outside the company.

Government's electrification budget has mainly provided grant financing to small isolated generation facilities, such as solar PV panels, in remote areas. The typical annual spending of the government is around USD 8.5 million. This usually includes around USD 6.5 million by local government through APBD and around USD 2 million from MoEMR's rural electrification budget. The impact of these grant supports appears very limited.

Small-scale rural power projects suffer from a lack of coordination and a whole-of-life approach to investments. Finally, under small scaled and fragmented rural electrification programs financed by both central and local governments, limited number of isolated solar PV systems and micro-hydro schemes were installed in some remote areas of the provinces. No comprehensive information is available on the status of these facilities, yet field visits and anecdotal evidence suggest that there is little thought given to these assets after the initial investment is made.

4.3. Existing Plans for the Future

PLN has developed the long-term national investment plan and this plan has been approved by the MoEMR recently. The power sector investment plan of Papua is part of the plan. The objective of the investment plan is to meet the growing demand in Papua with the least cost. This plan was developed based on the electricity demand growing at 8.6 percent annually. The electricity demand forecast was developed based on the assumptions of annual average GDP growth rate of 5.7 to 6.1 percent and annual population growth rate of 2 percent.

Demand for power is predicted to grow substantially. According to the demand forecast, the electricity consumption will increase from 562.2 GWh in 2008 to 1,278.2 GWh in 2018. The peak demand will grow from 132 MW in 2008 to 282 MW in 2018. Most of the electricity demand will be from major

24 Data source: PLN.

urban centers in the provinces, such as Jayapura, Sorong, Timika, Merauke, and Manokwari. The electricity demand of other parts of Papua only accounts for less than 10 percent of the total.

To meet the increasing demand, 443 MW of generation capacity will be installed in the provinces in the next ten years. Nearly 70 percent of the new capacity will be coal fired. Hydropower will account for 15 percent. Diesel capacity accounts for around 7 percent, the rest will be gas and geothermal. Associated with the investments in power generation infrastructure, distribution facility will also be constructed to connect more consumers in the provinces.

Total financing requirements of this investment program were estimated at USD 929.7 million, including USD 634.7 million for power generation investments and USD 295 million for power distribution infrastructure investments. It is expected that around USD 838 million will be financed by PLN with public financing resources, and only USD 85.2 million will be financed by private independent power producers (IPPs).

PLN's power sector investment program clearly focuses on system expansion in the urban and coastal areas while there are more economic activities and population density is relatively high. *Very few resources will be allocated to the vast rural areas and/or highland areas where poverty ratio is high but supply cost is also high. It appears that there are no systematic power sector investment plans developed by the provincial government authorities*. Past experience also shows that the government funding rural electrification program seems fragmented and not sustainable. Finally, there no signs that private companies, especially those multinationals who have significant interests in the provinces, will play an active role in developing power sector infrastructure.

4.4. Recommendations

Cooperation between PLN and local governments must be improved. The local government should coordinate with PLN for the development of power sector infrastructure and play a leading role in providing off-grid solutions in vast rural areas. To this end, extensive technical assistance may be required to strengthen the capacity government's capacity. A conventional solution to address this is for an international financial institution or donor to provide funds for technical assistance.

Fuel mix must be diversified. It is necessary to find ways to minimize the costs of serving both new and existing electricity connections. In this regards, the top priority should be to improve the generation mix through better planning and coordination. The current PLN's generation system is almost purely diesel based. Feasibility should be explored to develop the very rich hydropower resources and other lower cost generation technologies. Improved planning that optimizes benefits from economies of scale can also play an important role. For example, there is currently a tendency to provide small-scale technological solutions, such as the micro-hydro system, and small coal fired power plants. However, large scaled power generation options can produce electricity at much lower cost.

Tariff reform must be initiated. It is necessary to find ways to move tariffs towards greater cost recovery. Even if all technical and institutional options to minimize costs are taken up, it is still likely that the full cost of providing service would be above the current national tariff. While the full cost recovery tariff may not be affordable or politically acceptable, it would still be helpful to promote the principle that high-cost areas should have higher tariffs. This is important because electricity tariffs send important signals indicating where the cost load should be located.

Financing should be sought from a diversity of sources: public and private. It will be necessary to

address the question of financing. This review has identified a gap between the financing options available and the financing needs to achieve the government's electrification targets in Papua. In this aspect, public sector should increase its funding supports to the development of power sector infrastructure while private sectors should also be encouraged to invest in the power sector so that the government's electrification targets can be achieved.

For public sector, in addition to PLN's financing program, the government should consider to channel more budgetary supports in a sustainable and systematic way. In this regard, an electrification fund could be set up to provide concessional financing supports to both public sector and private sector investments in power sector. The fund sources could include government budget and concessional financing from international financial institutions and donors.

Regarding the private investments, the priority should be to encourage large multinational oil and gas companies who have interests and/or operations in Papua to participate in the development of power supply infrastructure, through their existing community development programs and/or certain types of private-public-partnership (PPP) arrangements. In addition, private investors should be encouraged to invest in power generation facilities as independent power producers (IPPs). Local NGOs and communities should be allowed to play an active role in operating and managing some of the small scaled power supply infrastructures financed by the government with fees to cover at least the operation and maintenance costs.

Box 13: Micro Hydro for Off-Grid Solution

Local Government of Pegunungan Bintang Regency has conducted several feasibility studies on micro hydro potential in their area. The capacity of proposed micro hydro station is ranging from 20-40 KW. Even though the studies are basic, it shows great commitment of local government in developing micro hydro potential as solution for increasing access to electricity. Utilization of hydro potential will replace diesel generator. Typically for operation and maintenance of a small isolated grid supplied by diesel generator local government spends around USD 1,000-1,500/day. This high operating cost also contributed by fact that diesel fuel shall be flown into the area because of land access is not available.

Long term sustainability of off-grid electrification depends on more than technology. It requires effective prioritization and planning to enable economic choices of technology, appropriate infrastructure to ensure that services are provided over the long run. To maximize the chances of sustaining operation of off-grid electrification projects over the long term, their design must ensure that all key actors along the value chain benefit.

Project design must not be technology driven. A cost-benefit analysis of alternative including grid extension must be carried out to determine least cost solution for each specific project location. Technology choice must be based on practical consideration and final choice must be left up to the service provider who usually has other investment parameters to consider.

For Papua, a thorough rural electrification study is needed, not only to look into technical and financial aspect, but also in institutional aspect to ensure sustainability. Off grid electrification program must complement grid expansion, in Indonesia case; PLN expansion. The government recognition of the role of off-grid options is important; its support, including subsidy commitment, and us of light-handed and simplified regulation, is essential. If the local government is to have a significant implementation role, the implementing agency should appoint competent and dedicated project management staff.

Box 14: Public-Private Partnerships hydropower project to supply power to Freeport

Local government presented to the mission feasibility studies of Urumuka Hydro Power Project (300MW) and Detail Engineering Design of Paniai Hydro Power Project (in total of 1000MW). These two hydropower candidates are in the same river system and are proposed to be developed by a provincially owned power company, rather than PLN. Current PLN plans do not take these proposed investments into account.

Looking at the demand and nearest load center around the area, PT Freeport Indonesia's (PTFI) mine site has the most potential demand for these hydro projects. Timika (90-km) and Nabire (120-km) are the nearest cities to project site with 8MW and 6MW peak load demand respectively. Freeport and other captive power users demand forecast will be the main determinant of timing to develop this project. Currently PTFI operates a 195MW coal power plant, and will soon need additional capacity to match electricity consumption to support their move underground as their current pit mine is exhausted.

Strong will from PTFI to work with other stakeholders is instrumental for development of this hydro project. Freeport cannot put their mining operation at risk because of power supply reliability. Certainty of Commercial Operation Date (COD) and reliability of supply during operation is crucial factor for Freeport in deciding their involvement in the project.

Commercial arrangement that incorporates benefit and risk of all stakeholders will be the key of project success.

Annex 5. Water Supply

5.1. Current Status of the Sector

5.1.1. Water sources[25]

Today, fewer than 25% of households in Papua and West Papua have access to piped water, which is inexpensive and of reasonable quality compared to alternative sources. The majority of the population continues to rely on surface water, groundwater and rainwater (Table 17). With the exception of the highlands in Papua and the mountainous areas in Papua Barat, where surface water is relatively abundant all year round, water is in short supply during the dry season and is deemed unfit for human consumption without some form of treatment (such as chemical filtering or boiling)[26]. Water borne gastrointestinal disease is a severe problem in Papua and West Papua.

