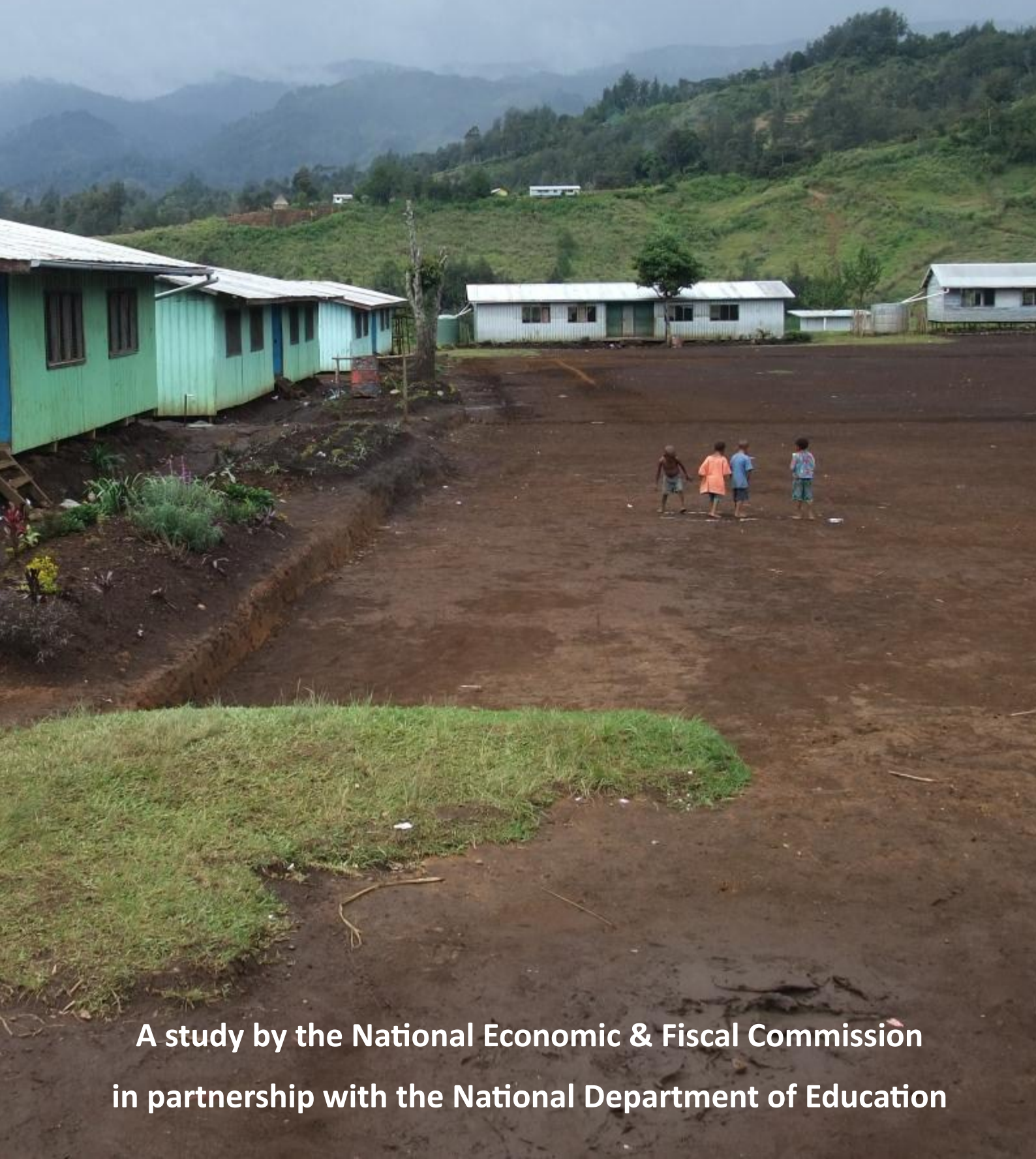


Go Long Ples

Reducing inequality in education funding



**A study by the National Economic & Fiscal Commission
in partnership with the National Department of Education**

FOREWORD

There have been increasing concerns over a number of years about the difficulties faced by Papua New Guineans living in rural and remote areas of PNG in accessing services that most urban dwellers take for granted.

A parallel concern has been the extent to which the education of people living in these areas is poorer than that of those living in areas with greater accessibility to education, welfare and other services. The NEFC has been dedicated to a vision of seeing regeneration of basic government services across the country. The need is most dire for our rural populations.

This report outlines the creation of a tool to assist policy makers to better analyse the circumstances and needs of the rural populations, and target assistance accordingly. The Papua New Guinea Accessibility/Remoteness Index is a standard classification and index of remoteness which will allow the comparison of information about populations based on their access to service centres of various sizes.

This is the first version of the Index and I recognise it will not be perfect. First steps are always challenging, but the groundwork has now been laid. The NEFC intends to continue to refine the index over the next few years as more information becomes available, particularly about the state of our rural infrastructure.

The index is only a tool and the main aim is to improve equity of opportunity to all Papua New Guineans.

The NEFC has worked in partnership with the National Department of Education to develop an equity based funding proposal for the National Government's Tuition Fee Free policy. This proposal demonstrates how more funds can be channeled to those schools located in remote locations. The aim is to provide a level playing field to students across the country in terms of their access to resources, and the quality of their school facilities.



Hohora Suve

Chairman and CEO

National Economic and Fiscal Commission

May 2014

EXECUTIVE SUMMARY

SCOPE

The National Department of Education (NDoE) has engaged the National Economic and Fiscal Commission (NEFC) to undertake a study to determine whether the Education Tuition Fee Subsidy could be distributed in a way that recognises the different cost impacts on schools. The NEFC currently manages the system of funding that aims to achieve horizontal fiscal equalisation amongst the Provinces and LLGs and distributes the Function Grants annually using a 'needs based' funding formula. The aim of this study is to improve the equity of funding to all students by outlining how a funding formula based on remoteness costs would work in PNG.

WORK UNDERTAKEN

The NEFC with assistance from the NDoE undertook this study over 2013 through GIS and other statistical analysis and on-site surveys of a number of schools in urban and rural settings. This report is accompanied by the Phase 2 design which was produced in March 2013.

STRUCTURE OF REPORT

The report outlines the key basis supporting the introduction of a 'needs' based approach to school funding. Using the data available to the review team the Phase 1 design found:

- Schools in remote areas face significantly higher costs than the main urban centres. These higher costs were mainly related to the cost to transport goods from the suppliers to school facilities.
- These remote schools don't receive any additional assistance to mitigate these higher transport costs.
- Students in remote locations appear to have larger class sizes and poorer educational outcomes.

FINDING 1

Schools in 'moderately accessible' locations spend

approximately 10 per cent of their budget on transport related costs. These transport related costs can be seen in:

- Direct delivery costs, where Schools pay contractors for the delivery of items.
- In house delivery costs, where schools pay for vehicle maintenance and running costs.
- Higher purchase prices, where schools are charged higher prices for goods compared to the cost of the same item in Port Moresby.

FINDING 2

To purchase a similar basket of goods in more remote locations would increase a school's transport costs to an estimated minimum percentage of their total budget of:

- 18% in 'Remote' locations
- 33% in 'Very Remote' locations
- 56% in 'Extremely Remote'

FINDING 3

Because of these high transport costs, schools in remote locations tended to purchase less student stationary and prioritised spending on:

- Maintenance materials
- Office supplies
- Reprints of curriculum materials





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THE CHALLENGES OF REMOTENESS

A CHALLENGING SERVICE DELIVERY ENVIRONMENT

Papua New Guinea is a rugged geography to deliver services. Among other challenges it has over 150 islands, 80% of its land mass is covered by forests, and it hosts one of the world largest swamps. Road infrastructure is limited and normally in poor condition making transport and communications expensive. Furthermore, there are over 800 languages and around 87 per cent of its population live in rural areas.

Service delivery is generally limited across the country, however, a number of influential studies have shown a strong relationship between disadvantage and remoteness.

One role of the NEFC is to equitably share financial resources between Provinces and Local-level Governments (LLGs). This is done through a formula that recognises the different cost impacts affecting the country. Delivering services in remote locations is a significant determinant of those costs.

PNG's commercial logistics networks are fragile and difficult to rely upon due to the infrequent delivery schedule and the general inability to verify delivery of goods. This makes providing inputs to service delivery (such as curriculum materials and stationary) administratively complex. In many cases public servants act as delivery agents themselves because using commercial providers is not practical. During visits to Provinces it became clear that in many cases Provincial Governments have struggled to fulfill their service delivery obligations of providing school materials and maintenance to schools.

In most instances the delivery of materials to schools relied on the schools themselves making collections at the Provincial or District Head Quarters. This is not a major problem for schools located in easily accessible areas who can send a staff member into the nearby education office. But schools in more remote locations tended to miss out because the cost to send for material was excessive. Similarly, the cost of purchasing materials from trade stores in the Provincial Head Quarters increased dramatically when schools do not have access to well maintained roads.



LANDSLIPS

are common in the highlands and impede the delivery of services even when roads are in good condition.



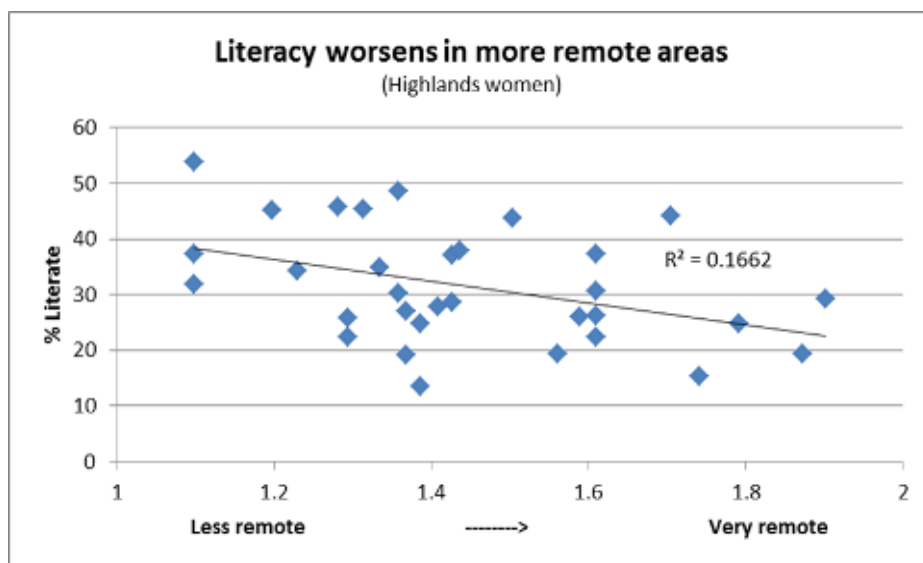
RIVERS

A lack of bridges in PNG means that river dinghies are the only means of transport in some areas.

THE CHALLENGES OF REMOTENESS

THE IMPACT OF REMOTENESS ON LEARNING OUTCOMES

PNG has large variations in education statistics across the country. Adult literacy rates in rural areas range from 20% - 80% and across every region the findings are the same: the more remote a village, the lower the number of people who can read and write. This is shown by the downward sloping trendline in the graph. This shows that for a women living in the highlands, the more remote a village she lives in the higher the chance that she will not be able to read or write.



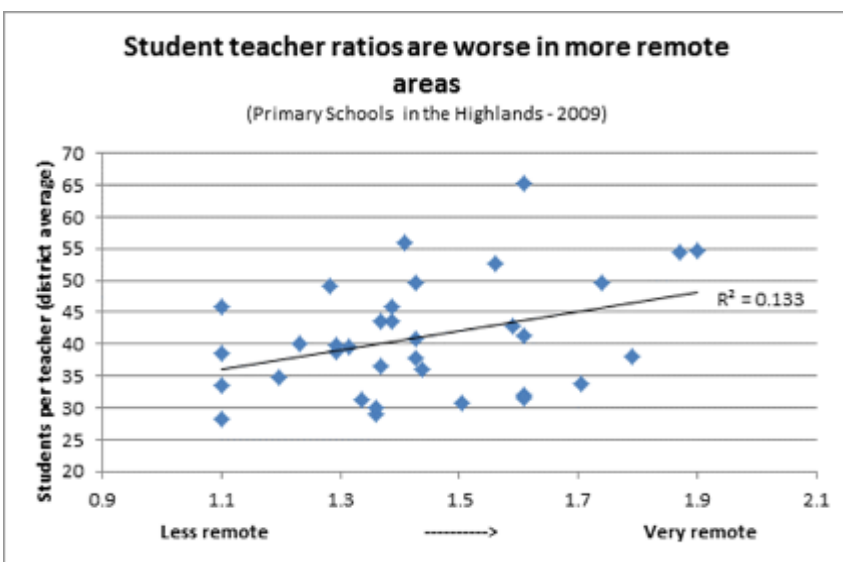
Source 2001 Census, DIMS diesel fuel prices

In a separate research study of isolated communities in the Obura-Wonenara District by the Australian National University and Care International it found that only 27 percent of people were literate. This was 14 percent below the Eastern Highlands Province level, and 30 percent below the national average. It also found that female literacy was 20 percent lower than males, demonstrating the disproportionate impact remoteness has on women.

THE IMPACT OF REMOTENESS ON SCHOOL RESOURCES

The poor literacy outcomes in remote locations are not surprising when considering the lack of resources available to schools in those areas. Student teacher ratios are higher in more remote areas when compared to urban and book to student ratios were found by the NEFC survey team to be marginally poorer.

In some cases schools take innovative measures to overcome their disadvantages. For example, schools in moderately accessible parts of the highlands were more likely to use reprinted textbooks (in violation of copyright)



than more accessible schools. In this way they overcame some of the cost disadvantages of transporting goods over long distances. However, even in these cases the number of students to textbooks was never below a ratio of 2:1.

Source 2001 Census, DIMS diesel fuel prices

THE CHALLENGES OF REMOTENESS

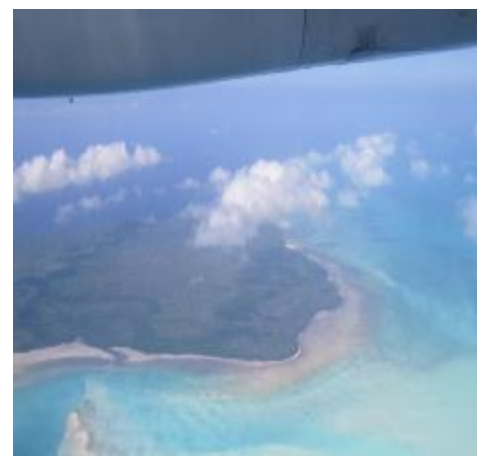
Differences exist in the price of goods and services across regions, this difference is material, and it affects most schools. Costs arise from isolation and diseconomies of small scale which are detailed below.