Table 17: Primary Water Sources for Human Consumption, % total

Source	Papua	West Papua	Total
Piped water, urban	10	14	11
Piped water, rural	11	8	10
Groundwater	21	39	25
Surface water	49	26	44
Rain water	8	12	9
Other	1	0	1
Total	**100**	**100**	**100**

Sources: Staff estimates, based on PODES (2006)

There is a drive for increased access to piped water. The latest national medium-term development plan (RPJM) aims to provide 40% of households in the country with access to piped water by the end of 2009. The National Action Plan on Clean Water, issued by the Ministry of Public Works (MPW) in 2004, describes a strategy to halve the proportion of people without sustainable access to safe drinking water by 2015, in accordance with Millennium Development Goal #7. The primary means to achieve this is to improve access from its current level of about 18% to 62% in 2015, and reduce dependency on other water sources. This requires a major increase in production and distribution capacity (through a combination of system optimization and system expansion) and the number of household connections. In addition, the Government requires that all water utilities supply potable (as opposed to clean) water by the end of 2008[27].

Most observers agree that it is unlikely that the Government will meet its self-imposed deadlines, but there is general agreement that GOI remains committed to a substantial increase in the number of piped water connections, as was recently confirmed by the vice-president's call for providing 10 million new house connections by 2013 (up from about 6 million in 2008).

25 The scope of this section is limited to municipal water supply only (it does not discuss water supply for agricultural or industrial uses).

26 This section was partly based on interviews with the heads of the provincial water resources departments of Papua and West Papua (Messrs Sigana and Malpac), the general director of PDAM Kab. Jayapura (Mr. Butar Butar), the general director of PDAM Kab. Manokwari (Mr. Taran) and officials of BAPPEDA Provinsi Papua Barat, and the public works department of Kabupaten Manokwari.

27 As required by Government Regulation 16 of 2005.

5.1.2. Piped water supply in urban areas – current state of affairs

In 2005, the urban population of Papua and West Papua was approximately 520,000, distributed over eight towns of over 25,000 inhabitants (Jayapura, Biak, Merauke, Sentani, Serui and Timika in Papua, and Manokwari and Sorong in West Papua). About half of the population in these towns had access to piped water provided by municipal water utilities, most of which are (wholly or partly) owned by kabupaten/kota governments.

The organization of the piped water sector remains highly fragmented, in both provinces, with over a dozen PDAMs providing piped water, of which only PDAM Kabupaten Jayapura operates more than 20,000 connections (Table 18). In recent years, the performance of most utilities has deteriorated, as they can no longer rely on central government grants and loans from multilateral and bilateral sources, formerly major sources of funding. (Exceptions are the utilities of PDAM Sorong and PDAM Biak, which have established joint ventures with a Dutch water utility – Waterleidingmaatschappij Drenthe or WMD –providing managerial and financial support.[28])

Maintenance of existing systems has been a chronic problem in most towns. Revenues are usually far lower than the full cost of the service due to downward political pressure on tariffs. As a result, most utilities have resorted to 'stop-gap' measures including deferring essential maintenance expenditures and defaulting on loans from the Ministry of Finance (MoF). Water losses, both physical and administrative, average 50% of production. In some areas, groundwater abstraction through individual and often unregistered wells has started to cause seawater infiltration. Water quality and regularity of service delivery are declining, especially in urban areas, and none of the utilities currently supplies potable water.

Table 18: Water Utilities in Papua and West Papua

Water Utility	House Connections ('000)	Household Coverage (% LG)*	Arrears on MoF Loans (IDR b)	Owned by**
Papua	**36.6**	**10**	**33.9**	
PT. War Besrendi (Biak)	5.1	26	6.1	LG (49%), WMD (51%)
PDAM Kab. Jayapura	23.9	41	27.7	LG (100%)
PDAM Kab. Jayawijaya	0.5	1	–	LG (100%)
PDAM Kab. Merauke	2.8	9	–	LG (100%)
PDAM Kab. Nabire	1.5	5	–	LG (100%)
PDAM Kab. Paniai	NA	NA	–	LG (100%)
BPAM Kab. Timika	NA	NA	–	MPW (100%)
PDAM Kab. Yapen Waropen	2.9	21	–	LG (100%)
Papua Barat	**16.8**	**14**	**22.8**	
PDAM Kab. Fakfak	3.1	27	–	LG (100%)
PDAM Kab. Manokwari	3.9	13	8.3	LG (100%)
PT. Tirta Remu (Sorong)	9.7	21	14.5	LG (49%), WMD (51%)
Total	**53.3**	**11**	**56.6**	

Sources: MoF (2008), Staff estimates, based on PERPAMSI (2004) and BPS (2005)
** Coverage of entire local government, assuming five persons per household*
*** LG = local government, WMD = Waterleidingmaatschappij Drenthe, MPW = Ministry of Public Works*

28 WMD has also signed, but not started implementing, JV agreements with Kab. Jayapura and Kabupaten Jayawijaya. Kabupaten Merauke and Kabupaten Manokwari cancelled JV agreements signed with WMD.

5.1.3. Piped water supply in peri-urban areas – current state of affairs

Peri-urban water supply was constructed by central government, but, largely, has not been maintained. Towns with a population of 5,000 – 25,000 are classified as 'peri-urban'. Most of these towns possess small-scale systems that were financed and constructed by the Ministry of Public Works, and usually supply 200 to 500 households. Formally, the responsibility for the management of such systems lies either with the kabupaten/kota government public works department (Dinas Public Works) or with community groups. In practice, however, management units either never were established or are no longer functioning. This problem is closely connected to the fact that households connected to the systems usually pay nothing for water. According to detailed records of the provincial water resources department of Papua, the majority of the small-scale systems have fallen in disrepair. The actual coverage rate of piped water supply in Papua may therefore be substantially lower than indicated by official statistics.

5.1.4. Piped water supply in rural areas – current state of affairs

At present, fewer than 10% of over 3000 villages (of up to 5000 inhabitants) are believed to have access to piped water. Most of these 'micro-systems' in are financed from two sources:

- **Central and provincial government grants**. Through the *Program Nasional Pemberdayaan Masyarakat* or PNPM, central and provincial government channel grants for small-scale infrastructure to villages. The utilization of the grant is largely determined by the villages themselves. A sample of 168 grants indicated that piped water supply systems were the third most popular investment, after roads and electricity. Most grants for water supply (IDR 100 million per village in 2008) were used to construct small-scale gravity-fed systems with up to 100 connections.

- **Municipal government grants**. Since 2005, the central government provides kabupaten/kota with a special allocation (*Dana Alokasi Khusus* or DAK) for the water supply sector. Several kabupaten/kota, such as Manokwari, use the allocation to finance piped water supply systems in villages. A typical system consists of 5 to 15 public taps, gravity-fed by rubber pipes with a built-in filter, with a raw water source 1 to 2 km from the village. The average cost of a system is IDR 200m (approximately USD 20,000).

As is the case with most peri-urban systems, many rural water supply systems have fallen in disrepair shortly after they were installed, primarily because institutions are not in place to manage the systems and collect revenue for maintenance and repairs.

5.2. Existing Plans for the Future

Provincial and kabupaten/kota government plans for the water sector are dictated by their sectoral mandates, as outlined in Government Regulation 38/2007. According to this regulation, provincial governments are responsible for the regulation of government affairs in the water sector that affect more than one kabupaten/kota government (*lintas kota/kabupaten*), whereas kabupaten/kota governments are responsible for the provision of water to citizens in their jurisdictions. In Papua and West Papua, kabupaten/kotas established before 2001 have delegated this responsibility to their respective water utilities[29]. In newly established kabupaten/kotas, the public works department is held responsible for retail water supply.

29 Kota Jayapura is a special case. In 1993, this Kota was split off from Kabupaten Jayapura, but the PDAM remained fully owned by the Kabupaten and supplies both the Kabupaten and the Kota.

5.2.1. Central government plans

No known plan exists for Papua or West Papua.

5.2.2. Provincial government plans

Papua. The provincial water resources department of Papua is currently preparing a 2009-2014 master plan for municipal water supply and urban drainage in and around Jayapura, based on reliable and accurate data (which, according to the head of the department, are currently not available). It has also budgeted funds for preparing water supply master plans for the capitals of six newly created kabupaten/kotas, and plans to establish management units (in the form of *Badan Layanan Umum-Daerah* or BLU-D) in sub-kabupaten/kota capitals to improve peri-urban water supply systems.