Isolation

Isolation refers to the distance of a geographical area from a major urban area where they can be supplied with manufactured goods and materials. As distance increases from these areas the cost of obtaining goods also increases, due to:

- Higher transportation costs; and
- Lack of competitive markets meaning that suppliers can charge higher prices.

This effect can be seen in the differences of the price of diesel across districts. Diesel is a good product to compare across regions because it is a commodity that is widely traded, meaning that the price difference should be largely due to the cost of transportation.



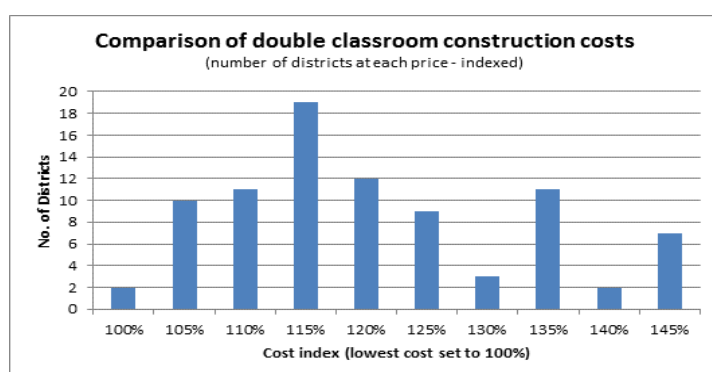
ISLANDS

are a challenge to deliver services to due to the high cost of transporting people and goods. Sea journey are normally made in a small dingy which is dangerous and in poor weather can cut off island communities completely.



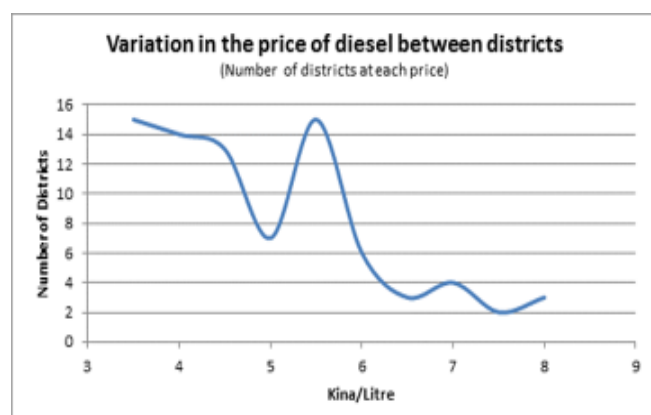
FLY ONLY

Some remote villages are entirely dependent on helicopters or light aircraft to deliver basic education materials.



Source: Raw cost schedule from Department of Works – 2005 price survey. Author's own calculations.

The graph shows that the price of diesel of the top of the range is 250% more expensive than the base of the range. Importantly, the cost differential is widespread across the entire sample with the median value being 150% above the base price. By extension it is assumed that the price of most manufactured goods would follow similar variations across geographical locations.



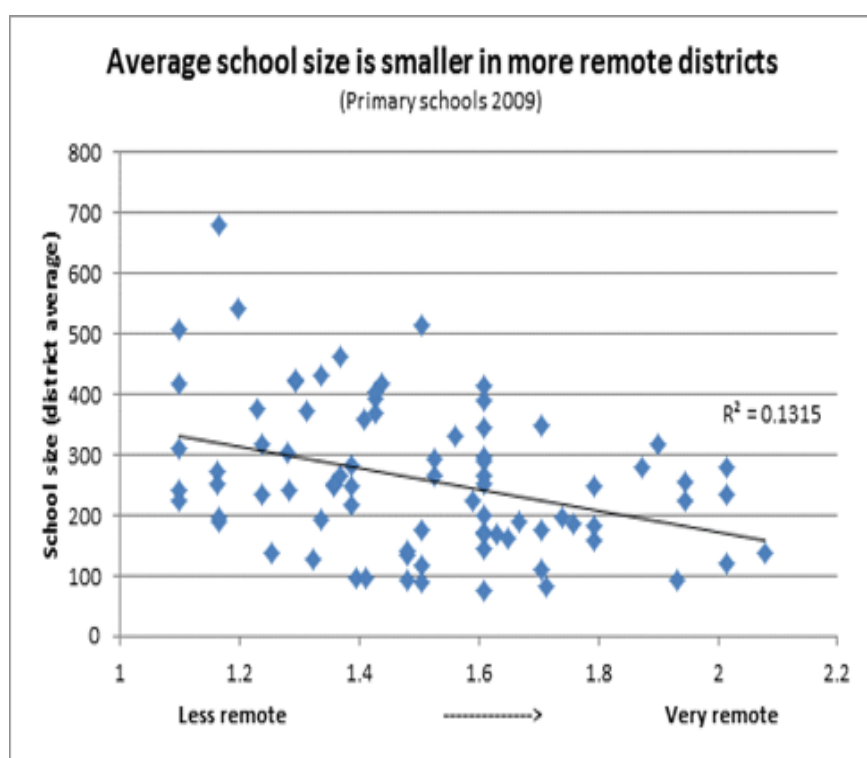
Source: Raw data from NEFC 2011 Cost of Service Model, OIRD DIMS. Author's own calculations.

THE CHALLENGES OF REMOTENESS

Diseconomies of small scale

The size of a school also impacts on the running costs because larger schools are able to economise in ways that small schools are not. For example, if a school pays a truck driver to deliver stationary supplies the cost to deliver a full load (e.g. 20 boxes) would be similar to the cost to deliver a half load (e.g. 10 boxes) as the vehicle still needs to travel the same distance.

The service delivery scale argument also applies to the use of materials once they have been purchased. A larger school is better able to make the use of any capital and equipment compared to a small school. For example, a computer lab in a large school and a small school will still require enough computers for all the students in a class, but the larger school could have classes using the computers every session, whereas the smaller school may only use them in every second session. This means that a larger school will have a lower cost of computers on a per student basis, and will have more remaining funds to purchase goods in other areas.



The information available on school sizes shows that (at least in the highlands) schools in more remote areas tend to be smaller and thus they would face higher scale related costs compared to larger schools.

This means that schools in remote areas face two negative cost impacts, firstly in higher costs of acquiring goods because they are geographically further away from supply points, and then in the lower potential utilisation of those goods because they tend to have smaller sized schools.

Source: 2009 school census, DIMS diesel fuel prices



EQUITY IN EDUCATION FUNDING

NATIONAL GOVERNMENT EDUCATION POLICIES

The Government have made a number of announcements on education. Over the long term the Vision 2050 objectives include universal quality education and the achievement of a 100 per cent literacy rate. In the near-term key international commitments have been the *Education for All* and *Millennium Development Goals* which both relate to the achievement of universal access to quality primary education for all children by 2015.

The National Education Plan (NEP) 2005-2014 was developed as the key planning tool to translate these goals into targets and programs within NDoE. It also provided a top level tool for channeling resources and institutional effort into achieving these goals. The themes of the NEP are around Access, Quality and Management. The NEP covered all levels of education but placed priority on basic education.

The NEP included strategies around improving access to education by expanding



infrastructure, increasing the number of certified teachers and lowering fees in primary schools and replacing the lost income with public subsidies. Initiatives around education quality included increasing the number of textbooks to students, improving training programs and up skilling existing teachers, and monitoring learning achievement in primary schools.

Over the past two years the government has focused on improving access to education through reducing the barriers to entry, primarily through increasing tuition fee subsidies. This strategy, at least in theory, should give parents (particularly in poor areas) the incentive to send their children to school. Discussions with school principals in rural areas agree that this is the case with enrolments increasing rapidly over the last two years. However, they also made mention that the quality of education provided has fallen due to a lack of infrastructure and insufficient increase in teacher numbers, leading some classes to have student : teacher ratios up to 65:1.

The 2013 Budget announced large increases in the DSIP and PSIP with 20% being tied to education related projects, representing around K267m per annum in development expenditure. Furthermore, the government



has begun to focus on the performance of the Outcomes Based Education curriculum, which is reported to be replaced in 2013 with a new curriculum. While it is not clear how practicable it will be to significantly change the curriculum in such a short period of time, the message is clear: the government is focused on improving education and is willing to (a) allocate a significant amount of new resources to education and (b) make changes to how the system runs in an attempt to improve student outcomes.

EQUITY IN EDUCATION FUNDING

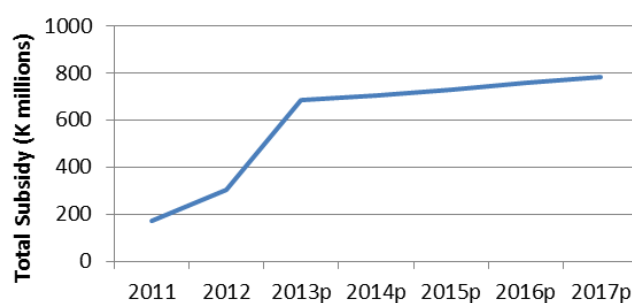
THE NATIONAL GOVERNMENT TUITION FEE FREE SUBSIDY

Vision 2050, the PNG national strategic plan, set the objective of universal education for all children and a 100% literacy rate by the year 2050. As a key first step in achieving this objective GoPNG, in its 2013 budget, announced that the National Government will pay 100% of school fees for children in elementary through to Year 12. This policy significantly reduces the cost burden on parents to send their children to school (although parents would still be subject to pay 'project fees' for specific items and school improvement projects).

The total national government subsidy is budgeted to be K682m in 2013 which is an almost tripling of the expenditure in 2011. The large scale up in funding is from the phased inclusion of year groups which started with subsidies for elementary, primary and lower secondary, and will fully subsidise upper secondary in 2013. Growth into the future is expected to increase more modestly at around 3.5% per annum to K782m in 2017

School fee subsidy has increased substantially

(PNG 2013 Budget, Volume 1)



School Level	NEB Maximum Fee Limits (per child)	Government contribution (per child)	Parental contribution (per child)
Elementary P1, E1, E2	100	100	0
Primary Grades 3 to 8	270	270	0
Lower Secondary (Day)	900	900	0
Lower Secondary (Boarding)	1500	1500	0
Vocational (Day)	900	675	225
Vocational (Boarding)	1300	975	325
Upper Secondary (Day)	990	743	247
Upper Secondary (Boarding)	1500	1125	375
Flexible, Open and Distance Education (one off payment)	100	75	25
Permitted Schools per student (one off payment)		30	
Inclusive Education (one off payment)		30	

A description of funding sources available to School facilities

The Tuition Fee Free subsidy is only one of many funding sources available to school facilities. Some of these provide funding in monetary form, whereas others provide goods and materials in lieu of money. A key legislative instrument that outlines the roles and responsibilities of different levels of government is the assignment of functions which is a determination enabled by the *Intergovernmental Relations (Functions and Funding) Act 2009*. The current determination stipulates that a number of activities are to be undertaken by Provincial and LLGs on behalf of schools. This includes school maintenance and the delivery of educational materials for primary and secondary schools. Furthermore, NDoE also provides curriculum materials that are to be delivered to all schools.

EQUITY IN EDUCATION FUNDING

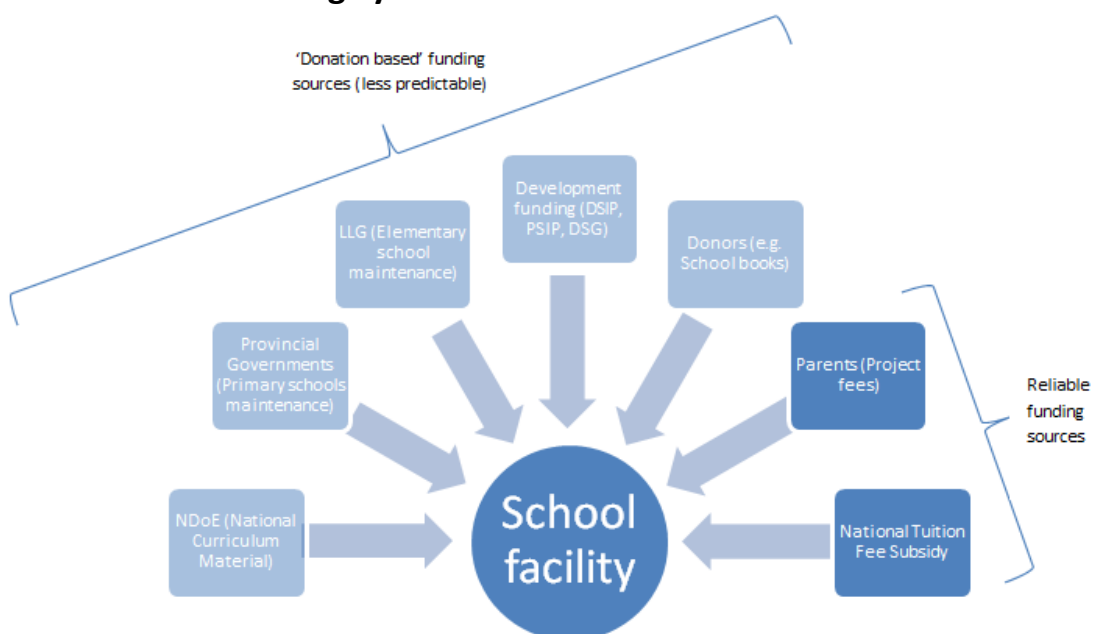
The funding system for schools can be categorised in two distinct ways:

Reliable financial resources were paid in by the National Government through tuition fee subsidies and parents who provided project fee funding. These two funding sources were the total of all the resources that a school could rely on to fund its operations throughout the year. The graph shows these funding sources in dark blue.

The alternate funding method (light blue in the graph) was more akin to donations than reliable funding streams and are referred to as **'donation based funding'**. These donations come from DSIP, Provincial Governments and International Donors. They are classified 'donation based' because resources were provided at the discretion of the resource provider and subject to their circumstances at the time. The level of future commitment varied between donors, some such as international aid programs tend to have well spelt out and predictable funding flows, whereas donations from Local Members of Parliament through DSIP were less predictable.

The Funding System we observed

Generally, donations are made with little to no firm commitments in regards to ongoing support. Schools also tended to not be well informed about upcoming donations and thus they were not incorporated into future plans by the school. In most instances the distribution of these donations was not



Source: Authors own classification

uniform or linked to an equity based funding framework, and there is almost no recourse for the schools that do not receive a 'donation'.