West Papua. This province does not have a water master plan. It is currently preparing a master plan for water resources, covering two municipalities (Kota Sorong and Kabupaten/Kota Manokwari). This draft plan[30] lists problems with water supply (such as high levels of unaccounted-for-water in PDAM Manokwari), but does not identify ways for addressing these problems.

5.2.3. Kabupaten/Kota government plans

Information was not available for kabupaten/kota government plans for peri-urban and rural water supply. Kabupaten are normally not involved in urban water supply, although some kabupaten/kotas finance part of the investment requirements of their water utilities (the province of Papua also provides such incidental financial support). The mission has reviewed the business plans of PDAM Jayapura and PDAM Manokwari which, taken together, supply over 50% of all house connections in the two provinces.

- **Business plan of PDAM Jayapura (2009-2015) projects strong growth.** The PDAM expects the population of its service area to increase from 260,000 to about 450,000 in 2015. To serve this population, it requires an increase of its production capacity from 515 l/s (in the rainy reason) to 850 l/s. This estimate is based on the following assumptions: 80% service coverage, 25% UfW, and average consumption per connection remains unchanged. As a first step, it will develop in 2009 an intake from the Bufer River with financial support from the provincial government. With a capacity of 50 l/s, this intake will only cover 15% of the extra capacity needed by 2015 and therefore is only a temporary solution. The PDAM is currently searching for new raw water sources to secure supply in the long term. The PDAM expects to finalize a five-year business plan by the end of 2008.
- **Business plan of PDAM Manokwari (2008-2013) also projects strong growth**. This PDAM intends to increase coverage of its service area of 60,000 persons from 45% in 2008 to 60-70% in 2013. This requires an investment in 2000 new connections (to be financed by the PDAM itself) and an increase of its production capacity of about 50% from its current level of about 150 l/s (to be financed by the province and other external sources). BPKP (a government auditing agency) is currently preparing a five-year business plan for the PDAM, covering the period 2008-2013, to be completed by the end 2008.

Neither PDAM has plans to provide its customers with potable (as opposed to clean) water, as required by the end of 2008 according to PP16/2005.

30 Penyusunan Master Plan Sumber Daya Air Baku di Kabupaten Sorong dan Kabupaten Manokwari Propinsi Papua Barat, Laporan Antara, Oktober 2008

5.3. Recommendations

5.3.1. General observations

As in most provinces in Indonesia, the number of households with access to piped water in both Papua and West Papua is far below national development targets, and none of the water utilities are currently providing potable water. However, several factors affect the development of the piped water supply systems in Papua and West Papua are not encountered elsewhere in the country to the same degree:

- **Low urbanization rate**. At present, only 20% of the population of the provinces lives in urban areas, which is far lower than elsewhere in Indonesia. Moreover, urban population densities are low (5 to 10 persons per Ha). The combined impact of these factors is a relatively high unit cost for providing piped water supply systems.
- **High transport costs**. Because of unique geographical circumstances, the unit costs of construction materials is significantly higher than elsewhere in Indonesia[31], imposing further upward pressure on the construction cost.
- **Variation in raw water availability**. There is no 'one-size-fits-all' solution for Papua or West Papua. Some areas are blessed with abundant natural water resources (notably the highlands). In contrast, the majority of the population in the southern lowlands continues to be dependent on harvesting rainwater.

In summary, providing piped water is more expensive and – from a planning perspective – more difficult than elsewhere in Indonesia. At the same time, the need for access to safe water remains as high as ever, given the high and rising incidence of gastrointestinal ailments and other water-borne diseases.

In the absence of a long-term development plan for the municipal water sector in Papua and West Papua, we will first present indicative long-term development targets, then provide estimated funding requirements, and conclude with a list of short- and medium-term development priorities.

5.3.2. Long-term development targets

The Government is currently preparing a national development plan for 2010-2014. We assume that the quantitative targets for the municipal water sector will be consistent with the vice president's plan to add 10 million house connections by 2013, but – at the same time – be less ambitious than targets mentioned in the 2004 National Action Plan on Clean Water (which no longer appears realistic). Against this background, we assume that both provinces will seek to provide 80% of the urban population and 60% of the peri-urban and rural population with access to piped water by 2020. In 2020, the total population of both provinces is estimated at about 3.5 million persons, of which over 900,000 will live in urban areas (Table 19).

- **To provide piped water to 80% of the urban population, the number of connections must triple from 53,000 in 2005 to almost 150,000 in 2020.**
- **To achieve 60% coverage of the non-urban population, the number of connections must increase at a much higher rate, from 50,000 to over 300,000.**

31 According to BPS, the average construction cost index was 44% above the national average in 2007.

Table 19: Population and Household Connections, 2005 and 2020 (indicative)

Province	Population ('000)			Household Connections ('000)		
	2005	2020	Increase	2005	2020	Increase
Papua						
- Urban	420	756	336	37	121	84
- Peri-urban/rural	1,403	1,888	485	40	227	187
West Papua						
- Urban	94	170	75	17	27	10
- Peri-urban/rural	523	704	181	10	84	74
Total						
- Urban	514	926	412	53	148	95
- Peri-urban/rural	1,926	2,592	666	50	311	261

Sources: Staff estimates, based on PERPAMSI (2004) and BPS (2005)
Assumptions: annual population growth rates: 4% p.a. (urban) and 2% (non-urban); household size: 5; coverage targets: 80% (urban), 60% (rural)

5.3.3. Indicative funding requirements.

The total investment cost is estimated at approximately USD 250 million[32] (in constant 2008 prices). The total investment cost of the required increase in house connections consists of the cost of installing the new connections themselves, plus required investments in water intakes, transmission mains, water treatment plants, distribution networks and other supporting infrastructure. The average cost is lowest in areas where raw water is available from springs (such as the highlands in Papua), which requires relatively small investments in pumps and treatment facilities. The average cost is highest in urban areas, where raw water is usually not available from nearby sources (thereby necessitating substantial investments in transmission mains), or requires expensive pumping systems if the water supply system relies on groundwater. Based on unit cost prices used by the Ministry of Public Works, the average investment cost of a new house connection, in constant 2008 prices, was estimated as follows:

- **Urban: USD 880**
- **Peri-urban / Rural (other than highlands in Papua): USD 720**
- **Highlands in Papua: USD 600**

Based on these assumptions, the total investment cost of the required increase is estimated at approximately USD 250 million (in constant 2008 prices), consisting of:

- **Urban: USD 880 x 95,000 ≈ appr. USD 80 million**
- **Peri-urban / Rural (other than highlands in Papua): USD 720 x 152,000 ≈ appr. USD 110 million**
- **Highlands in Papua: USD 600 x 109,000 ≈ appr. USD 60 million**

Of this amount, about USD 185 million would be allocated to Papua, and the remainder to West Papua.

5.3.4. Indicative O&M financing requirements.

The cost of operations and maintenance (O&M) of a piped water supply system is largely determined by the source of raw water. If the system largely depends on groundwater, pumping and treatment costs are substantially higher than for a system that sources its water from springs. In a sample of water utilities in Java, the O&M cost of spring-fed systems was approximately USD 0.10 per m^3 of water sold. In contrast, the O&M cost (per m^3 of water sold) of systems that relied on surface water or

32 Unit cost assumptions based on the 2004 National Action Plan for Water Supply (rehabilitation and increase in urban connections), and mission to Papua (increase in rural connections).

groundwater were USD 0.20 and USD 0.35, respectively. These estimates were adjusted for Papua and West Papua because of unusually high construction cost prices. Assuming an average O&M cost of USD 0.30 per m^3 of water sold (in constant 2008 prices) throughout both provinces, the annual O&M financing requirements in 2020 are approximately (459,000 connections x 219[33] m3 of water sold per connection per year x 0.30 ≈) approximately USD 30 million.

5.3.5. Proposed Short- and Medium-Term Development Priorities (2010-2014)

At present, provincial and kabupaten/kota governments have not prepared clear medium- to long-term strategy for the development of the municipal water sector. The absence of such plans appears to reflect limited planning skills, coupled to the low profile of the sector (vis-à-vis roads, for example).

Institutional reform of the piped water supply sector is the single most important development priority. In Indonesia, most investments in piped water have not yielded the expected results. This is especially the case for peri-urban and village water supply systems, many of which cease to function within 3 to 5 years, in the absence of a unit with the authority and revenue to operate and maintain the system. Investments in systems managed by water utilities tend to have a longer economic lifetime but as long as water tariffs are determined by political instead of commercial factors, as the case virtually everywhere in Indonesia, utilities will not become financial viable, and therefore able to maintain and expand the piped water systems in their service area.