These 'donations' almost always came in the form of resources in kind or funding dedicated to a specific project. As a funding source they are less useful for schools because they are unpredictable in nature and subject to the desires of the resource providers rather than supporting the purchase of resources that are high priority for individual schools. For example, DSIP funding in one province provided school bags every year to students - relieving parents of future expenditure rather than benefiting the school (which was in a state of poor repair) or improving educational outcomes for students.

EQUITY IN EDUCATION FUNDING

Donation based funding also seemed to benefit some schools more so than others. The study team observed that of all schools inspected the school in the best condition and the worst were in the same district, about 15 minutes' drive from each other. The principal in the well maintained school outlined all the beneficial development projects that the local member had financially supported, whereas the school in the worst condition could not name any past development funding that had been provided to the school.

Specifically, the roles of each funder are outlined:

The national education tuition fee subsidy

Responsibility

The national government abolished school tuition fees for parents and replaced that funding source with direct per student payments to schools by the government.

Field observations

All surveyed schools reported receiving the school subsidy. The subsidy was predictable so it was considered a strong base on which to fund ongoing expenditure. Because school fees are now paid by the National Government it was reported that this reduced the administrative effort of collecting this revenue from parents. This freed up principals who reported that they would previously have spent a considerable amount of time chasing up parents who had not paid their fees.

With the exception of one school who was having issues with modifying its registration to include upper secondary, all schools reported no problems with their receipt of the subsidy payments.

The role of project fees

Responsibility

Schools are allowed to request project fees from parents up to limits set by each Provincial administration. These fees are only to be used for school improvement projects. Of the schools surveyed all charged project fees which ranged from K25 – K250 per year.

Field observations

Some schools reported that they only use project fees for specific capital expenditure. Others had a more flexible interpretation of projects and used the funds for new school books or school uniforms. The upside of project fees is that they tended to be for spending that was already prearranged and is transparent for parents.

While some parents refused or were unable to pay project fees, most parents paid or, in the case of one school that was surveyed, provided labour to the school in lieu of payment. Overall, school principals outlined that they could reasonably rely on project fees from parents to cover a portion of their annual expenditure.



EQUITY IN EDUCATION FUNDING

The role of the National Department of Education

Responsibility

The NDoE explained to the study team that the department supplied curriculum materials to schools. These curriculum materials included textbooks and teaching materials. There were conflicting accounts of what the expectations were with regards to the delivery of these materials to actual school facilities, however, the experience was that delivery tended to be to the Provincial Headquarters (PHQ).

Field observations

It was reported that NDoE does in fact provide these materials on a regular basis, however, most schools told the exploratory mission that the amount of materials that were received was insufficient and that they used some of the tuition fee subsidy funds to purchase additional curriculum materials. From reports, curriculum materials were expensive and as such the shortages must have been acute to warrant further purchases.

It appeared that delivery to the PHQ was taking place, with schools then sending their own staff or a contractor to pick up the materials and deliver them to the school facility.

The role of Provincial and LLG Governments

Responsibility

Provinces are funded through the Provincial Function Grants to undertake a number of activities in the education sector and there is an expectation that Provinces with fiscal capacity would also allocate a proportion of their own source revenues towards funding their schools. These activities range from Provincial level monitoring, planning and evaluating to more facility level activities like undertaking school maintenance and partially subsidising school fees (before the introduction of the National Tuition Fee Subsidy).

These functions are laid out under the *Intergovernmental Relations (Functions and Funding) Act 2009*. The key functions affecting school facilities that are the responsibility of the Provinces are:

- Preparing an annual maintenance plan, inspecting the condition and maintaining:
 - ◇ Provincial Secondary schools,
 - ◇ Vocation and Trade Training Schools,
 - ◇ teacher and education worker housing, and
 - ◇ ancillary facilities.
- Distributing in-service materials (provided by NDoE) to schools.
- Purchasing and distributing materials and supplies for Provincial schools where the school does not have sufficient capacity to make their own purchases or source these from other donors.
- Funding and distributing school subsidies.
- Distributing curriculum materials, National examination papers, Certificates, Diplomas and other awards to schools.

LLGs are responsible for “inspect[ing] the condition of and maintain[ing] elementary and primary schools and its teacher housing and ancillary facilities”.

Field observations

It appears that books are not routinely delivered to schools by Provincial Administrations and only some Provinces provide funding for maintenance to their schools. Normally the reason for not fulfilling the functional responsibilities was due to insufficient funding.

In one Province the provincial administration detailed that they occasionally flew in stationary to ‘fly in only’ schools (i.e. those with no surface vehicle access), but this only occurred occasionally due to the high cost.

EQUITY IN EDUCATION FUNDING

The largest component of cost was spent on goods such as stationary and rations. Schools with their own vehicles occasionally sent a staff member out to pick up supplies, but most arranged for a local contractor to deliver the goods in small trucks.

Most Provinces reportedly provided a partial fee subsidy, while Enga and NIP both had a fully subsidised education system. However, upon the introduction of the National Subsidy both Enga and NIP diverted resources away from the education sector – albeit Enga did use some of the funding to start up an income contingent loan scheme for secondary and tertiary students.

The role of national development funding

Responsibility

DSIP and PSIP funding is meant to fund upgrades and expansions to school facilities. The funding is project based and the spending decisions are made by a committee (in the case of DSIP the Joint District Planning & Budget Priority Committee – JDP&BPC) on what projects to undertake. The JDPBPC is chaired by the local MP and constituted by the heads of each LLG and up to three other members appointed by the MP. Effectively the local member controls the JDP&BPC with District Administrators also having some influence to nominate worthy projects. In the past DSIP had been K5m per District per year, however, the 2013 Budget increased this to K10m per year, with K2m being allocated to education spending.

Field observations

DSIP is not regularly audited and is not reported as part of the Provincial accounts so data on the exact usage of funds could not be located. During the review there were only limited cases where schools reported DSIP as being a strong source of development funding. There were a number of instances (as outlined above) where DSIP was used on projects that were low priority for the school.

The role of donors

Responsibility

Donors occasionally provide resources directly to schools, commonly using Provinces to distribute goods. The review did not do an expansive study of the types of Donor support, however, while principals detailed that they appreciated donations, they did not consider it to be a material input in terms of financing their schools.

Field observations

A number of schools reported that Donors (AusAID and overseas church based NGOs) had previously provided school books. They did not appear to be provided on a regular basis or necessarily aligned with the curriculum requirements. Other types of donor support included financing for major capital projects, such as new classrooms or major maintenance/rehabilitation efforts. Once again the inputs from donors were seen as *ad hoc* and not a reliable source of resources with which to run the school on a regular basis.

THE CASE FOR IMPROVING EQUITY IN EDUCATION FUNDING

Equity in education has two dimensions. The first is fairness, which refers to making sure that personal and social circumstances – for example gender, socio-economic status or ethnic origin – should not be an obstacle to achieving educational potential.

The second is inclusion, which is ensuring a basic minimum standard of education for all – for example that everyone should be able to read, write and do simple arithmetic.

Educational outcomes play a key role in determining how individuals spend their adult life – a higher level of education means higher earnings, better health, and a longer life. On the other hand, the long-term social and financial costs of educational failure are high. Those

EQUITY IN EDUCATION FUNDING

without the skills to participate socially and economically generate higher costs for health, child welfare and law and justice systems. So a fair and inclusive system that makes the advantages of education available to all is one of the most powerful levers to make society more equitable.

Since national education resources are limited, the National Government needs to ensure that funds are being directed to the areas most in need so that minimum standards are met everywhere. Internationally many countries have special schemes to direct additional resources to schools or school areas serving disadvantaged pupils.

A FUNDING FRAMEWORK THAT INCREASES FUNDING TO REMOTE SCHOOLS

The use of formula funding to determine resource allocations in school systems is not a new concept. For example, many ministries of education around the world have, at least, a simple 'in kind' formula funding system that employs student/teacher ratios to guide staffing decisions. In addition, some school systems provide certain schools with supplementary resources when these schools are designated as serving poor or disadvantaged communities according to certain indicators of 'poverty' or 'socio-economic disadvantage'. Other school systems take the physical location of schools into consideration and then provide extra staff or allowances to schools that are considered to be isolated because of their distance from population centres.

While the mechanisms and objectives of these funding systems differ according to the individual circumstances of a country, at the core, the focus is on improving equity in education. In PNG the most obvious equity issue is access to quality education for students in remote areas of the country. The cost of transporting education materials into remote areas of PNG (sometimes by charter plane or by foot) can be extremely high. Conceptually purchasing power is greater in urban areas than in remote regions due to this transportation cost. That is, a school in Lae is able to purchase goods cheaper than a school in Telefomin, and therefore is able to provide a student with more educational resources, leading to better educational outcomes. This reduces the equity of the education system, with students in remote areas not being provided with a similar opportunity as those in urban areas. Poor opportunities for children to learn is linked directly to issues like low adult literacy rates, which in turn has been shown to have a strong correlation with poverty, drug abuse and other anti-social behaviors.



EQUITY IN EDUCATION FUNDING

A needs based approach to service delivery financing aims to reduce or eliminate the equality gaps between people in different regions. This is achieved by providing extra funding to schools in areas of high cost to ensure they are able to purchase the same amount of educational materials. Broadly the theory is that by ensuring that children have access to the same amount and quality of education materials, similar infrastructure and similar quality teachers, they will therefore be provided with the same opportunity to learn.

A 'needs based' funding formula would align to the following principles:

- An education system that delivers broad benefits to many is preferable to one that provides concentrated benefits to a fortunate few.
- Funding should be equitable not necessarily equal. This means that more funding should be provided to higher cost locations or disadvantaged groups.
- Equitable funding is aligned to the underlying cost drivers.
- Funding should be structured in a way that ensures an acceptable minimum level of quality and access to services is achieved by all citizens.



MEASURING REMOTENESS IN PNG

THE IMPORTANCE OF MEASURING REMOTENESS

There has been an increasing concern over a number of years about the difficulties faced by Papua New Guineans living in rural and remote areas in accessing services that most urban dwellers take for granted. The NEFC in particular has advocated for reforms to government financing which better recognises these differences. The Government is now beginning to appreciate the differing needs and circumstances of people living in regional Papua New Guinea and to target funding and programs accordingly.

However, the concept of remoteness itself has lacked precision. A number of past studies have classified remoteness based on individuals perceptions, or using proxy data such as the price of goods. However, these approaches have considerable drawbacks. Other typical approaches are the assignment of a qualitative description to an area such as “remote” or “urban”. While these descriptions may be correct, they are limited in their benefits because it is unclear how much higher costs are in more remote areas.

For the purposes of creating an equity based funding formula for the National Department of Education’s fee free tuition policy the concept of remoteness had to be refined to the extent that it could be quantified. With an objective measure of ‘remoteness’, future services can more easily be designed and targeted to address priority areas of need.

For this purpose the NEFC has created the PNG Accessibility/Remoteness Index (PARI).

HOW THE PARI CONCEPTUALISES REMOTENESS

Remoteness in PNG has routinely been defined in terms of a lack of accessibility to goods and services. In taking a GIS approach it was clear that villages that were a relatively far distance to major urban centres would be considered remote. But it was also determined that urban centres in PNG could also be remote if the range of goods and services available at those centres was limited and the District/Province is distant or lacked easy access to larger urban centres.

The PARI uses the following definition of remoteness :

Remoteness refers to a lack of access to a range of services, some of which are available in smaller and others only in larger centres; the remoteness of a location can thus be measured in terms of how far someone has to travel to centres of various sizes, taking into account the differences in cost of travelling using different transport modes.

Based on this definition the following principles were used in creating the PARI:

- Population size of urban LLGs was used as a proxy for availability of goods and services. This assumes that there is a standard range of goods and services available in similar sized urban centres, but that the range of goods and services in less populous urban areas is lower than in more populous urban areas. The 2011 Census preliminary data was used to determine the size of population centres.
- Road, river, sea or air routes are access indicators, but they each need to be weighted by the relative cost per kilometer to make them comparable.
- Distances are measured to the closest urban centres in each size category.

MEASURING REMOTENESS IN PNG

It was assumed that services available at smaller centres are also available at larger centres so that if an LLG is close enough to a larger centre, distances to other smaller urban centres that are further away do not need to be measured.

PARI METHODOLOGY

Development of a GIS database of PNG

To calculate the index values a GIS database was constructed containing:

- Topographical information including rivers and lakes
- Census units
- Road network
- Boat routes
- Airstrips
- Administrative boundaries (Province, District, LLG), and
- Locations of towns and urban centres.

Defining service centres

The relationship between population size to availability of goods and services was analysed for urban centres. On the basis of this analysis urban centres with populations greater than 5000.

The four categories were:

- A. More than 50,000
- B. Between 20,001 and 50,000 and a special case for Vanimo
- C. Between 10,001 and 20,000
- D. Between 5,000 and 10,000

The special case for Vanimo shifted it one category higher to reflect the fact that it is close to Jayapura (a large city in Indonesia) and would have greater access to goods through the Wutung border market.

Distance calculations

The GIS analysis measured the distances between each LLG Head Quarters and the nearest category A, B, C and D service centres. This gave 4

measurements per LLG, each representing the minimum distance. If an LLG was located in a service centre it was given a distance of zero.

These measurements were also adjusted by substituting minimum distances to larger centres when these were closer than smaller centres. For example, it was assumed that if an LLG was closer to, say, a “B” service centre than the nearest “C” centre, then services which would otherwise be provided by the “C” centre would instead be obtained from the closer “B” centre.

Distances from each LLG head quarters to the nearest service centres of each category were then measured and categories by one of 4 different modes:

- Road. This was the default transport mode. Where a mapped road existed in the GIS database it was assumed that this road was in a reasonable condition to travel by Toyota Landcruiser.
- Ferry was used to calculate travel distances between District Head Quarters and “A” Towns (Lae and Port Moresby). This transport mode would reflect the movement of goods from major international ports and manufacturing centres.
- Dinghy. River journeys were assumed to be made by dinghy as well as travel between LLGs and the District Head Quarters. Sea journeys shorter than 350km were also assumed to be made by dinghy.
- Aeroplane. Assumed to be used for inland LLGs where no road connections exist. The distances were mapped to the local airfield.

The cost per kilometer for travel between LLGs and District Head Quarters was doubled to reflect the fact that travel would normally be made on minor roads that were less likely to be maintained, using charter air services, or up difficult to navigate rivers.

MEASURING REMOTENESS IN PNG

Weightings

The weightings for **roads** was calculated in the following manner.

- Vehicle fuel efficiency of a Toyota Landcruiser on PNG roads was provided by Ela Motors Toyota.
- The local cost of diesel in each district was used to calculate an average cost per kilometer. This average was applied across all LLGs
- It was assumed that the vehicle would be carrying 4 people so the cost per kilometre was divided by 4.

The weightings for **dinghy** was calculated by:

- Surveying a number of chartered dinghy operators to determine the amount of fuel used for common journeys with 4 passengers.
- Mapping the journey using the GIS database to determine the journey length.
- Calculating the average cost per kilometer based on District specific zoom prices.
- Dividing by 4 passengers.

The weightings for **ferries** was calculated by analysing commercial passenger shipping routes and ticket prices to determine a cost per kilometer.

The weightings for **air** travel were calculated by:

- obtaining a price list from Airlines PNG, Air Niugini, and MAF.
- Comparing the price for a single route with the straight line distance to determine a cost per kilometer.
- Averaging the cost per kilometer of all air routes.

WEIGHTINGS	
Travel Mode	Weight
Road	1
Ferry	1.1
Dinghy	2.1
Aeroplane	4

- Due to lack of available data no routes were assessed as being only accessible by foot.

Combining the weighed distances

For each measurement between LLG and service centres (A,B, C and D) each transport mode was weighted and where multimodal journeys existed the two modes were combined.

Weighted Distances	A	B	C	D
Kundiawa Urban	373	96	0	0
Lorengau Urban	884	545	545	0
Wage Rural	693	234	98	135
Category Average	868	470	364	326

Combining the 4 distance scores

The 4 distances cannot just be combined together because the category A distances (from each LLG to either Port Moresby or Lae) are so long that they would heavily outweigh the other 3 distances. As such a ratio of each distance was taken by dividing each distance by the category average. Then the 4 scores are added together to create the raw scores.

Raw Score	A	B	C	D	Total
Kundiawa Urban	0.43	0.20	0	0	0.63
Lorengau Urban	1.02	1.16	1.50	0	3.68
Wage Rural	0.80	0.5	0.27	0.41	1.98
Category Average	1	1	1	1	4

Calculating the index

Each LLGs raw score is then divided by the category average to create the index score. A score of 100 on the index means that an LLG is at the national average level of remoteness. A score of 92% means that the LLG is 8% less remote than the average LLG.

Raw Score	Total	Index
Kundiawa Urban	0.63	16%
Lorengau Urban	3.68	92%
Wage Rural	1.98	49%
Category Average	4	

MEASURING REMOTENESS IN PNG

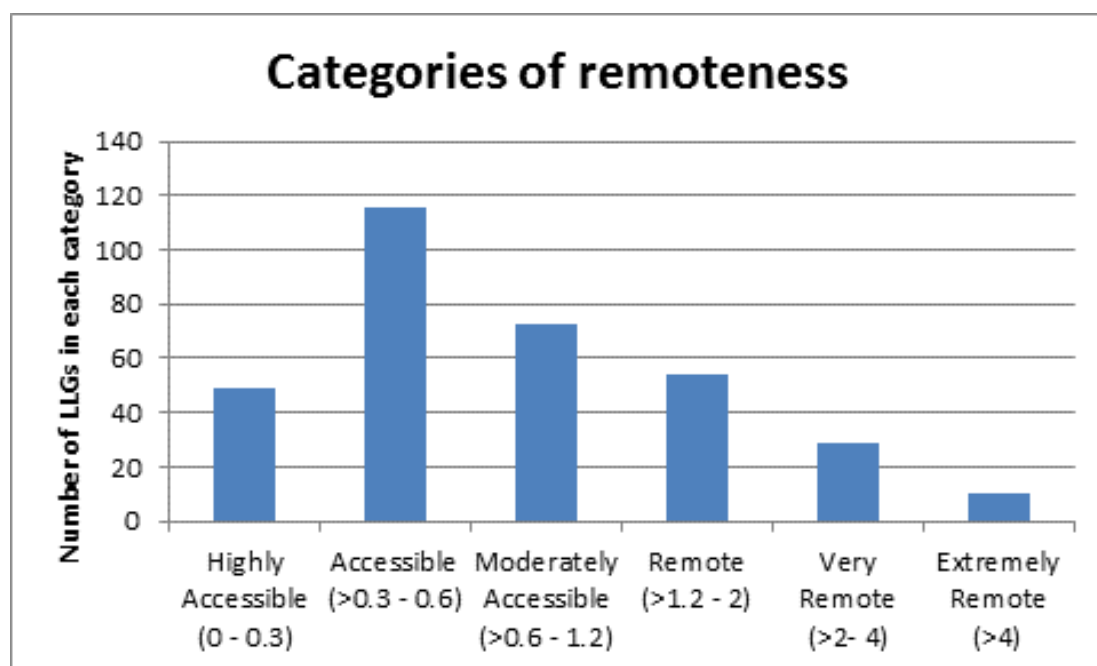
Categories of Remoteness

The remoteness scores range from 0% (Port Moresby) to 586% (Namea, Telefomin). In order for a funding formula to be practical it was considered that all the individual valued should be categorised so that any financial transfer can be easily administered. A number of factors were taken into account in devising a set of categories, namely:

- Balance across categories (see graph)
- Natural breaks in the data.

The categories are:

- Highly accessible (raw score 0—0.3). Relatively unrestricted accessibility to a wide range of goods and services.
- Accessible (raw score >0.3—0.6). Some restrictions to accessibility of some goods and services.
- Moderately accessible (raw score >0.6—1.2). Significantly restricted accessibility of goods and services.
- Remote (raw score >1.2—2). Very restricted accessibility of goods and services.
- Very remote (>2—4). Very little accessibility of goods and services.
- Extremely remote (>4). No accessibility to goods and services.



Source: PNG Accessibility/Remoteness Index



MEASURING REMOTENESS IN PNG

PNG ACCESSIBILITY/REMOTENESS INDEX SCORES

Province	District	LLG	PARI	Category
WESTERN	Middle Fly	Bamu Rural	189%	Remote (>1.2 - 2)
	Middle Fly	Gogodala Rural	152%	Remote (>1.2 - 2)
	Middle Fly	Lake Murray Rural	469%	Extremely Remote (>4)
	Middle Fly	Nomad Rural	494%	Extremely Remote (>4)
	Middle Fly	Balimo Urban	115%	Moderately Accessible (>0.6 - 1.2)
	North Fly	Kiunga Rural	245%	Very Remote (>2- 4)
	North Fly	Ningerum Rural	278%	Very Remote (>2- 4)
	North Fly	Olsobip Rural	400%	Extremely Remote (>4)
	North Fly	Star Mountains Rural	306%	Very Remote (>2- 4)
	North Fly	Kiunga Urban	245%	Very Remote (>2- 4)
	South Fly	Kiwai Rural	115%	Moderately Accessible (>0.6 - 1.2)
	South Fly	Morehead Rural	359%	Very Remote (>2- 4)
	South Fly	Oriomo Bituri Rural	127%	Remote (>1.2 - 2)
	South Fly	Daru Urban	40%	Accessible (>0.3 - 0.6)
GULF	Kerema	Central Kerema Rural	58%	Accessible (>0.3 - 0.6)
	Kerema	East Kerema Rural	95%	Moderately Accessible (>0.6 - 1.2)
	Kerema	Kaintiba Rural	155%	Remote (>1.2 - 2)
	Kerema	Kotidanga Rural	138%	Remote (>1.2 - 2)
	Kerema	Lakekamu Tauri Rural	80%	Moderately Accessible (>0.6 - 1.2)
	Kerema	Kerema Urban	48%	Accessible (>0.3 - 0.6)
	Kikori	Baimuru Rural	251%	Very Remote (>2- 4)
	Kikori	East Kikori Rural	143%	Remote (>1.2 - 2)
	Kikori	Ihu Rural	316%	Very Remote (>2- 4)
	Kikori	West Kikori Rural	353%	Very Remote (>2- 4)
CENTRAL	Abau	Amazon Bay Rural	184%	Remote (>1.2 - 2)
	Abau	Aroma Rural	44%	Accessible (>0.3 - 0.6)
	Abau	Cloudy Bay Rural	65%	Moderately Accessible (>0.6 - 1.2)
	Goilala	Guari Rural	162%	Remote (>1.2 - 2)
	Goilala	Tapini Rural	110%	Moderately Accessible (>0.6 - 1.2)
	Goilala	Woitape Rural	175%	Remote (>1.2 - 2)
	Kairuku - Hiri	Hiri Rural	7%	Highly Accessible (0 - 0.3)
	Kairuku - Hiri	Kairuku Rural	36%	Accessible (>0.3 - 0.6)
	Kairuku - Hiri	Koiari Rural	36%	Accessible (>0.3 - 0.6)
	Kairuku - Hiri	Mekeo Kuni Rural	58%	Accessible (>0.3 - 0.6)
	Rigo	Rigo Central Rural	20%	Highly Accessible (0 - 0.3)
	Rigo	Rigo Coastal Rural	44%	Accessible (>0.3 - 0.6)
	Rigo	Rigo Inland Rural	42%	Accessible (>0.3 - 0.6)

MEASURING REMOTENESS IN PNG

Province	District	LLG	PARI	Category
MILNE BAY	Alotau	Makamaka Rural	134%	Remote (>1.2 - 2)
	Alotau	Daga Rural	233%	Very Remote (>2- 4)
	Alotau	Weraura Rural	129%	Remote (>1.2 - 2)
	Alotau	Maramatana Rural	54%	Accessible (>0.3 - 0.6)
	Alotau	Huhu Rural	41%	Accessible (>0.3 - 0.6)
	Alotau	Suau Rural	168%	Remote (>1.2 - 2)
	Alotau	Alotau Urban	31%	Accessible (>0.3 - 0.6)
	Samarai - Murua	Bwanabwana Rural	415%	Extremely Remote (>4)
	Samarai - Murua	Louisiade Rural	173%	Remote (>1.2 - 2)
	Samarai - Murua	Yaleyemba Rural	257%	Very Remote (>2- 4)
	Samarai - Murua	Murua Rural	340%	Very Remote (>2- 4)
	Kiriwina - Goodenough	Kiriwina Rural	142%	Remote (>1.2 - 2)
	Kiriwina - Goodenough	Goodenough Island Rural	260%	Very Remote (>2- 4)
	Esa'ala	West Ferguson Rural	121%	Remote (>1.2 - 2)
	Esa'ala	Dobu Rural	77%	Moderately Accessible (>0.6 - 1.2)
	Esa'ala	Duau Rural	124%	Remote (>1.2 - 2)
ORO	Ijivitari	Afore rural	68%	Moderately Accessible (>0.6 - 1.2)
	Ijivitari	Tufi rural	150%	Remote (>1.2 - 2)
	Ijivitari	Oro Bay Rural	42%	Accessible (>0.3 - 0.6)
	Ijivitari	Safia rural	187%	Remote (>1.2 - 2)
	Ijivitari	Popondetta Urban	16%	Highly Accessible (0 - 0.3)
	Sohe	Kokoda Rural	26%	Highly Accessible (0 - 0.3)
	Sohe	Higaturu Rural	54%	Accessible (>0.3 - 0.6)
	Sohe	Tamata Rural	146%	Remote (>1.2 - 2)
	Sohe	Kira Rural	260%	Very Remote (>2- 4)
SOUTHERN HIGHLANDS	Ialibu - Pangia	East Pangia Rural	34%	Accessible (>0.3 - 0.6)
	Ialibu - Pangia	Kewabi Rural	28%	Highly Accessible (0 - 0.3)
	Ialibu - Pangia	Wiru Rural	42%	Accessible (>0.3 - 0.6)
	Ialibu - Pangia	Ialibu Urban	24%	Highly Accessible (0 - 0.3)
	Imbonggu	Ialibu Basin Rural	44%	Accessible (>0.3 - 0.6)
	Imbonggu	Imbonggu Rural	44%	Accessible (>0.3 - 0.6)
	Imbonggu	Lower Mendi Rural	70%	Moderately Accessible (>0.6 - 1.2)
	Kagua - Erave	Erave Rural	54%	Accessible (>0.3 - 0.6)
	Kagua - Erave	Kagua rural	36%	Accessible (>0.3 - 0.6)
	Kagua - Erave	Kuare Rural	48%	Accessible (>0.3 - 0.6)
	Kagua - Erave	Ai ya rural	43%	Accessible (>0.3 - 0.6)
	Mendi - Munihu	Mendi Urban	24%	Highly Accessible (0 - 0.3)
	Mendi - Munihu	Karints Rural	32%	Accessible (>0.3 - 0.6)
	Mendi - Munihu	Lai Valley Rural	37%	Accessible (>0.3 - 0.6)
	Mendi - Munihu	Upper Mendi Rural	32%	Accessible (>0.3 - 0.6)
	Nipa - Kutubu	Lake Kutubu Rural	80%	Moderately Accessible (>0.6 - 1.2)
	Nipa - Kutubu	Mt Bosavi Rural	80%	Moderately Accessible (>0.6 - 1.2)
	Nipa - Kutubu	Nembi Plateau Rural	43%	Accessible (>0.3 - 0.6)
	Nipa - Kutubu	Nipa Rural	37%	Accessible (>0.3 - 0.6)
	Nipa - Kutubu	Poroma Rural	54%	Accessible (>0.3 - 0.6)