Options for institutional reform include: (i) the establishment of a public service agency (BLU), as proposed by the provincial water resources department of Papua, (ii) the establishment of a joint-venture between a PDAM and a private investor with a majority share (as explored by WMD, although this model requires modification to meet Indonesian legal standards), (iii) the establishment on an independent regulatory body (this option enjoys the support of the provincial government of Papua for the regulation of tariffs by PDAM Kabupaten Jayapura), and (iv) the creation of provincial government-owned PDAMs in Jayapura and Sorong, to prevent the further defragmentation of an already defragmented sector (see Box 14).

33 This amount is based on a household size of 5, and average sales of 120 liter per person per day.

Box 15: The Need to Stop Defragmentation of the Municipal Water Sector

As elsewhere in Indonesia, the provision of municipal water is highly fragmented in both Papua and West Papua. Since the mid-1990s, the Ministry of Public Works has actively encouraged the merger of PDAMs to achieve economies of scale, with the long-term objectives of restoring PDAMs to profitability and lowering the price of piped water. Due to difficult geographical conditions, low population densities, and considerable distances between urban centers, there is limited scope for such mergers in either province. There is, however, a significant risk of further defragmentation of the municipal water sector, as both Kota Jayapura and Kota Sorong – the largest urban areas in Papua and West Papua – are each considering to establish a new PDAM, even though both cities are already served by an existing water utility (by PDAM Kabupaten Jayapura and Kab. PDAM Tirta Remu, respectively; the latter is owned by Kab. Sorong and WMD).

Both *kota* governments were split off from a *kabupaten* that continues to (co-)own the PDAM[34], even though most of its customers live inside the boundaries of the newly created city government. For example, in 2008 PDAM Kabupaten Jayapura served about 26,000 connections, of which only 3,300 (or less than 15% of the total) were located inside the *kabupaten*. Nonetheless, the mayor of the *kabupaten* retains the right to set water tariffs (which happen to be higher than in most other cities in Indonesia), even though most of the PDAM's customers are living outside his jurisdiction. At the same time, the *kabupaten* is not interested in investing in its PDAM, because the benefits from these investments mainly accrue to residents of Kota Jayapura. Conversely, the *kota* is reluctant to invest in a company that it does not control. Similar concerns apply to Kota and Kabupaten Sorong.

PP38/2007, a government regulation on the allocation of responsibilities among central, provincial and *kabupaten/kota* governments, stipulates that a provincial government is responsible for affairs that affect more than one *kabupaten/kota* and cannot be solved by these *kabupaten* or *kota*. The head of the department for human settlements of the province of Papua strongly supports the conversion of PDAM Kabupaten Jayapura into a provincial PDAM, modeled after PDAM Tirta Nadi in Medan. He informed the World Bank that the province is willing to take over both the assets and the liabilities (the latter of which include arrears on Ministry of Finance loans of approximately IDR 10 billion)[35]. The director of PDAM Kabupaten Jayapura also supports the conversion of the PDAM into a provincial-owned entity, as a means to better balance the interest of the *kota* and its hinterland, and – at the same time – ensure that overheads will remain at their current levels[36]. It is recommended that GOI provides financial and political support to this initiative, in order to prevent the further defragmentation of an already defragmented sector.

343536

Expansion of coverage in distressed peri-urban and rural areas should be a high priority. As mentioned above, the majority of households in Papua and West Papua remain dependent on water sources that are scarce in the dry season. The absence of clean water is most pressing in the lowland areas, where rainwater is sometimes the only source. These include: Yapen, Waropen, Asmat, Merauke, Boven Digoel and Mappi in Papua, and Kaimana and Fakfak in Papua Barat. These areas should receive priority in the allocation of available financing for expansions of piped water supply systems.

Provision of access to long-term financing to commercially viable water utilities should be undertaken in Papua and West Papua. The Government is currently implementing a program of PDAM debt restructuring, as a means to establish municipal water utilities on a sound commercial footing. However, because of the absence of a market for long-term capital in Indonesia, even financially sound water utilities will have difficulties to finance network expansion, which typically has a long payback period. We encourage the Government to develop market-based facilities for the financing of long-term infrastructure development projects by public and private providers of piped water.

34 Kota Jayapura was split off from Kabupaten Jayapura in 1993. Kota Sorong was split off from Kabupaten Sorong six years later, in 1993.

35 Interview with Mr. Adelison Sinaga, Head of Subdinas Cipta Karya Provinsi Papua (Jayapura, Swiss-Belhotel, 19 November 2008).

36 Interview with Mr. Butar Butar, General Director of PDAM Kabupaten Jayapura (Jayapura, PDAM Head Office, 19 November 2008).

Annex 6. Sanitation

6.1. Current Status of the Sector[37]

Over one-third of all households in Papua and West Papua currently lack any form of on-site sanitation. A large portion of the rural population, as well as many low-income households in urban areas, discharge human waste directly into rivers, lakes, and open space. The resulting contamination of surface and groundwater has led to high incidences of waste-transmitted diseases and environmental degradation of water sources, especially in densely populated areas.

On-site sanitation services are limited to major cities. Households in urban areas have usually established pit latrines or septic tanks. Only in two cities in Papua and West Papua are septic tank emptying services available. In Jayapura, a private company operates a fleet of sludge trucks (*truk tinja*) and dumps the sludge in a location nearby the city, without any form of treatment or protection. The government of Kota Sorong used to operate a fleet of sludge trucks but no longer does so. The trucks used to dump the sludge in a sludge treatment facility (IPLT). This facility was not maintained, so that private operators now dump sludge on an uncontrolled dumpsite. Sludge discharge facilities are not available elsewhere in Papua or West Papua. In Manokwari, citizens either discharge the sludge manually, by dumping into a nearby river, or sometimes build an additional septic tank.

Off-site sanitation services are non-existent. In the early 1990s, the Ministry of Public Works used part of the proceeds of an ADB loan to finance the construction of a wastewater treatment plant and piped sewerage system in Kota Jayapura. The system was never used, fell in disrepair, and it now covered by a bus terminal that was built over it.

6.2. Existing Plans for the Future

Provincial and kabupaten/kota government plans for the water sector are dictated by their sectoral mandates, as outlined in Government Regulation 38 of 2007. According to this regulation, the central government is responsible for the development of piped sewerage networks in large and metropolitan cities (which, in the context of this section, only includes Jayapura). Kabupaten/kota governments are responsible for the regulation and provision of sanitation services to citizens in their jurisdictions, usually through the public works department. The role of provincial governments is limited to the regulation of affairs that affect more than one kabupaten/kota.

6.2.1. Central government plans

During 2010-2014, MPW intends to finance the preparation of an urban drainage master plan for Kota Jayapura (at an estimated cost of IDR 1.5 billion). The head of the provincial water resources department of Papua was not aware of this plan. According to him, such a plan was prepared relatively recently (in 2004), and requires updating only.

37 The scope of this section is limited to municipal wastewater only (it does not discuss urban drainage or solid waste management) due to a lack of data and formal plans.

6.2.2. Provincial government plans

Both provinces consider Kabupaten and Kota responsible for this sub-sector (with investments in physical infrastructure to be financed from DAK and other kabupaten/kota government revenue), and not the provincial governments themselves, neither of which has invested in sanitation in recent years.

6.2.3. Kabupaten/Kota government plans

It appears that kabupaten/kotas governments in Papua and Papua do not provide urban sanitation services, with the exception of solid waste collection and disposal.

6.3. Recommendations

6.3.1. Long-term development targets.

In the absence of provincial or kabupaten/kota government plans, the following targets are proposed for the period 2010-2020:

- **Enforce the construction of wastewater treatment facilities**. At present, Kabupaten and Kota governments do not enforce new buildings to have septic tanks or other forms of wastewater treatment. It is recommended to start make the availability of such services conditional for a building permit from 2010 onwards and, in the longer term, enforce the construction of such facilities in commercial establishments (2010-2014), and urban households (2015-2020).
- **Construct sludge treatment facilities (IPLT).** Such facilities must be built with due regards for watersheds. Upon completion, the use of septic tank emptying services must be enforced.
- **Construct a piped sewerage system in Jayapura**. In the long run, the central government intends to provide each large and metropolitan city in the country with a piped sewerage system. By 2020, the population of the CBD of Jayapura will have a population of approximately 60,000 – at which point population densities are sufficiently high to warrant the investment in a piped sewerage system. Before construction commences, the central government will need to have worked out the institutional set-up and responsibilities for O&M, to avoid a repeat of the debacle of the early 1990s.