MEASURING REMOTENESS IN PNG

Province	District	LLG	PARI	Category
HELA	Komo - Magarima	Hulia Rural	75%	Moderately Accessible (>0.6 - 1.2)
	Komo - Magarima	Komo Rural	96%	Moderately Accessible (>0.6 - 1.2)
	Komo - Magarima	Upper Wage rural	47%	Accessible (>0.3 - 0.6)
	Komo - Magarima	Lower Wage rural	46%	Accessible (>0.3 - 0.6)
	Koroba - Kopiago	Awi Pori Rural	96%	Moderately Accessible (>0.6 - 1.2)
	Koroba - Kopiago	Lake Kopiago Rural	83%	Moderately Accessible (>0.6 - 1.2)
	Koroba - Kopiago	North Koroba Rural	102%	Moderately Accessible (>0.6 - 1.2)
	Koroba - Kopiago	South Koroba Rural	111%	Moderately Accessible (>0.6 - 1.2)
	Tari - Pori	Tari Urban	37%	Accessible (>0.3 - 0.6)
	Tari - Pori	Hayapuga Rural	42%	Accessible (>0.3 - 0.6)
	Tari - Pori	Tagali Rural	44%	Accessible (>0.3 - 0.6)
	Tari - Pori	Tebi Rural	41%	Accessible (>0.3 - 0.6)
ENGA	Kandep	Kandep Rural	39%	Accessible (>0.3 - 0.6)
	Kandep	Wage Rural	49%	Accessible (>0.3 - 0.6)
	Kompam	Ambum Rural	60%	Accessible (>0.3 - 0.6)
	Kompam	Kompam Rural	38%	Accessible (>0.3 - 0.6)
	Kompam	Wapi-Yengis Rural	93%	Moderately Accessible (>0.6 - 1.2)
	Kompam	Wali Tarua Rural	49%	Accessible (>0.3 - 0.6)
	Lagaip - Porgera	Porgera Urban	44%	Accessible (>0.3 - 0.6)
	Lagaip - Porgera	Lagaip Rural	75%	Moderately Accessible (>0.6 - 1.2)
	Lagaip - Porgera	Maip Muritaka Rural	61%	Moderately Accessible (>0.6 - 1.2)
	Lagaip - Porgera	Paiela/Hewa Rural	62%	Moderately Accessible (>0.6 - 1.2)
	Lagaip - Porgera	Porgera Rural	47%	Accessible (>0.3 - 0.6)
	Lagaip - Porgera	Pilikambi Rural	61%	Moderately Accessible (>0.6 - 1.2)
	Wabag	Wabag Urban	28%	Highly Accessible (0 - 0.3)
	Wabag	Wabag Rural	35%	Accessible (>0.3 - 0.6)
	Wabag	Maramuni Rural	54%	Accessible (>0.3 - 0.6)
	Wapenamanda	Wapenamanda Rural	26%	Highly Accessible (0 - 0.3)
	Wapenamanda	Tsak Rural	35%	Accessible (>0.3 - 0.6)
WESTERN HIGHLANDS	Dei	Kotna rural	42%	Accessible (>0.3 - 0.6)
	Dei	Muglamp rural	32%	Accessible (>0.3 - 0.6)
	Mt Hagen	Mt Hagen Rural	19%	Highly Accessible (0 - 0.3)
	Mt Hagen	Mt Hagen Urban	13%	Highly Accessible (0 - 0.3)
	Mul - Baiyer	Mul Rural	39%	Accessible (>0.3 - 0.6)
	Mul - Baiyer	Baiyer Rural	24%	Highly Accessible (0 - 0.3)
	Mul - Baiyer	Lumusa Rural	32%	Accessible (>0.3 - 0.6)
	Tambul - Nebilyer	Mt Giluwe Rural	73%	Moderately Accessible (>0.6 - 1.2)
	Tambul - Nebilyer	Nebilyer Rural	92%	Moderately Accessible (>0.6 - 1.2)
JIWAKA	Anglimp - South Waghi	Anglimp Rural	43%	Accessible (>0.3 - 0.6)
	Anglimp - South Waghi	South Waghi Rural	24%	Highly Accessible (0 - 0.3)
	Jimi	Jimi Rural	32%	Accessible (>0.3 - 0.6)
	Jimi	Kol Rural	49%	Accessible (>0.3 - 0.6)
	North Waghi	North Waghi Rural	24%	Highly Accessible (0 - 0.3)
	North Waghi	Nondugl rural	34%	Accessible (>0.3 - 0.6)

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Province	District	LLG	PARI	Category
SIMBU	Chuave	Chuave Rural	22%	Highly Accessible (0 - 0.3)
	Chuave	Elimbari Rural	30%	Highly Accessible (0 - 0.3)
	Chuave	Siane Rural	32%	Accessible (>0.3 - 0.6)
	Gumine	Bomai/Gumai Rural	36%	Accessible (>0.3 - 0.6)
	Gumine	Gumine Rural	26%	Highly Accessible (0 - 0.3)
	Gumine	Mt Digne Rural	39%	Accessible (>0.3 - 0.6)
	Karimui - Nomane	Karimui Rural	66%	Moderately Accessible (>0.6 - 1.2)
	Karimui - Nomane	Nomane Rural	126%	Remote (>1.2 - 2)
	Karimui - Nomane	Salt Rural	74%	Moderately Accessible (>0.6 - 1.2)
	Kerowagi	Kerowagi Urban	19%	Highly Accessible (0 - 0.3)
	Kerowagi	Gena/Waugla Rural	25%	Highly Accessible (0 - 0.3)
	Kerowagi	Lower-Upper Koronigl rural	23%	Highly Accessible (0 - 0.3)
	Kerowagi	Kup Rural	31%	Accessible (>0.3 - 0.6)
	Kundiawa - Gembogl	Kundiawa Urban	16%	Highly Accessible (0 - 0.3)
	Kundiawa - Gembogl	Mitnande Rural	30%	Highly Accessible (0 - 0.3)
	Kundiawa - Gembogl	Niglkande Rural	25%	Highly Accessible (0 - 0.3)
	Kundiawa - Gembogl	Waiye Rural	20%	Highly Accessible (0 - 0.3)
	Sina Sina - Yonggomugl	Sinasina Rural	20%	Highly Accessible (0 - 0.3)
	Sina Sina - Yonggomugl	Suai Rural	24%	Highly Accessible (0 - 0.3)
	Sina Sina - Yonggomugl	Yonggomugl Rural	31%	Accessible (>0.3 - 0.6)
EASTERN HIGHLANDS	Daulo	Lower Asaro Rural	20%	Highly Accessible (0 - 0.3)
	Daulo	Upper Asaro Rural	26%	Highly Accessible (0 - 0.3)
	Daulo	Watabung Rural	31%	Accessible (>0.3 - 0.6)
	Goroka	Goroka Urban	18%	Highly Accessible (0 - 0.3)
	Goroka	Gahuku Rural	23%	Highly Accessible (0 - 0.3)
	Goroka	Mimanalo Rural	24%	Highly Accessible (0 - 0.3)
	Henganofi	Dunatina Rural	28%	Highly Accessible (0 - 0.3)
	Henganofi	Fayantina Rural	33%	Accessible (>0.3 - 0.6)
	Henganofi	Kafentina Rural	36%	Accessible (>0.3 - 0.6)
	Kainantu	Kainantu Urban	24%	Highly Accessible (0 - 0.3)
	Kainantu	Agarabi Rural	27%	Highly Accessible (0 - 0.3)
	Kainantu	Kamano 1 Rural	31%	Accessible (>0.3 - 0.6)
	Kainantu	Kamano 2 Rural	35%	Accessible (>0.3 - 0.6)
	Lufa	Mt. Michael Rural	48%	Accessible (>0.3 - 0.6)
	Lufa	Unavi Rural	48%	Accessible (>0.3 - 0.6)
	Lufa	Yagaria Rural	48%	Accessible (>0.3 - 0.6)
	Obura-Wonenara	Lamari Rural	34%	Accessible (>0.3 - 0.6)
	Obura-Wonenara	Yelia Rural	162%	Remote (>1.2 - 2)
	Obura-Wonenara	Tairoa-Gadsup Rural	31%	Accessible (>0.3 - 0.6)
	Okapa	East Okapa Rural	39%	Accessible (>0.3 - 0.6)
	Okapa	West Okapa Rural	50%	Accessible (>0.3 - 0.6)
	Unggai-Bena	Ungai Rural	43%	Accessible (>0.3 - 0.6)
	Unggai-Bena	Upper Bena Rural	32%	Accessible (>0.3 - 0.6)
	Unggai-Bena	Lower Bena Rural	24%	Highly Accessible (0 - 0.3)

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Province	District	LLG	PARI	Category
MOROBE	Bulolo	Mumeng Rural	32%	Accessible (>0.3 - 0.6)
	Bulolo	Waria Rural	176%	Remote (>1.2 - 2)
	Bulolo	Watut Rural	22%	Highly Accessible (0 - 0.3)
	Bulolo	Wau Rural	21%	Highly Accessible (0 - 0.3)
	Bulolo	Buang Rural	39%	Accessible (>0.3 - 0.6)
	Bulolo	Wau/Bulolo Urban	9%	Highly Accessible (0 - 0.3)
	Finschafen	Finschafen Urban	54%	Accessible (>0.3 - 0.6)
	Finschafen	Hube Rural	87%	Moderately Accessible (>0.6 - 1.2)
	Finschafen	Kotte Rural	69%	Moderately Accessible (>0.6 - 1.2)
	Finschafen	Yabim Mape Rural	58%	Accessible (>0.3 - 0.6)
	Finschafen	Burum/Kuat rural	104%	Moderately Accessible (>0.6 - 1.2)
	Huon	Morobe Rural	116%	Moderately Accessible (>0.6 - 1.2)
	Huon	Salamaua Rural	18%	Highly Accessible (0 - 0.3)
	Huon	Wampar Rural	80%	Moderately Accessible (>0.6 - 1.2)
	Kabwum	Deyamos Rural	132%	Remote (>1.2 - 2)
	Kabwum	Komba rural	133%	Remote (>1.2 - 2)
	Kabwum	Yus Rural	219%	Very Remote (>2- 4)
	Kabwum	Selepet rural	120%	Moderately Accessible (>0.6 - 1.2)
	Lae	Ahi Rural	3%	Highly Accessible (0 - 0.3)
	Lae	Lae Urban	0%	Highly Accessible (0 - 0.3)
	Markham	Onga/Waffa Rural	56%	Accessible (>0.3 - 0.6)
	Markham	Umi/Atzera Rural	45%	Accessible (>0.3 - 0.6)
	Markham	Wantoat/Leron Rural	70%	Moderately Accessible (>0.6 - 1.2)
	Menyamya	Kapao rural	66%	Moderately Accessible (>0.6 - 1.2)
	Menyamya	Kome Rural	51%	Accessible (>0.3 - 0.6)
	Menyamya	Wapi Rural	54%	Accessible (>0.3 - 0.6)
	Menyamya	Nanima/Kariba rural	66%	Moderately Accessible (>0.6 - 1.2)
	Nawae	Labuta Rural	72%	Moderately Accessible (>0.6 - 1.2)
	Nawae	Nabak Rural	66%	Moderately Accessible (>0.6 - 1.2)
	Nawae	Wain-Erap Rural	16%	Highly Accessible (0 - 0.3)
	Tewae - Siassi	Sialum Rural	167%	Remote (>1.2 - 2)
	Tewae - Siassi	Siassi Rural	227%	Very Remote (>2- 4)
	Tewae - Siassi	Wasu Rural	113%	Moderately Accessible (>0.6 - 1.2)

MEASURING REMOTENESS IN PNG

Province	District	LLG	PARI	Category
MADANG	Bogia	Almami Rural	69%	Moderately Accessible (>0.6 - 1.2)
	Bogia	Iabu Rural	80%	Moderately Accessible (>0.6 - 1.2)
	Bogia	Yawar Rural	53%	Accessible (>0.3 - 0.6)
	Madang	Madang Urban	10%	Highly Accessible (0 - 0.3)
	Madang	Ambenob Rural	14%	Highly Accessible (0 - 0.3)
	Madang	Transgogol Rural	27%	Highly Accessible (0 - 0.3)
	Middle Ramu	Arabaka Rural	150%	Remote (>1.2 - 2)
	Middle Ramu	Josephstaal Rural	202%	Very Remote (>2- 4)
	Middle Ramu	Kovon rural	189%	Remote (>1.2 - 2)
	Middle Ramu	Simbai Rural	127%	Remote (>1.2 - 2)
	Rai Coast	Astrolabe Bay Rural	82%	Moderately Accessible (>0.6 - 1.2)
	Rai Coast	Naho Rawa Rural	152%	Remote (>1.2 - 2)
	Rai Coast	Rai Coast Rural	64%	Moderately Accessible (>0.6 - 1.2)
	Rai Coast	Nayudo rural	110%	Moderately Accessible (>0.6 - 1.2)
	Sumkar	Karkar Rural	47%	Accessible (>0.3 - 0.6)
	Sumkar	Sumgilbar Rural	85%	Moderately Accessible (>0.6 - 1.2)
	Usino-Bundi	Bundi Rural	53%	Accessible (>0.3 - 0.6)
	Usino-Bundi	Usino Rural	24%	Highly Accessible (0 - 0.3)
	Usino-Bundi	Gama rural	53%	Accessible (>0.3 - 0.6)
EAST SEPIK	Ambunti - Dreikir	Ambunti Rural	84%	Moderately Accessible (>0.6 - 1.2)
	Ambunti - Dreikir	Dreikir Rural	188%	Remote (>1.2 - 2)
	Ambunti - Dreikir	Gawanga Rural	172%	Remote (>1.2 - 2)
	Ambunti - Dreikir	Tunap/Hustein rural	338%	Very Remote (>2- 4)
	Angoram	Angoram/Middle Sepik rural	48%	Accessible (>0.3 - 0.6)
	Angoram	Karawari Rural	254%	Very Remote (>2- 4)
	Angoram	Keram Rural	110%	Moderately Accessible (>0.6 - 1.2)
	Angoram	Marienberg Rural	83%	Moderately Accessible (>0.6 - 1.2)
	Angoram	Yuat Rural	126%	Remote (>1.2 - 2)
	Maprik	Maprik Urban	51%	Accessible (>0.3 - 0.6)
	Maprik	Albiges/Mablep Rural	58%	Accessible (>0.3 - 0.6)
	Maprik	Bumbita/Kunai Rural	64%	Moderately Accessible (>0.6 - 1.2)
	Maprik	Maprik/Wora Rural	55%	Accessible (>0.3 - 0.6)
	Maprik	Yamil/Tamaui Rural	61%	Moderately Accessible (>0.6 - 1.2)
	Wewak	Wewak Urban	23%	Highly Accessible (0 - 0.3)
	Wewak	Boikin/Dagua Rural	47%	Accessible (>0.3 - 0.6)
	Wewak	Turubu Rural	39%	Accessible (>0.3 - 0.6)
	Wewak	Wewak Islands Rural	50%	Accessible (>0.3 - 0.6)
	Wewak	Wewak Rural	33%	Accessible (>0.3 - 0.6)
	Wosera-Gawi	Burui/Kunai Rural	66%	Moderately Accessible (>0.6 - 1.2)
	Wosera-Gawi	Gawi Rural	60%	Moderately Accessible (>0.6 - 1.2)
	Wosera-Gawi	North Wosera Rural	81%	Moderately Accessible (>0.6 - 1.2)
	Wosera-Gawi	South Wosera Rural	77%	Moderately Accessible (>0.6 - 1.2)
	Yangoru-Saussia	East Yangoru Rural	43%	Accessible (>0.3 - 0.6)
	Yangoru-Saussia	Numbor Rural	64%	Moderately Accessible (>0.6 - 1.2)
	Yangoru-Saussia	Sausso Rural	57%	Accessible (>0.3 - 0.6)
	Yangoru-Saussia	West Yangoru Rural	48%	Accessible (>0.3 - 0.6)