6.3.2. Indicative funding requirements (public sector only).

The total investment cost of the required increases is estimated at approximately USD 50 million[38] (in constant 2008 prices), consisting of:

- **Construction of sludge treatment facilities: USD 1.25m x 8 ≈ appr. USD 10 million**
- **Construction of piped sewerage connections in Jayapura: USD 400 x 10,000 ≈ appr. USD 40 million**

The investment and operating cost of sludge trucks (*truk tinja*) will be borne by the private sector, as is the case for investments in on-site treatment facilities by large-scale commercial establishments.

38 Unit cost assumptions based on subproject appraisal reports of the Metropolitan Sanitation Management and Health Project, which is currently being prepared by MPW and ADB.

Annex 7. Telecommunications

7.1. Current Status of the Sector

7.1.1. Strong demand exists

Demand for telecommunications services is increasing throughout Papua and West Papua; from the private sector, provincial, and kabupaten/kota governments, as well as households. As basic telephony needs are met, this demand is shifting towards Internet, which delivers not only voice but also data services and content/media. Projections for Papua and West Papua, particularly for larger population centers, clearly indicate increasing demand for broadband Internet, consistent with Indonesia-wide and indeed global trends. Outside major population centers, demand for broadband in the short-term is primarily institutional: large corporations/projects, government offices, universities, secondary and vocational schools (SMP, SMK, and SMA). For example, the Provincial Education Development Strategy envisages significantly increased connectivity for junior high and secondary schools to support teacher professional development and delivery of teaching/learning materials.

Table 20: Papua & West Papua Telecommunications Demand Projection (Forecast 2020)

	Fixed Lines	Fixed-Wireless	Total Fixed	GSM mobile	3G mobile	Dial-up Internet	Broadband Internet	Internet TV (IPTV)	TOTAL
Subscribers	226,000	319,000	545,000	1,719,000	1,910,000	2,000	468,000	278,000	
% population				46	50				
% households	22	57	79			0	56	38	
Capacity (Gbps)			1.9	6	29	0	133	2	**171**
% of total			1	2	11	0	86	0.3	

Source: Staff estimates
Note: Demand has been calculated as a function of household income data, population projections, availability of schools, hospitals, government institutions, location of businesses. Demand is expressed in terms of number of users, and required capacity (traffic). This scenario also assumes a Papua and West Papua-specific GDP distribution to compensate for the extreme remoteness of most rural areas.

At the kabupaten/kota level the highest demand for telecommunications, is projected to be in Mimika, Kota Jayapura, Merauke and Jayawijaya, followed by Jayapura and Nabire; particularly for broadband by 2020. In West Papua the highest projected demand is in Kota Sorong, Kabupaten Sorong and Manokwari.

The provincial Governments are major potential users of telecommunications capacity. At the basic level, Government offices need to communicate by phone and email. Government also provides information to the public, and has set up informational websites, for example city profiles and investment opportunities, as well as public Internet access facilities. The Government has several internal information systems needs, for planning and budgeting, and routine reporting. A shift from paper-based to electronic reporting, for example on monthly expenditures in line ministries, on school management and health surveillance, will increase demand for better connectivity. For the longer-term the Government envisages the development of "Papua Online" allowing electronic transactions such as e-procurement and permit applications, and potentially other "e-government" services. Such services will require significantly higher telecommunications capacity than is available today, as well as substantial institutional change management and skills development in government.

7.1.2. Overall supply constraint

Telecommunications offers Papua and West Papua an excellent opportunity to bridge physical distance virtually, and reduce the isolation of many communities. However, the "digital divide" is still very significant in Papua and West Papua. About half the population of Papua and West Papua currently has access to basic telecommunications, mainly through mobile phones. Internet access is particularly limited. There are major telecommunications access gaps in the Highlands and inland lowland areas due to the relatively high costs of network deployment in mountainous, forested or swampy terrain, lack of supporting infrastructure (power supply, roads), land/site access issues, low population densities, and limited formal economic activities outside "enclave" projects. Large corporate users such as PT Freeport and oil companies in the Bintuni area have set up their own satellite-based communications networks to meet their high demand for connectivity.

7.1.3. Access networks[39]

As of end-2008 there were about 1.2 million mobile subscribers, including in all kabupaten/kota capitals, and prospectively in all *kecamatan* centers in Papua and West Papua (see coverage map). Providers are Telkomsel, Indosat and Excelcomindo (XL) with about one million, 100,000 and 20,000 subscribers respectively. PT Telkom has 76,000 fixed lines (copper) in service, 36 percent in and directly around Jayapura city. Further investment in fixed lines is not anticipated due to high unit costs; rather Telkom is deploying cheaper fixed-wireless[40] service in the main towns, with about 20,000 subscribers at present. More remote localities, particularly across large areas of the Highlands, are connected via very small aperture terminal (VSAT) satellites and/or short-wave (SSB) radio, if at all.

Internet access is generally through slow dial-up connections where fixed lines are in place (about 10,000 estimated subscribers) and stand-alone VSAT connections for specific customers/locations such as large corporations, missions, some Government offices, and Internet cafes. VSAT connections are offered by the large telecommunications operators above as well as specialized service providers. Broadband or high-speed Internet access is extremely limited. Telkom launched fixed broadband (ADSL) in Timika and Jayapura in 2008, with an initial capacity of 1,500 lines; subsequent roll-out to main urban centers such as Sorong, Manokwari, Biak and Merauke is anticipated. Wireless broadband deployment is in the very early stages. Some Wi-Fi "hotspots" have been set up in towns. Mobile broadband is available on a limited basis: GPRS/EDGE (2.5G) service (which supports basic Internet browsing and Blackberry service, for example) is available in most mobile network coverage areas. Higher-speed or third-generation (3G) mobile broadband deployment is anticipated but has been delayed. Internet cafes operate in major towns, in some cases between twice and three times the hourly usage costs in Java (IDR 15,000 per hour in Wamena, for example); facilities are typically overcrowded.

7.1.4. Backbone or transmission networks

Papua and West Papua depend entirely on satellite transmission, both to connect major urban centers internally, and externally, to other locations in Indonesia and the rest of the world. This is quite insufficient to meet existing demand, analogous to airline passengers being routed from Jayapura to Jakarta in small boats. So far, there is virtually no terrestrial backbone, such as microwave or fiber-optic cables; there is limited fiber within Jayapura. For example, PT Telkom's Internet bandwidth for the entire Papua and W. Papua Provinces was 30 megabits per second (Mbps) as of mid-2008; by comparison, a typical home in Western Europe, Japan or Korea would have a bandwidth of approximately 10 Mbps. Moreover, the cost

39 Telecommunications infrastructure consists of access networks (fixed lines or mobile base stations reaching end-users) and backbone networks, which transmit, aggregated volumes of telecommunications traffic across long distances (satellite, or terrestrial--microwave or fiber-optic).

40 Mobile technology standards: GSM=global system for mobile communications, CDMA=code division multiple access. GPRS=general packet radio service (2.5G).

structure for satellite bandwidth (per Mbps), both capital investment and recurrent costs, is significantly higher over the medium term than for terrestrial backbone. Typically the cost per bandwidth unit on high capacity fiber optic cable routes is 1/50th or lower than for a satellite connection. *This reliance on satellite transmission limits capacity and speed of data transmission, and the quality of service.*

7.2. Recent Developments

Investments in telecommunications have been made primarily by the private sector. Public investment has been mainly in computer and networking equipment in Government offices, for example by the provincial electronic data center (BPDE) and department of planning (BAPPEDA/BP3D) and, more recently, computer labs and networks for secondary schools. Government has also invested limited funds in a fixed-wireless communication network for 17 kabupaten/kota offices, wireless connections to 4 universities and 16 schools and in SSB radio links for schools and health centers. Many kabupaten/kota governments have deployed VSATs.

The order of magnitude of private capital investment to date in fixed lines, mobile BTS and transmission is likely to be at least USD 500-700 million over the last ten years, reflecting the high cost structure of Papua and West Papua. However, the principal financial burden is operating costs: power supply, road/helicopter access for maintenance, and, as noted above, satellite backhaul.