MEASURING REMOTENESS IN PNG

Province	District	LLG	PARI	Category
SANDAUN	Aitape-Lumi	East Aitape Rural	112%	Moderately Accessible (>0.6 - 1.2)
	Aitape-Lumi	East Wapei Rural	138%	Remote (>1.2 - 2)
	Aitape-Lumi	West Aitape Rural	106%	Moderately Accessible (>0.6 - 1.2)
	Aitape-Lumi	West Wapei Rural	138%	Remote (>1.2 - 2)
	Aitape-Lumi	Aitape Lumi Urban	86%	Moderately Accessible (>0.6 - 1.2)
	Nuku	Maimai Wanwan rural	132%	Remote (>1.2 - 2)
	Nuku	Palai rural	138%	Remote (>1.2 - 2)
	Nuku	Yangkok Rural	143%	Remote (>1.2 - 2)
	Nuku	Nuku rural	119%	Moderately Accessible (>0.6 - 1.2)
	Telefomin	Namea Rural	584%	Extremely Remote (>4)
	Telefomin	Oksapmin Rural	453%	Extremely Remote (>4)
	Telefomin	Telefomin Rural	335%	Very Remote (>2- 4)
	Telefomin	Yapsie Rural	483%	Extremely Remote (>4)
	Vanimo-Green River	Vanimo Urban	32%	Accessible (>0.3 - 0.6)
	Vanimo-Green River	Amanab Rural	213%	Very Remote (>2- 4)
	Vanimo-Green River	Bewani/Wutung Onei Rural	56%	Accessible (>0.3 - 0.6)
	Vanimo-Green River	Green River Rural	277%	Very Remote (>2- 4)
	Vanimo-Green River	Walsa Rural	162%	Remote (>1.2 - 2)
MANUS	Manus	Aua Wuvulu rural	583%	Extremely Remote (>4)
	Manus	Lorengau Urban	92%	Moderately Accessible (>0.6 - 1.2)
	Manus	Nigoherm rural	441%	Extremely Remote (>4)
	Manus	Bisikani/Soparibeu rural	189%	Remote (>1.2 - 2)
	Manus	Pomutu/Kurti/Andra rural	126%	Remote (>1.2 - 2)
	Manus	Lelemadih/Bupichupeu rural	94%	Moderately Accessible (>0.6 - 1.2)
	Manus	Los Negros rural	102%	Moderately Accessible (>0.6 - 1.2)
	Manus	Nali Sopat/Penabu rural	128%	Remote (>1.2 - 2)
	Manus	Tetidu rural	105%	Moderately Accessible (>0.6 - 1.2)
	Manus	Pobuma rural	158%	Remote (>1.2 - 2)
	Manus	Balopa rural	141%	Remote (>1.2 - 2)
	Manus	Rapatona rural	166%	Remote (>1.2 - 2)
NEW IRELAND	Kavieng	Kavieng Urban	40%	Accessible (>0.3 - 0.6)
	Kavieng	Murat Rural	206%	Very Remote (>2- 4)
	Kavieng	Lovongai Rural	108%	Moderately Accessible (>0.6 - 1.2)
	Kavieng	Tikana Rural	74%	Moderately Accessible (>0.6 - 1.2)
	Namatanai	Namatanai Rural	81%	Moderately Accessible (>0.6 - 1.2)
	Namatanai	Matalai Rural	81%	Moderately Accessible (>0.6 - 1.2)
	Namatanai	Central Niu Ailan Rural	137%	Remote (>1.2 - 2)
	Namatanai	Konoagil Rural	164%	Remote (>1.2 - 2)
	Namatanai	Tanir Rural	220%	Very Remote (>2- 4)
	Namatanai	Nimamar Rural	116%	Moderately Accessible (>0.6 - 1.2)

MEASURING REMOTENESS IN PNG

Province	District	LLG	PARI	Category
EAST NEW BRITAIN	Gazelle	Central Gazelle Rural	33%	Accessible (>0.3 - 0.6)
	Gazelle	Inland Baining Rural	42%	Accessible (>0.3 - 0.6)
	Gazelle	Lassul Baining Rural	63%	Moderately Accessible (>0.6 - 1.2)
	Gazelle	Livuan/Reimber Rural	48%	Accessible (>0.3 - 0.6)
	Gazelle	Vunadidir/Toma Rural	41%	Accessible (>0.3 - 0.6)
	Kokopo	Kokopo/Vunamami Urban	26%	Highly Accessible (0 - 0.3)
	Kokopo	Bitapaka Rural	33%	Accessible (>0.3 - 0.6)
	Kokopo	Duke of York Rural	62%	Moderately Accessible (>0.6 - 1.2)
	Kokopo	Raluana Rural	28%	Highly Accessible (0 - 0.3)
	Pomio	Central/Inland Pomio Rural	162%	Remote (>1.2 - 2)
	Pomio	East Pomio Rural	261%	Very Remote (>2- 4)
	Pomio	Melkoi Rural	233%	Very Remote (>2- 4)
	Pomio	Sinivit Rural	49%	Accessible (>0.3 - 0.6)
	Pomio	West Pomio/Mamusi Rural	150%	Remote (>1.2 - 2)
	Rabaul	Rabaul Urban	31%	Accessible (>0.3 - 0.6)
	Rabaul	Balanataman Rural	34%	Accessible (>0.3 - 0.6)
	Rabaul	Kombiu Rural	47%	Accessible (>0.3 - 0.6)
	Rabaul	Watom Island Rural	42%	Accessible (>0.3 - 0.6)
WEST NEW BRITAIN	Kandrian - Gloucester	Gasmata Rural	369%	Very Remote (>2- 4)
	Kandrian - Gloucester	Gloucester Rural	495%	Extremely Remote (>4)
	Kandrian - Gloucester	Kandrian Coastal Rural	266%	Very Remote (>2- 4)
	Kandrian - Gloucester	Kandrian Inland Rural	273%	Very Remote (>2- 4)
	Kandrian - Gloucester	Kove/Kaliai Rural	185%	Remote (>1.2 - 2)
	Talasea	Kimbe Urban	37%	Accessible (>0.3 - 0.6)
	Talasea	Central Nakanai Rural	124%	Remote (>1.2 - 2)
	Talasea	East Nakanai Rural	146%	Remote (>1.2 - 2)
	Talasea	Bali/Witu Rural	197%	Remote (>1.2 - 2)
	Talasea	Hoskins Rural	57%	Accessible (>0.3 - 0.6)
	Talasea	Mosa Rural	45%	Accessible (>0.3 - 0.6)
	Talasea	Talasea Rural	54%	Accessible (>0.3 - 0.6)
BOUGAINVILLE		TOROKINA rural	188%	Remote (>1.2 - 2)
		BANA rural	83%	Moderately Accessible (>0.6 - 1.2)
		SIWAI rural	68%	Moderately Accessible (>0.6 - 1.2)
		BUIN rural	47%	Accessible (>0.3 - 0.6)
		KUNUA rural	60%	Moderately Accessible (>0.6 - 1.2)
		TINPUTZ rural	55%	Accessible (>0.3 - 0.6)
		SELAU SUIR rural	31%	Accessible (>0.3 - 0.6)
		BUKA rural	30%	Accessible (>0.3 - 0.6)
		NISSAN rural	153%	Remote (>1.2 - 2)
		ATOLLS rural	297%	Very Remote (>2- 4)
		WAKAUNAI rural	68%	Moderately Accessible (>0.6 - 1.2)
		ARAWA rural	33%	Accessible (>0.3 - 0.6)

SCHOOL SPENDING & REMOTENESS

DETERMINING THE IMPACT OF TRANSPORT COSTS ON SCHOOL BUDGETS

The PARI provides a measure of how remote an LLG is from service centres compared to other LLGs, but it does not provide a baseline as to how much money is spent by schools on transport costs in different categories.

In order to obtain a baseline the review team undertook a series of surveys of schools in ‘Moderately accessible’ locations. The survey team travelled to Simbu, Eastern Highlands, Madang, Gulf and Milne Bay Province (including Kirawina Island). As part of the survey copies of school budgets were obtained and analysed. The spending varied more than expected between schools with some dedicating large amounts to new construction and others focusing more on education materials. Overall due to the high variation between the samples and the limited sample size it was not viewed as providing a representative sample.

The survey teams did however, ask a series of questions about vehicle use and frequency of travel to service centres. Details around motor vehicle costs also provided an insight of transport costs. As a fallback option the costings from the 2007 Unit Cost Study were analysed to draw out transport related costs compared to the cost of purchases. Variation was also observed across those costings as outlined in the below table so the average across all school types (3.5%) was used as the benchmark.

	Lower Primary	Upper Primary	Lower second-ary	Upper second-ary	Vocational
Vehicle costs (% of total costs)	2%	1%	11%	1%	1%

A Study of the Unit Costs of Education, Coffey International, 2007

The survey teams did, however, collect price listings from stationary supply stores and analysis indicated that prices in a Category ‘B’ town were on average around 6.5% higher than in a Category ‘A’ town.

Combining the direct cost to schools in vehicle maintenance with the higher costs of purchasing goods outside of category ‘A’ towns provides a conservative estimate of 10% of school budgets being spent on transport related costs in schools located within ‘moderately accessible’ LLGs.



SCHOOL SPENDING & REMOTENESS

APPLYING TRANSPORT COSTS TO OTHER REMOTENESS CLASSIFICATIONS

Combining the assessed transport costs applying to a school in an “moderately accessible” location with the remoteness index allows for an estimate to be made on the potential transport costs of schools in other PARI classifications.

A conservative estimate is made by taking the mid-point of the remoteness score of each category, rebasing each category so that “moderately accessible” is set to 10%. This gives the following weightings for each category.

Classification	PARI mid-point	Transport costs as % of total
Highly accessible	0.15	1.5%
Accessible	0.45	5%
Moderately Accessible	0.90	10% based on survey results
Remote	1.6	18%
Very Remote	3	33%
Extremely Remote	5	56%



TOP UP FUNDING FORMULA

A simple funding formula to address remoteness costs is to provide each school with a top up payment of varying amounts depending on their remoteness classification. This would be calculated as a proportion of the TFF on a per student basis. For example, a school with 100 students in a ‘Very Remote’ LLG would receive:

Remoteness top up = 100 x per student TFF rate x 33%

Note that in order to reduce the administrative complexity it is not recommended that schools in ‘highly accessible’ LLGs be provided with a top up payment.



SCHOOL SPENDING & REMOTENESS

TRAVEL REPORT ON SURVEY TRIP TO KIRIWINA ISLAND—Fiona Dienier

Brief Information on Location

Kiriwina is the largest of the Trobriand Islands, with an area of 290.5 km² (Wikipedia info) in the Milne Bay Province. From the main service delivery port Alotau, the travel distance by air is 216.20 Km² and 271.60 Km² by sea. The most frequent travel to the island is by air because of Airlines PNG scheduled flights and sea travel is considered only when cases where materials/goods are to be transported to the island (many would say it's the cheapest mode – considering weight/load of materials).

Trip to Kiriwina

Day 1

The team departed Port Moresby for Losuia via Alotau on the 20th August. The flight took about two and a half hours and the actual arrival time in Losuia was around 12:30pm. The drive from the airstrip to the DHQ is about 15 minutes and the Lodge is just some kilometres walk from the DHQ.

At first glance, Kiriwina Island (which is the DHQ of Kiriwina/Goodenough) is just like any other remote rural setting that tries to ensure that basic service delivery is available to the population. The district has a generator that supplies the nearby township from 6pm to 10pm, built digicel network towers for communication, a health centre and an aid post located to the north of the island. There are about three trade stores on the island which sell common store goods like biscuits, tinned fish/meat, rice etc...

Day 2

At around 8:30am, we depart for the first school visit to Kaibola Primary School which is far North of the Island. Due to unsealed road conditions, it took us about 45 minutes to reach the school. On



the way, most people were walking carrying their produce and roofing materials to an extent. PMV operations were not regular on the island because of high cost of maintaining vehicle and unsealed road conditions would be another factor.

We arrived at Kaibola Primary at around 9:15am and the students were just finishing off from their morning assembly. The school view was neat and from the outside, classrooms looked to be well maintained but most of the lower grade classes (3-5) do not have enough desks to sit on only a teacher table can be seen. The only new buildings would be the two grade eight classrooms funded by foreign aid assistance.

Okaikoda and Tukwaukwa Primary Schools were the next surveyed schools, unlike Kaibola Primary School a fair bit of maintenance is needed to be done on the classrooms. As we proceed with the survey questions the head teachers indicated the arising need of classroom maintenance and also having in plan building of new classrooms due to an increased number of students in the lower



SCHOOL SPENDING & REMOTENESS

grades is the school's priority at the moment. The most interesting thing I saw was that regardless of the schools current situation of shortage of basic school materials/equipment (teachers and students resource book, desks/tables etc...), the children showed great interest to learn and are very focus in doing their work.

Main Findings of the Survey:

- Lack of teachers and students basic resource materials (text books/desks/tables)
- Need of new library buildings and computer room for Kiriwina High School
- Transportation cost is expensive – survey results shows that its expensive to hire a boat/dinghy to transport materials from Alotau to Kiriwina (K6,000 to K9,000)

My general observation is that “schools at Kiriwina Island needs basic education service delivery such as school resource text books/building materials for maintenance/etc... and the cost of delivery is expensive” – because of this schools are limited to spend on items that they thought it would at least maintain the operation of the school in an academic year.

A word of thanks to the schools head teachers who made time available for the survey interview and also a special thank you to the district administrator who was very generous to assist the survey team with the district vehicle.



FINDINGS & RECOMMENDATIONS

Finding 1

Schools in 'moderately accessible' locations spend approximately 10 per cent of their budget on transport related costs. These transport related costs can be seen in:

- Direct delivery costs, where Schools pay contractors for the delivery of items.
- In house delivery costs, where schools pay for vehicle maintenance and running costs.
- Higher purchase prices, where schools are charged higher prices for goods compared to the cost of the same item in Port Moresby.

Finding 2

To purchase a similar basket of goods in more remote locations would increase a school's transport costs to an estimated minimum percentage of their total budget of:

- 18% in 'Remote' locations
- 33% in 'Very Remote' locations
- 56% in 'Extremely Remote'

Finding 3

Because of these high transport costs, schools in remote locations tended to purchase less student stationary and prioritised spending on:

- Maintenance materials
- Office supplies
- Reprints of curriculum materials



FINDINGS & RECOMMENDATIONS

Recommendation 1

Introduce a remoteness payment to affected schools on top of the existing Tuition Fee Free Subsidy payments.

Consideration 1.1

The current level of the Tuition Fee Free Subsidy payment should be continued as a minimum guarantee to all schools. Reducing the TFF from its current level would create confusion with schools around the government’s commitment to free education and may lead to some schools levying fees to cover the difference.

Consideration 1.2

The remoteness payment could be provided as a top up that is calculated separately to the Tuition Fee Free Subsidy payment but paid at the same time.

Recommendation 2

The top up should be set at the following percentages of the per student TFF:

- Schools in “Moderately accessible’ LLGs TFF x 10%
- Schools in “Remote” LLGs TFF x 18%
- Schools in ‘Very Remote” LLGs TFF x 33%
- Schools in “Extremely Remote’ LLGs TFF x 56%

Consideration 2.1

Setting the remoteness top up payments at a percentage of the TFF will ensure that it increases in line with the TFF payments.

Consideration 2.2

The estimated cost of a remoteness top up scheme will require a more detailed costing exercise using the 2013 enrolment data as each LLG will have different numbers of students. This data was not available to the review team, however, a ballpark estimate using population as a proxy for student numbers estimates that the scheme would cost an addition of 10% - 15% of the annual TFF payments.



FINDINGS & RECOMMENDATIONS

Recommendation 3

Phase in the remoteness payment using future growth in the total resource envelope for the Fee Free Education policy.

Consideration 3.1

In recognising the need to maintain the TFF at its current level to all schools, one implementation option is to phase in the remoteness payments over a number of years by allocating say half of the growth in the funding pool to the remoteness top up.

If this approach was taken, it is recommended that funding be provided first to those schools located in 'Extremely Remote' locations followed by 'Very Remote' and so on. This would mean that those schools in most dire need are accommodated as a priority.

Recommendation 4

Future work should be undertaken on the cost of schools to better understand the funding requirements of schools in accessible areas. Combining a base costing study with the remoteness index in this report will allow for a more evidence based approach to funding.

Recommendation 5

Future work on the cost of supervision in rural areas should be undertaken. Supervision activities undertaken by District Education officers are also heavily affected by remoteness, but it is not fully captured by the analysis undertaken for this report.



GIS TECHNICAL NOTES

TECHNICAL NOTES ON GIS ANALYSIS

Both the raster and vector data used in this mapping exercise were sourced from the NEFC/UPNGRSC Geobooks 2010. Landsat images were used as backdrops to assist in the identification of Census Units where the District HQ, LLG HQ and Provincial HQ could be located. This was to avoid issues such as placing points and polyline features over water bodies (river, lake, ocean).

Vector data including the administrative boundaries (province, district, LLG), Census Units, PNG Roads 2010, PNG Boat routes 2010 and PNG Airstrips 2010 were used to guide the mapping process. Basically all these data were displayed and overlaid on each other while digitizing.

All spatial data were in MapInfo .tab format. Whenever further analyses needed to be done in ArcMap 10.1, the MapInfo's Universal Translator was used to convert from MapInfo .tab to ESRI shapefiles .shp. A summary of the data description is shown below in table 1.

Raster and vector data description.

Raster	Data	Landsat satellite images for all provinces
	Format	MapInfo.tab
	Coordinate System	Geographic Coordinate System (GCS) - WGS 84
	Cell Size	12.5 by 12.5 (m)
	Source	Joint NEFC/UPNGRSC Geobooks 2010
Vector		
	Data	Provincial Boundary, District Boundary, LLG Boundary, Census Units, Roads, Airstrips, Boat Routes
	Format	MapInfo.tab and ESRI Shapefile.shp
	Coordinate System	Geographic Coordinate System (GCS) - WGS 84
	Source	Joint NEFC/UPNGRSC Geobooks 2010

Non Spatial

The non spatial data used in this exercise were as follows:

- The district and province/town listings provided by NEFC. The mapped districts and towns were taken from this list.
- LLG listing extracted from the DPLGA LLG document dated April 12 2013. The mapped LLGs are those included in this document.
- NEFC's Cost of Services Study 2010 maps in PDF format. These maps were very useful in locating district and LLG headquarters as these information were indicated on the maps by locals during the Cost of Services survey.
- NRI district and provincial profile dated March 2010. This document was also useful to an extent in pointing out some district headquarter locations.

WORKFLOW

This part of the report sets out the general workflow followed in this mapping exercise.

1. As per the list of all Districts and Towns provided by NEFC, individual routes were then mapped to link all district headquarters to each town. The towns were categorized into A, B, C and D based on their population size. Distances between each District Headquarter and each Main Town A, B, C and D were then generated.

2. Mapping work involved first of all, mapping the District Headquarters, LLG Headquarters and Towns as point features. Basically creating a point with its attribute features that can be geographically referenced with x,y coordinates. Figure 1 illustrates how these points would look on the map

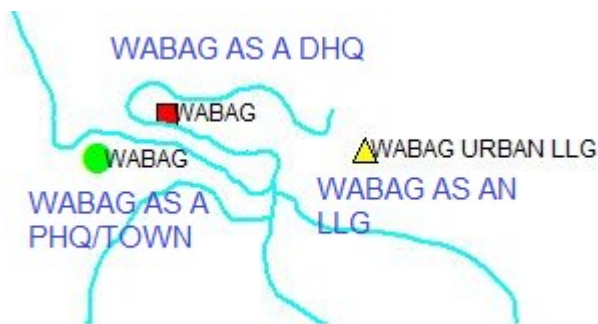


Figure 1: Mapped District HQ, LLG HQ and Town as point features

Secondly, digitizing of routes as polyline features based on existing network. In figure 2 below, the purple line indicates the road digitized as a polyline feature. This polyline feature connects a District HQ to a Provincial HQ/Town. Distances are generated from this connecting polylines.



Figure 2: Digitizing road as a polyline feature

An important part of the mapping process is the entering in of attribute data for each digitized feature. It is these attribute information that attach meaning to the point and polyline features that are digitized or mapped. This was done throughout the mapping process. As shown in figure 3 below is a sample of what the attribute table resembles.

DHQ_from	Town_to	Town_Cat	Mode	Distance
KIMBE	LAE	A	Sea	577.8
KIMBE	LAE	A	Air	424.7
KIMBE	BUKA	B	Air	473.1
KIMBE	BUKA	B	Sea	756.8

Figure 3: MapInfo type attribute table

Where there are multiple modes of travel, these information were captured both on map as well as the attribute table.

3. For the Districts, four MapInfo tables were created to accommodate the travel routes between District Headquarters to each of the Towns categorized into A, B, C and D. For instance, one table is named: Town A Links, this table contained the mapped travel routes between all District Headquarters and all Town A (Port Moresby and Lae). The same is done for B, C and D. On completion, these tables were then combined and converted to a .dbf file for further analysis in Excel.

4. For the LLG, one MapInfo table was created. Similar considerations and approach used to map travel routes between District Headquarter and Province Headquarter/Main Town/Service Center was applied during the mapping of LLG Headquarters to District Headquarters. On completion, the MapInfo table was converted to a .dbf file, also for further analysis in Excel.

OUTPUT

The main outputs of this exercise include:

- Spatial data in the form of MapInfo .tab and Shapefile .shp of all the district and llg as point features.
- Spatial data in the form of MapInfo .tab and Shapefile .shp of all the travel routes and modes as polyline features between LLG HQ, District HQ and Provincial HQ/Main Towns.
- *The most important attribute data forming part of the travel route is the **distance and mode**. The **distance** weighted by the cost per kilometer (mode specific) of travel is highly required in the calculation of the Remoteness Index.*
- MapInfo file of all the travel routes and modes were converted to a dBase file .dbf which is interoperable with MS Excel. Further processing and analyses for the Remoteness Index were then implemented in Excel.

REMARKS

The following notes and challenges are included as concluding remarks to this exercise.

Notes:

- The digitized routes follow the existing road network, for those that travel by road, boat routes for those that travel by water/sea and Air for those that travel by air. Air routes are straight flight path distances.
- The Town, District Headquarter and LLG Head-

quarter locations are based on **available** existing data mainly the Census Units (Census 2000), NEFC's Cost of Services Maps, Geobooks and NRI Provincial Profile.

- Situations where a District Headquarter or LLG Headquarter is located in Town/Urban or District Headquarter, they get a distance of zero. For mapping of routes between District Headquarter and Provincial Headquarter, the decision on which Town A, B, C, D to connect to depended upon the towns' proximity to the District.
- Situations where an LLG HQ could not be found, they are placed at the DHQ.

Challenges:

- Inadequate information on the x,y location of some District and LLG Headquarters. For instance saying an "LLG is located in Kandep district" is not sufficient to put it on map. To derive distances, we need a point A and point B. Kandep has a polygon boundary and any LLG HQ under Kandep could be anywhere within this polygon. Knowledge on the exact point location within this boundary where the LLG HQ is required so that distances can be generated accurately. This is the reason a list of LLGs and their districts on some DPLGA/NRI document for example may not always be useful. What would be useful is if these lists also contain information on names of villages or census units surrounding the point location of the LLG HQ as shown in the table below.

A Sample template of District/LLG listing that is mappable:

District	CU proximity	LLG	CU proximity
Kandep	Along Kandep-Laiagam road, surrounded by Imali, Kokasa and Kapaon villages	Wage LLG	Close to Wipa, Opyao and Bioko villages

It would be worth doing an inventory of the LLG Admin Centers (office) as well, in terms of where they are located. They receive grants annually but where are they operating from? Do they have office/s? If so, where are they located?

In terms of mapping, having these information will help further categorize LLG Locations into two sets: Geographical/Political location and Admin Location. This is a way of gaining further understanding, as well as increasing the level of detail in our efforts to capture service delivery events.

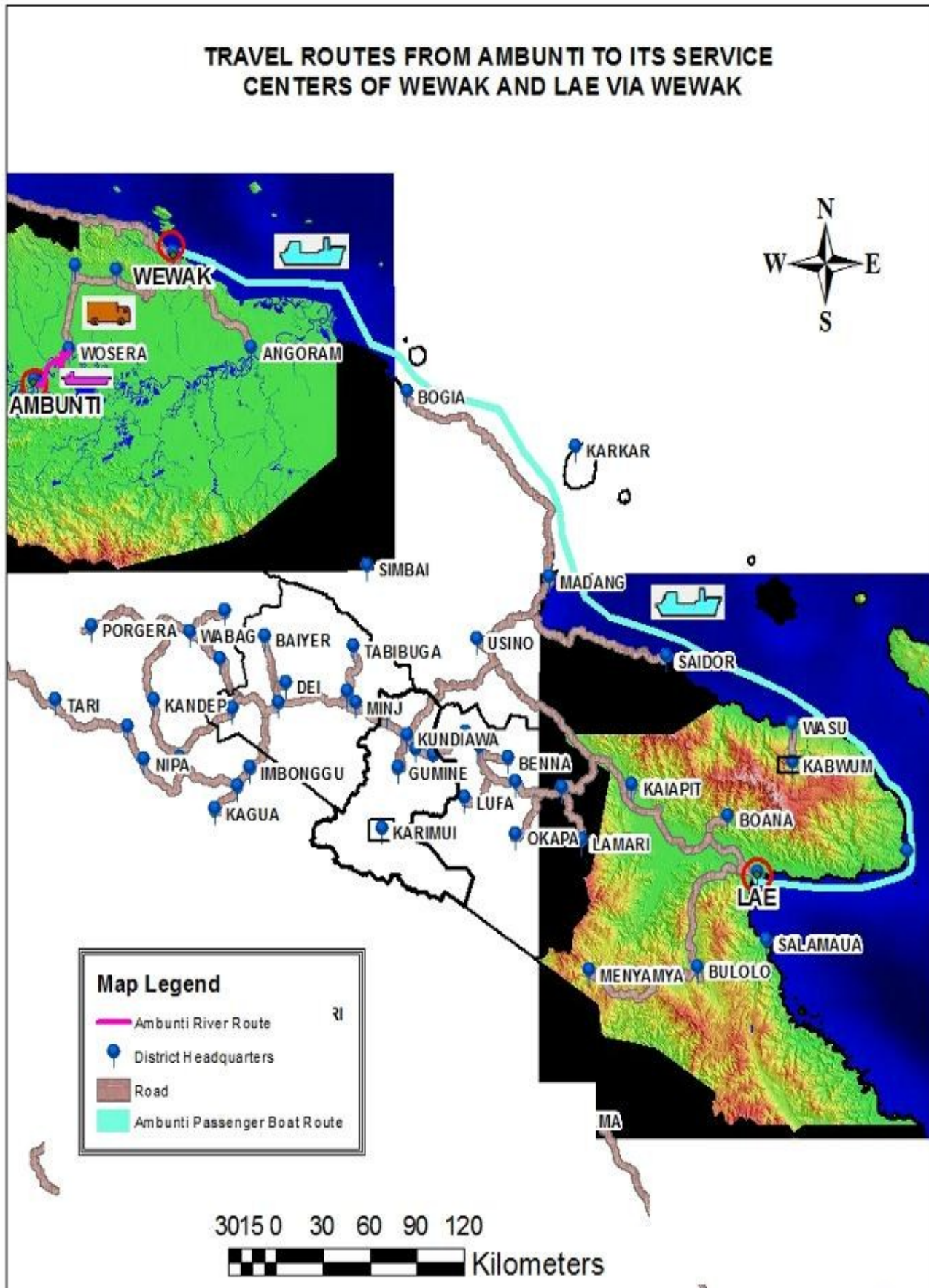
Inadequate information on province and sector specific "actual travel details" associated with **service delivery**. For instance, for each district or LLG, **where** do they go and **which route** and **mode** do they normally take, with regards to mapping? This is so that in future we don't assume modes and routes based on our own criteria.