7.3. Existing Plans for the Future

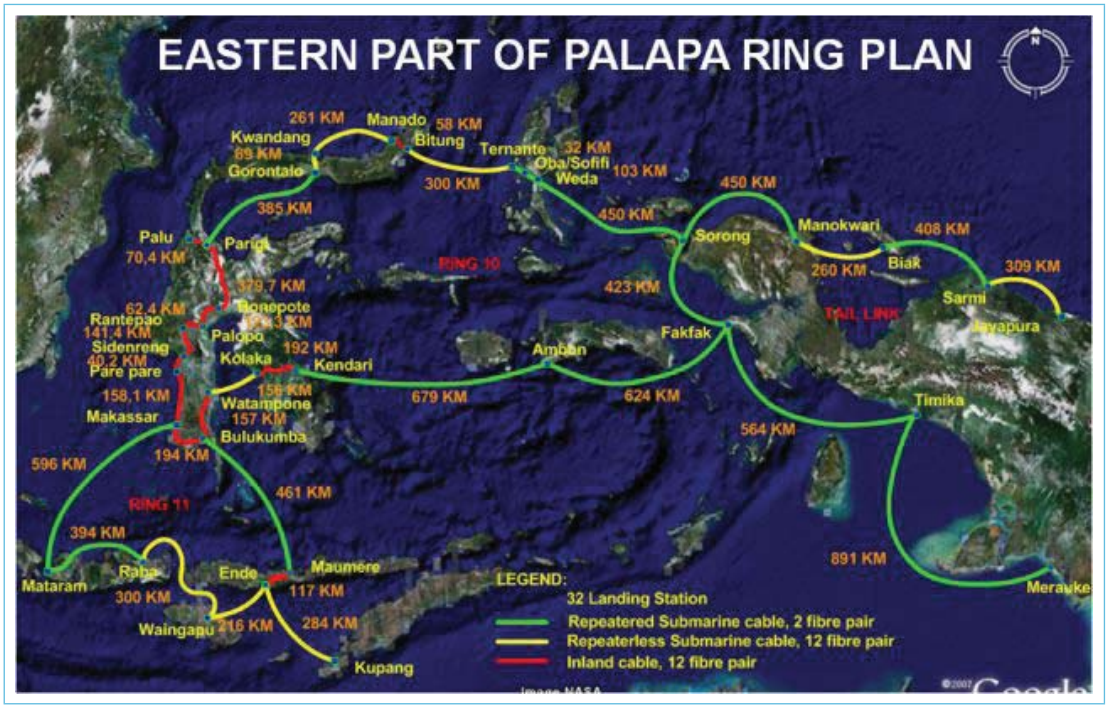
Detailed investment and recurrent cost data on access and backbone networks are commercially sensitive and difficult to obtain. Moreover, past investment levels may not adequately reflect likely future costs due to technological change, for example increased availability of low-cost, low-power mobile base stations and IP VSATs. Recurrent costs for access networks are very high due to reliance on satellite backhaul; these are also expected to come down if terrestrial backhaul options become available. For example, the capital investment required to transmit 1Mbps by satellite is about USD 150,000, compared to USD 2,500 for transmission—or as low as USD 100 when expanding the capacity of an existing route--via fiber-optic cable. Moreover, typical monthly bandwidth costs for satellite capacity are quite high, between IDR 5 – IDR 8 million per month in Papua and West Papua for a VSAT with 128kbps capacity. Though Indonesia's mobile operators enjoy significant economies of scale, and hence equipment purchasing power, the capital investment for a mobile base transceiver station (BTS) in Papua and West Papua may still exceed USD 200,000, compared to less than USD 75,000 in Sumatra, for example, reflecting the need for additional civil works in remote sites. There are currently about 200 mobile BTS in place with a further 50 or so planned in the near-term.

7.3.1. Palapa Ring

Figure 10: Proposed Nationwide Palapa Ring (initial design, 2006)

Source: DEPKOMINFO

Figure 11: Eastern Palapa Ring (design as of mid-2008)



Source: DEPKOMINFO

The Palapa Ring is the proposed 34,000km backbone fiber optic cable network linking all provinces of Indonesia. This project was first envisioned in the mid-1990s, but was delayed by the Asian financial crisis, and subsequently revived in 2006.

To meet the projected demand in Eastern Indonesia, a consortium of investors has committed to investing in the Eastern Palapa Ring to link major coastal cities in Papua and West Papua and other eastern islands. The Eastern Palapa Ring was originally conceived as a USD 700 million project with eight landing stations in Papua and West Papua and a consortium of seven investors was formed in 2008 to complete the project (see Figure 11). The proposed investment would yield a total capacity to Papua and West Papua of 80Gbps – thousands of times higher than existing capacity – and would significantly reduce the cost of building additional access networks around these landing stations.

Financial difficulties have led to many consortium members dropping out, leaving only PT Telkom, Indosat and Bakrie Telekom remaining. This reduction in numbers has meant a reduction in the proposed investment to about USD 255 million and the number of landings stations in has been reduced to one, in Sorong, West Papua and none in Papua.

In order to extend the Palapa Ring to the major coastal cities in Papua and West Papua, and into the interior, public assistance may be required, in partnership with private investors. Table 21 summarizes the likely investment needs. It should be noted that several governments around the world are investing – or considering are investment – in internet backbone as part of economic stimulus packages.

Table 21: Potential Investments in Kabupaten/Kota Backbone Networks

Project	Kabupaten	Estimated Cost (USD)
Palapa Ring (Northern Route)	Sorong (Kota and Kabupaten) Manokwari Biak Numfor Sarmi Jayapura (Kota and Kabupaten)	60 million
Palapa Ring (Southern Route)	Sorong (Kota and Kabupaten) Fakfak Mimika Merauke	85 million
Route Teminbuan-Bintuni	Sorong Selatan Teluk Bintuni	12.5 million
Extension Manokwari-Nabire	Nabire Teluk Wondama	14.4 million 3.6 million
Merauke – Oksibil Note: assuming completion of the road	Boven Digoel Pegunungan Bintang	5 million
Jayapura – Highlands – Nabire route Note: assuming a road	Paniai Jayawijaya Tolikara Puncak Jaya	8.5 million
Jayapura – Highlands – Nabire route Note: assuming a road	Trans-highland microwave option	5.5 million
Route: Biak-Serui Spur from Palapa Ring Extension of Metro Ethernet Jayapura		

Project	Kabupaten	Estimated Cost (USD)
Route: Biak-Serui Spur from Palapa Ring Extension of Metro Ethernet Jayapura	Kepulauan Yapen Kaimana Keerom	2.5 million 4.5 million 1 million
Microwave link + mobile extension from Sorong Microwave link + mobile extension from Biak Microwave link + mobile extension from Serui	Raja Ampat Supiori Waropen	0.65 million 0.35 million 0.35 million
Continued satellite dependency	Asmat Mappi Yahukimo	

Source: DEPKOMINFO and staff estimates based on average international cost levels

7.4. Recommendations

The Papua and West Papua provincial governments recognize the importance of telecommunications to support economic activities, reduce the isolation of communities and support the delivery of public services, in particular education. The need for improved connectivity is reflected in planning documents. While funding for telecommunications infrastructure is primarily private sector/commercially-driven the provincial Government has an important role to regulate and provide oversight to these private operators and, when it is advantageous to the people of Papua and West Papua, provide certain incentives to improve access and services.

7.4.1. Encourage Extension of Eastern Palapa Ring Backbone Network

The current model of the Eastern Palapa Ring has only one landing point in West Papua and none in Papua. The Northern Route of Manokwari, Biak, Sarmi and Jayapura and the Southern Route of Fakfak, TImika and Merauke are not currently considered financially viable by the consortium, and will not be completed without public support.

The private sector should remain the main source of investment, but there are ways that provincial governments can support the project. Potential roles for the Provincial Governments are to: (a) encourage the consortium to invest in these additional cable routes, possible through agreements under which the government would, for example, pre-purchase capacity (for example to support ICT in education or e-government services); and (b) offer catalytic financing for such investments on a private-public partnership basis, for example through a ***capital investment subsidy***.

Box 16: Palapa Ring Sections

Short-term feasible projects

- **Northern route with landing stations at Manokwari, Biak, Sarmi and Jayapura** (1200 km) at an estimated cost of USD 60 million based on average international cost levels.
- **Southern route: landing stations in Fakfak, Timika and Merauke** (1700 km) at an estimated cost of USD 85 million based on average international cost levels.

Long-term feasible projects

- **Sorong to Teminabuan and Bintuni**. Some of the main commercial drivers for this project are the large-scale oil and gas activities around the Bintuni bay area. Total cost is around US D3.2 million if a land cable can be built between Sorong – Teminabuan and Bintuni along roads. An alternative route would be 120 km of land cable along roads up to Teminabuan and 250 km of submarine cable to reach the Bintuni area requiring an investment of around USD 12.5 million. Potential sources of financing would be from the telcos and the oil and gas industry.
- **Manokwari to Nabire, possibly with a spur to Wasior**. The estimated cost of the main route Manokwari – Nabire would be around USD 14.4 million while the spur route to Wasior would add another USD 3.6 million. The alternative from Biak via Serui is slightly shorter and possibly cheaper but also more difficult due to the land crossing of Pulau Yapen.
- **Biak – Serui**. The cost of the main route Biak – Serui would be around USD 2.5 million.
- **Fakfak – Kaimana**. The estimated cost of the main route Fakfak – Kaimana would be around USD 4.5 million assuming a Palapa Ring landing station at Fakfak.
- **Jayapura - Keerom**. This could be seen as an extension of Telkom's planned Jayapura Metro Ethernet network. The actual distance is around 50 km but some spurs to specific population centers would be anticipated. The estimated cost is USD 1 million.

In addition, the following links are technically feasible but the actual number of inhabitants is low: (i) Sorong – Raja Ampat; (ii) Serui-Waren; (iii) Biak-Supiori. Some of these cases could be more cost-effectively served by extension of existing mobile networks with associated microwave links:

Long-term marginal projects

- **Highland Kabupaten/Kotas**. Fiber-optic backbone extensions to these areas would have to be undertaken in conjunction with other infrastructure development to be cost-effective. For example, if the road system Jayapura – Wamena – Karubaga Mulia – Enarotali – Nabire were completed then a fiber optic cable of around 845 km could be deployed along this route for about USD 8.5 million. Absent other infrastructure such as roads the main alternative route to the Highlands would be via microwave, but requiring multiple tower constructions including in remote mountain top locations perhaps starting with the Timika-Enarotali link.
- **Extension to the lowlands North of Merauke.** Fiber-optic network extension to a number of lowland areas like Boven-Digoel would require a land route from Merauke. There is some road infrastructure between Merauke and Tanah Merah and there are plans to extend this route to Oksibil, Pengunungan Bintang. This would imply a land fiber cable project of 470 km at an estimated cost of around USD 5 million if built along a road. Alternatively, a microwave link in combination with mobile coverage could be deployed to connect the lowlands North of Merauke to Merauke and the future Palapa Ring landing station.
- **Other Kabupaten/Kotas**. Mappi, Yahukimo and Agats are very costly and difficult to connect to fiber-optic backbone, due to lack of (road) infrastructure and low population densities. These areas will depend on satellite backbone for the foreseeable future. This does not preclude roll-out of basic mobile services (voice, low-speed data) even in small remote villages cost-effectively. This could be achieved through more widespread utilization of lower-cost technologies, including: Internet Protocol (IP) mobile base stations, IP VSATs and low-power base stations.

7.4.2. Facilitate additional private investment in basic access network

Facilitate additional private investment in access network rollout by helping to identify unserved or under-served areas. The main role of the provincial Government can be to facilitate private investment by helping operators to identify priority sites, and assisting with permit and site acquisition. Land acquisition is particularly challenging and time-consuming in Papua and West Papua due to the prevalence of customary land rights.

A further potential avenue of Government support is through a competitively-run capital investment subsidy program. There is a national-level model for this, and such schemes are also widely used internationally. The National Government, through the Directorate-General of Post and Telecommunications under the Ministry of Communications and Information, is implementing a Universal Service Obligation (USO) program, funded by a levy on the telecommunications industry (1 percent of net revenues) to subsidize the capital costs of access network rollout in commercially marginal areas throughout Indonesia. 3,000 villages in Papua and West Papua have been included in this program, for an estimated total subsidy cost of USD 11 million. A tender was awarded in July 2009 ; the Provinces could consider a similar competive subsidy mechanism for other unserved villages in these provinces.

7.4.3. Expand network using lowest-cost available methods

For coastal urban concentrations with short-term prospects of rapidly growing commercial activity, the goal should be to close the access gap and meet the rising demand for bandwidth through providing access to fiber optic networks. In these places, well-functioning and affordable telecommunications infrastructure is essential for business development, small and medium-sized as well as large.

Throughout the rest of Papua and West Papua, it is not feasible to lay fiber optic cable to most villages and schools, nor are the communications needs as demanding of bandwidth as in coastal growth centers. Yet distant locations as much, or even more than easily accessible locations, will benefit from communications technology that facilitates electronic delivery of public services, offers opportunities for distance learning, teacher training, and access to medical and commercial advice. In Papua and West Papua, improvements in telecommunications can partly substitute for other infrastructure. For example, a phone call or email may save significant travel time and costs for individuals living in villages where the only alternative is walking or irregular and expensive air service. For such distant locations, low-cost satellite connection should be a goal of infrastructure planning, installed together with local power sources, particularly solar.

Where fiber-optic backbone extensions are possible, the Government can reduce the cost of delivery by providing ducts along any major roads or power line being constructed and/or upgraded. During construction the additional cost of adding ducts (or plastic pipes) to allow for "easy" fiber optic deployment inland is low. Laying cables along roads without a duct afterwards is far more costly.

Where expansion of microwave networks is required, the Government can facilitate civil works needed to access remote mountain top locations, as well as site acquisition. As in the case of stimulating near-term investment in access networks, the provincial Governments could offer catalytic financing, for example through a competitive capital investment subsidy program. The provincial Governments could also contract with the private sector to pre-purchase capacity on such networks since they could be significant users of such network capacity.

Appendix 1. Value of forests

Table 1. Volume, Value, and Per unit value of log production in Papua and West Papua in 2006

Province/Type of log	Log production in 2006		
	Volume (m3)	Value (Rp 000s)	Per unit value (IDR 000s/m3)
West Papua	**669,901**	**321,010,561**	**479**
Mangrove/Bakau	121,964	45,736,298	375
Luxury/Indah	2,140	824,100	385
Keben	121,963	54,882,959	450
Kenari	5,024	2,386,891	475
Matoa	522	227,264	435
Meranti	260,839	138,063,714	529
Merbau	29,076	27,218,848	936
Mersawa	2,146	965,777	450
Resak	1,335	590,632	442
Mixed species/Rimba Campuran	124,892	50,114,078	401
Papua	**431,115**	**128,463,980**	**298**
Luxury/Indah	387	123,288	319
Meranti	225,096	70,313,590	312
Others	8,641	2,335,665	270
Mixed species/Rimba Campuran	196,991	55,691,437	283

Source: BPS (2008): Statistik Perusahaan Hak Pengusahaan Hutan 2006

Table 2. Realization area of annual work plan and log volume in Papua and West Papua in 2006 (commercial species)

Province	Area RKT (ha)	Volume (m3)	Volume (m3/ha)
Papua Barat	23,994	627,967	26.2
Papua	19,635	561,187	28.6

Source: MOF (2007): Monitoring perkembangan produksi kayu bulat dan HHBK tahun 2006-2007

Table 3. Trees potency per ha for all species in Papua and West Papua

Province	Volume (m3/ha)		
	> 20 cm	> 50 cm	> 60 cm
Papua Barat	157.6	94.2	73.1
Papua	103.9	59.4	43.8

Source: MOF (2008): Statistik Kehutanan Indonesia 2007

Table 4. Weighted Average Timber Price in Papua and West Papua

Timber size	Timber Stock (m3/ha)	Domestic Price (USD/m3)		International Price (USD/m3)	
		Standing	Stumpage*	Standing	Stumpage*
Papua					
20-49.9 cm	44.5	19.4	-5.6	74.2	49.2
50-59.9 cm	15.6	32.4	7.4	123.7	98.7
60 cm up	43.8	32.4	7.4	123.7	98.7
WAVG Value (USD/ha)		**2,789**	**192**	**16,362**	**12,421**
West Papua					
20-49.9 cm	63.4	31.3	6.3	74.2	49.2
50-59.9 cm	21.1	52.1	27.1	123.7	98.7
60 cm up	73.1	52.1	27.1	123.7	98.7
WAVG Value (USD/ha)		**6,892**	**2,951**	**16,362**	**12,421**
AVG Value (Both Prov)		**4,840**	**1,571**	**13,504**	**10,236**

Sources: International price from ITTO, WAVG Domestic Price from Table 1, WAVG Timber Stock from Table 3.
Note: Assumed a stumpage price of USD 25/m3, and price for 20-49.9 cm assumed to be 60% of ITTO price.

We calculate the weighted average timber value of one hectare of Papuan or West Papuan forest to be approximately USD 13,504. Note that this does not include the stumpage cost.

Table 5: Total economic value of the forest (USD/ha/yr): adjusted for PWP

Type of value	Forest Value	Source
Total Economic Value	**5,709.04**	
Use value	**5,654.42**	
Direct use value	***1,143.45***	
Sustainable logging*	266.00	Pearce, 2001
Fuel wood	40.00	IPB, 1999
Other non-timber forest products	109.45	Kim, 2002; Pearce, 2001
Water regulation	146.00	ITFMP, 1997; IPB 1999; Dishut Jabar
Food production	32.00	Costanza, 1997
Raw materials	315.00	Costanza, 1997
Recreation	235.00	Pearce, 2001
Indirect use value	***4,510.97***	
Soil formation and conservation	48.97	Costanza, 1997; NRM 2001; Kim, 2002
Gas regulation	2,830.00	Pearce, 2001
Climate regulation	360.00	Costanza, 1997; Pearce, 2001
Disturbance regulation	5.00	NRM 2001; Costanza, 1997
Erosion control	245.00	Costanza, 1997
Nutrient cycling	922.00	Pearce, 2001; Costanza, 1997
Waste treatment	100.00	Costanza, 1997; NRM 2001
Non-use value	**54.62**	
Option value	9.62	Kim, 2002
Existence value	45.00	Kim, 2002; Pearce, 2001

** The term "sustainable logging" is easy to use, but very difficult to enforce. See Pearce (2001).*

We calculate the Total Economic Value of one average hectare of Papuan or West Papuan forest to be approximately USD 5,709 USD/ha/year. Of these, approximately USD 1,143.45 accrue to local users and USD 4,565.59 accrues to humanity indirectly per year.

References

Badan Perencanaan Pembangunan Daerah Provinsi Papua, *Perencanaan Tata Ruang Provinsi Papua (Saat ini dan Harapan)*. November 19, 2008.

Badan Perencanaan Pembangunan Daerah Provinsi Papua, *Kerangka Acuan Kegiatan Studi Penyusunan Rencana Induk Infrastruktur Provinsi Papua*. 2008.

Brown, David W. *Addicted to Rent: Corporate and Spatial Distribution of Forest Resources in Indonesia; Implications for Forest Sustainability and Government Policy*, DFID/ITFMP. Jakarta.

Cannon J. *Natural Resource Economics of Papua, in (eds) Marhall A & Beehler B, The Ecology of Papua Part One: The Ecology of Indonesia Series Volume VI*, Periplus, Singapore. 2007.

Dinas Pekerjaan Umum Provinsi Papua, *Infrastructure Investment Opportunities: A New Day for Papua*. 2002.

Government of Indonesia, *DG Postel, Press Releases*, 2007-2009

http://www.bkpm.go.id

http://www.papuaweb.org

http://www.teara.govt.nz

http://www.bps.go.id

International Tropical Timber Organization (ITTO), *Tropical Timber Market Report, Volume 12 Number 9, 1-15 May 2007*.

IPB. *Kajian Nilai Hutan Produksi. Fakultas Kehutanan, Institut Pertanian Bogor*. 1999. Bogor.

Kim, Young Cheol. *A Tropical Forest Management Model Based On Concept of Total Economic Value. Unpublished dissertation*. 2002. Gajah Mada University. Yogyakarta.

Klassen, A.W. *Reduced Impact Logging: Making it Work*, Tropical Forest Foundation.

Manurung, T. *Economic Valuation Analysis on Palm Oil Estate Investment in Indonesia*. NRM/EPIQ. 2001. Jakarta.

Maryani, Retno, Setiasih Irawati. Economic Analysis of Land Use. 1997.

Maturana, Julia. *Economic Costs and Benefits of Allocating Forest Land for Industrial Tree Plantation Development in Indonesia*. 2001. Center for International Forestry Research (CIFOR). Bogor.

NRM/EPIQ dan SHK Kaltim. *Valuasi Sistem Pengelolaan Hutan Secara Tradisional oleh Dayak Benuaq di Kalimantan Timur: Manfaat dari sistem tradisional dibandingkan dengan sistem alternatif*. 2000, Jakarta.

NRM/EPIQ. *Analisis Valuasi Ekonomi Investasi Perkebunan Kelapa Sawit di Indonesia*. 2001, Jakarta.

Paoli, Gary D., David R. Peart, Mark Leighton, Ismayadi Samsoedi. *An Ecological and Economic Assessment of the Non-timber Forest Product Gaharu Wood in Gunung Palung National Park, West Kalimantan, Indonesia*. Conservation Biology Volume 15, No. 6, December 2001.

Pattiselanno, Freedy, 2004. *Wildlife Utilization and Food Security in West Papua, Indonesia. Paper presented in SEARCA Agriculture and Development Seminar Series, April 2004*. Laguna, Philippines.

Pearce, David, 2001. *How Valuable Are The Tropical Forests? Demonstrating and Capturing Economic Value as a Means of Addressing the Causes of Deforestation. Seminar paper for Conseil d'Analyse Économique*, Paris, December 2001.

Pedercini, Matteo. *Evaluation of Alternative Development Strategies for Papua, Indonesia: A Regional Application of T21*. University of Bergen, Norway.

Pemerintah Provinsi Papua, *Studi Kelayakan PLTA Urumuka di Kabupaten Mimika*. 2009

Pemerintah Provinsi Papua Dinas Pertambangan dan Energi, *Urumuka Hydroelectric Power Development Project*. February, 2009.

Pemerintah Provinsi Papua, *Rencana Strategis Pembangunan Kampung (RESPEK)*. 2007.

Pemerintah Provinsi Papua Barat, *Rencana Induk dan Aksi Infrastruktur Provinsi Papua Barat, Laporan Final*. 2008.

Pemerintah Provinsi Papua Barat, *Rencana Tata Ruang Wilayah 2008-2028, Laporan Rencana*. 2008.

Pemerintah Provinsi Papua Barat, *Penyusunan Master Plan Sumber Daya Air Baku di Kabupaten Sorong dan Kabupaten Manokwari Propinsi Papua Barat, Laporan Antara*. Oktober 2008

Pemerintah Provinsi Irian Jaya Barat, *Rencana Pembangunan Jangka Menengah Daerah 2006-2011*. October 2006.

Pemerintah Kabupaten Pegunungan Bintang, *Kebijakan Pembangunan Daerah Tahun 2005-2010*. July 2008.

Pemerintah Kabupaten Pegunungan Bintang, *Pelaksanaan Pembangunan di Kabupaten Pegunungan Bintang Tahun 2004 s/d 2007*. August 2008.

Pierce, David W. *The Economic Value of Forest Ecosystem. CSERGE-Economics, University College London. UK. Blackwell Science, Inc*. 2001

PT Santika Kusuma Agung, *Executive Summary: Survei Potensi Simpul Transportasi Sungai di Papua*. 2009.

Sabandar, William, *Improving Accessibility and Mobility of Riverine People: Lessons from Beraur Communities of Papua, Indonesia*. 2003. Draft for Comments.

Simangunsong, B. C. H. *The Economic Value of Indonesia's Natural Production Forest. Indonesian Working Group on Forest Finance*. 2003. Jakarta.

Simangunsong, B. C. H. 2004. *The Economic Performance of Indonesia's Forest Sector in the Period 1980-2002*. GTZ-SMCP. Jakarta.

ICRAF SE-Asia, *System for Large Scale Plantations of Oil Palm and Industrial Timber Estate.* Bogor. Indonesia.

van Beukering Pieter J.H. Herman S.J. Cesar, Marco A. Janssen. *Economic Valuation of the Leuser National Park on Sumatra, Indonesia. Ecological Economics*. (2002).

van Der Ven, Joris, *The Papua and West Papua Transport Sector*. 2009, Mimeo.

World Bank/Private-Public Infrastructure Advisory Facility (PPIAF): *Study on Indonesia Communications Backbone with Nationwide Coverage*. 2008.

World Bank, *A Brief Review of the Infrastructure Expenditure Priorities for Papua and West Papua in 2008*, November 8, 2007.

World Bank, *Strategic Assessment for Spatial Planning in Papua Province*. September 30, 2008.

World Bank, *Strategy and Implementation Plan for ICT in Education in Papua*. 2008.

World Bank, *Papua Public Expenditure Analysis: Regional Finance and Service Delivery in Indonesia's most Remote Region*. August 26, 2005.

World Bank, Universitas Cendrawasih, *Kajian Pengeluaran Publik Provinsi Papua Tahun 2009*, 2009. Advance Draft.

World Bank, *A Strategic Assessment of Spatial Planning Options for Papua Province*. 2008. Jakarta.