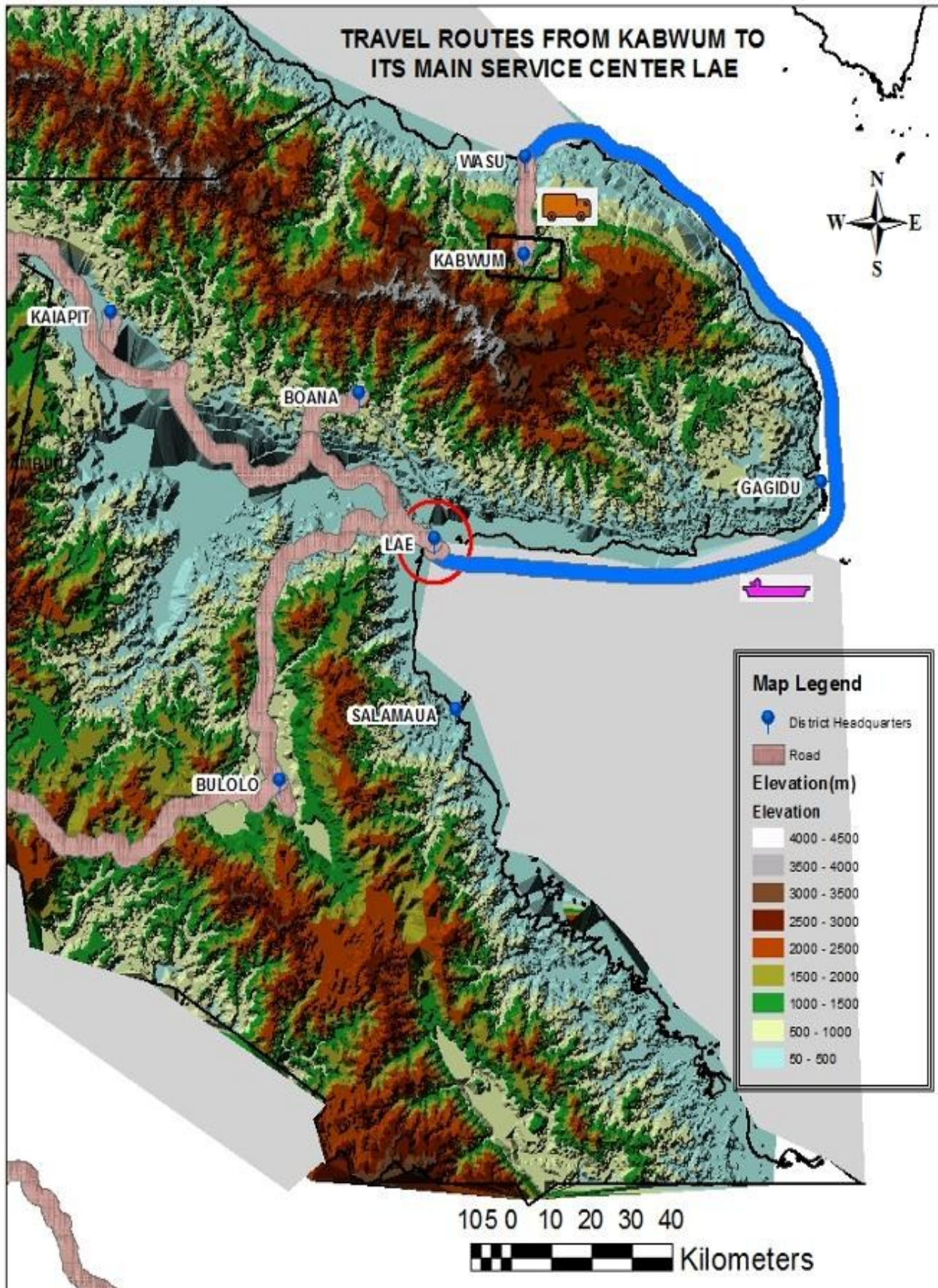
ACKNOWLEDGEMENT

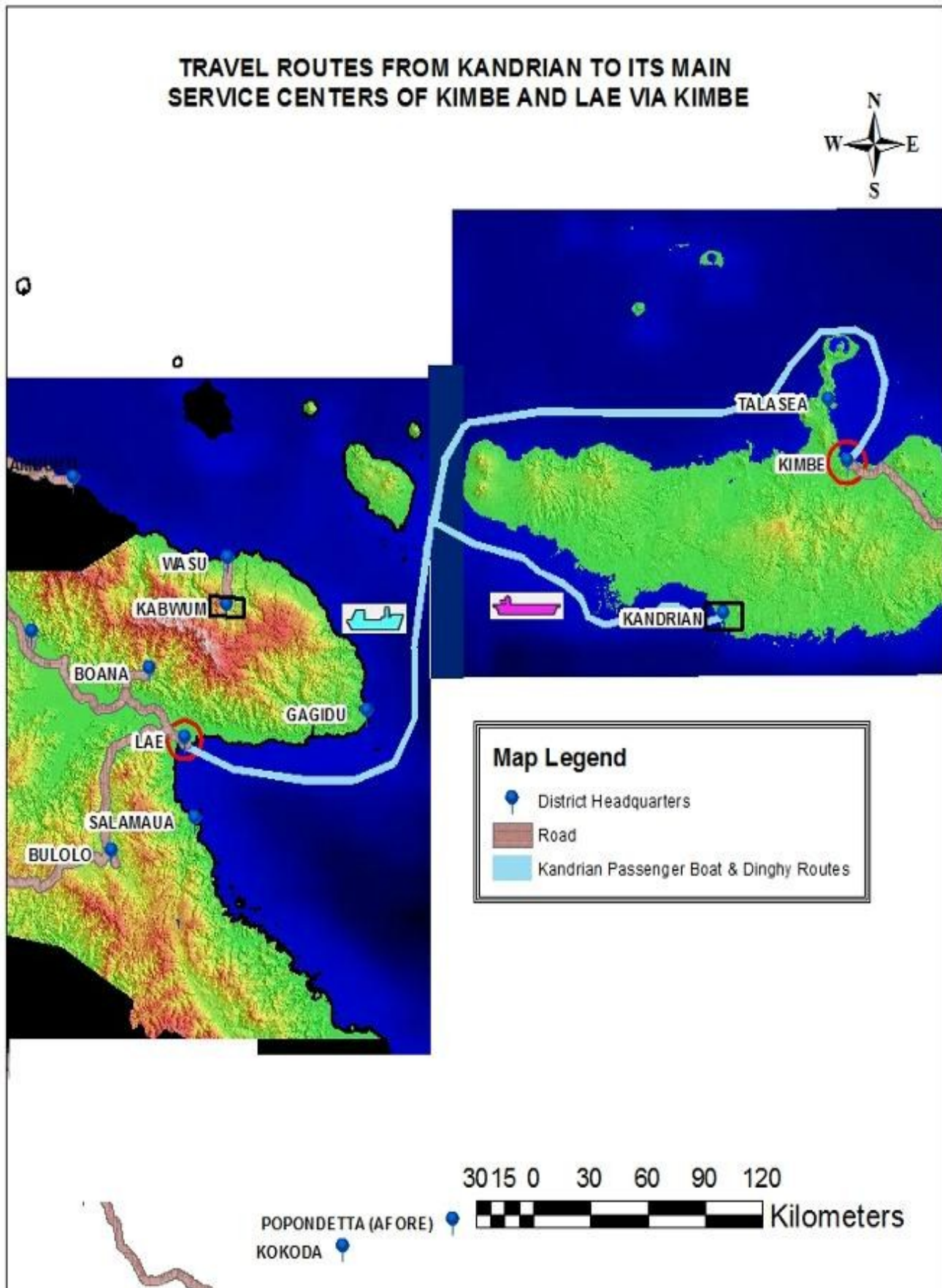
I would like to sincerely thank the staff, management and Advisors of NEFC for their support and contribution to this mapping exercise.

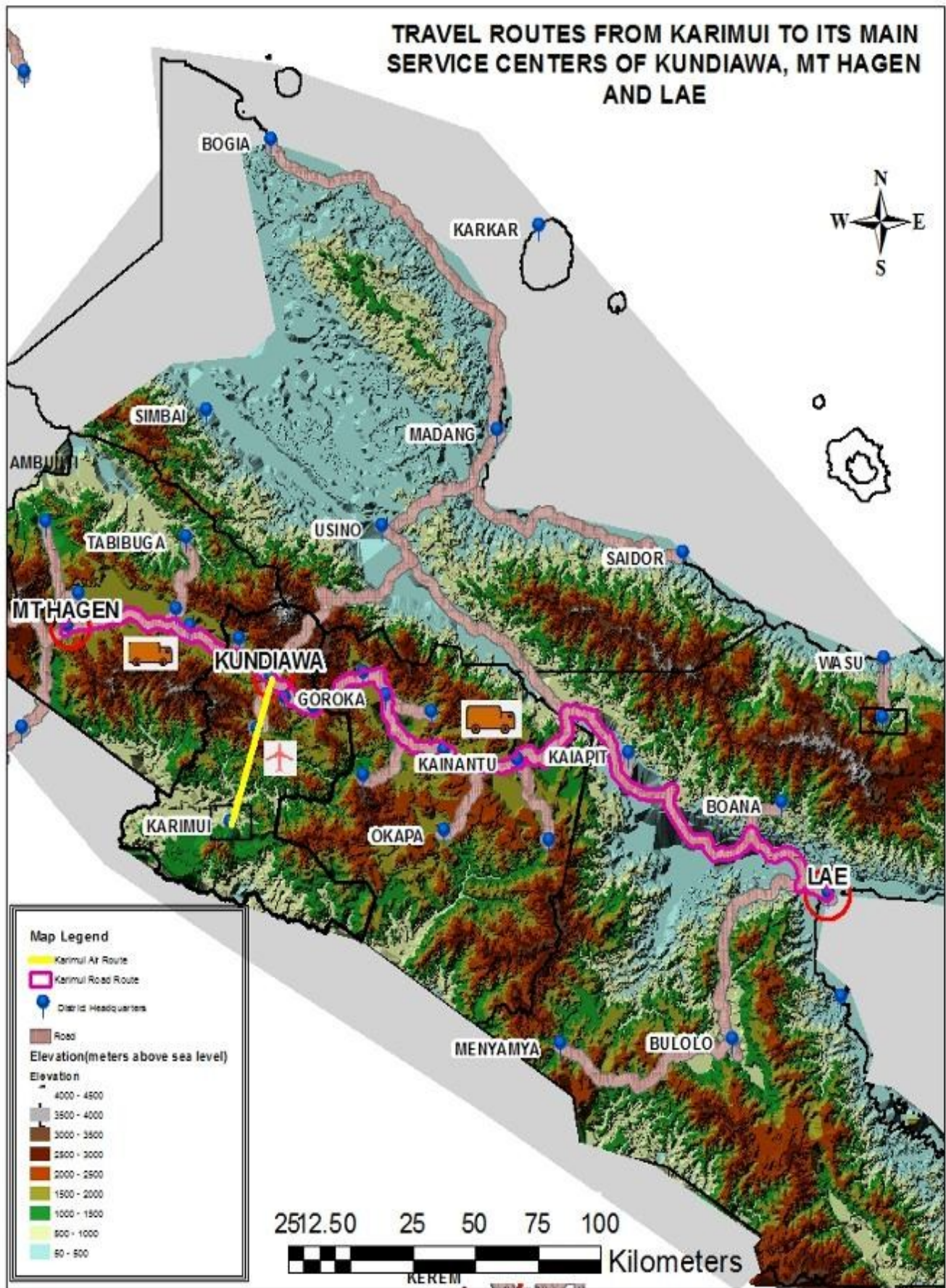
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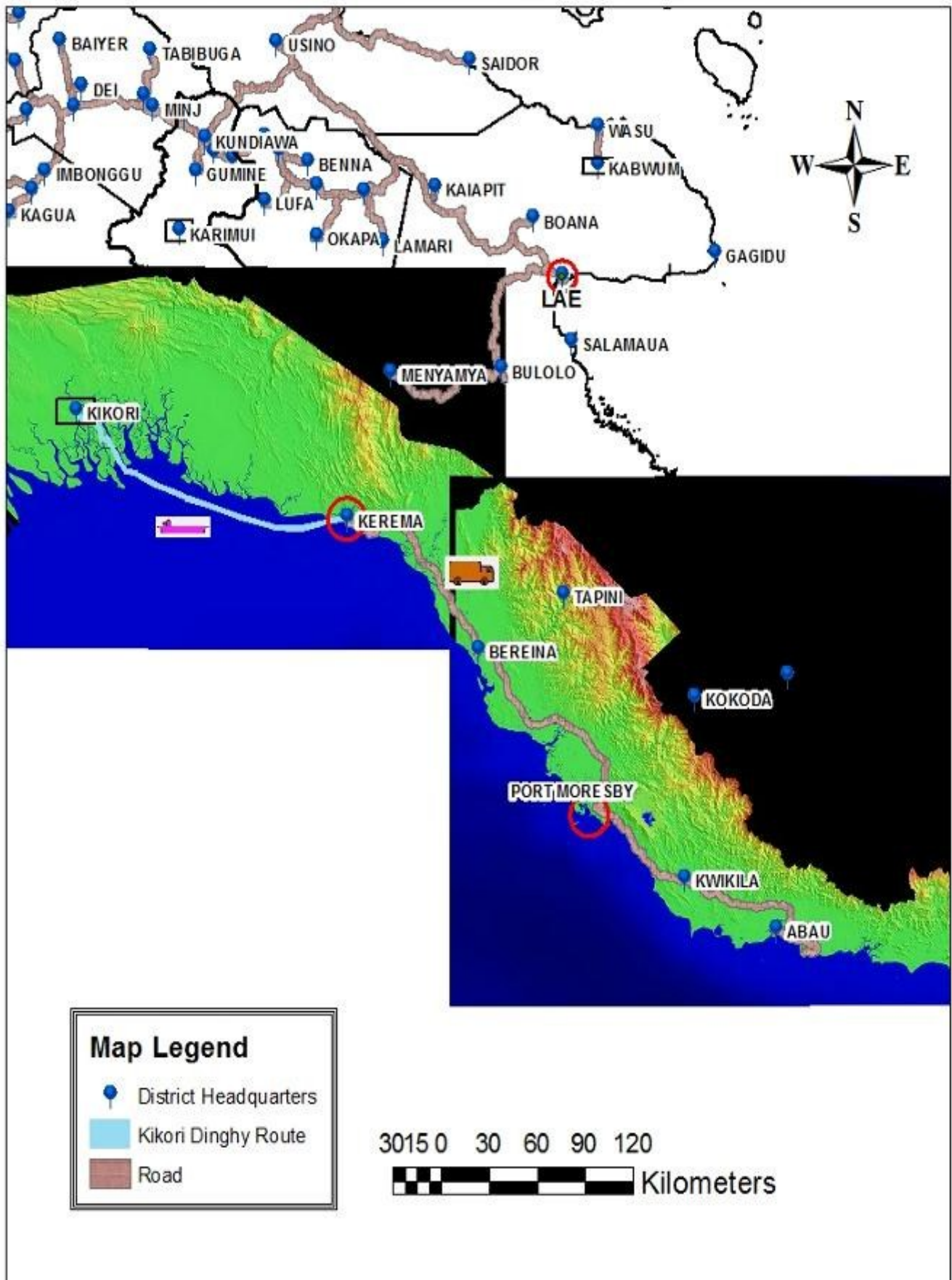


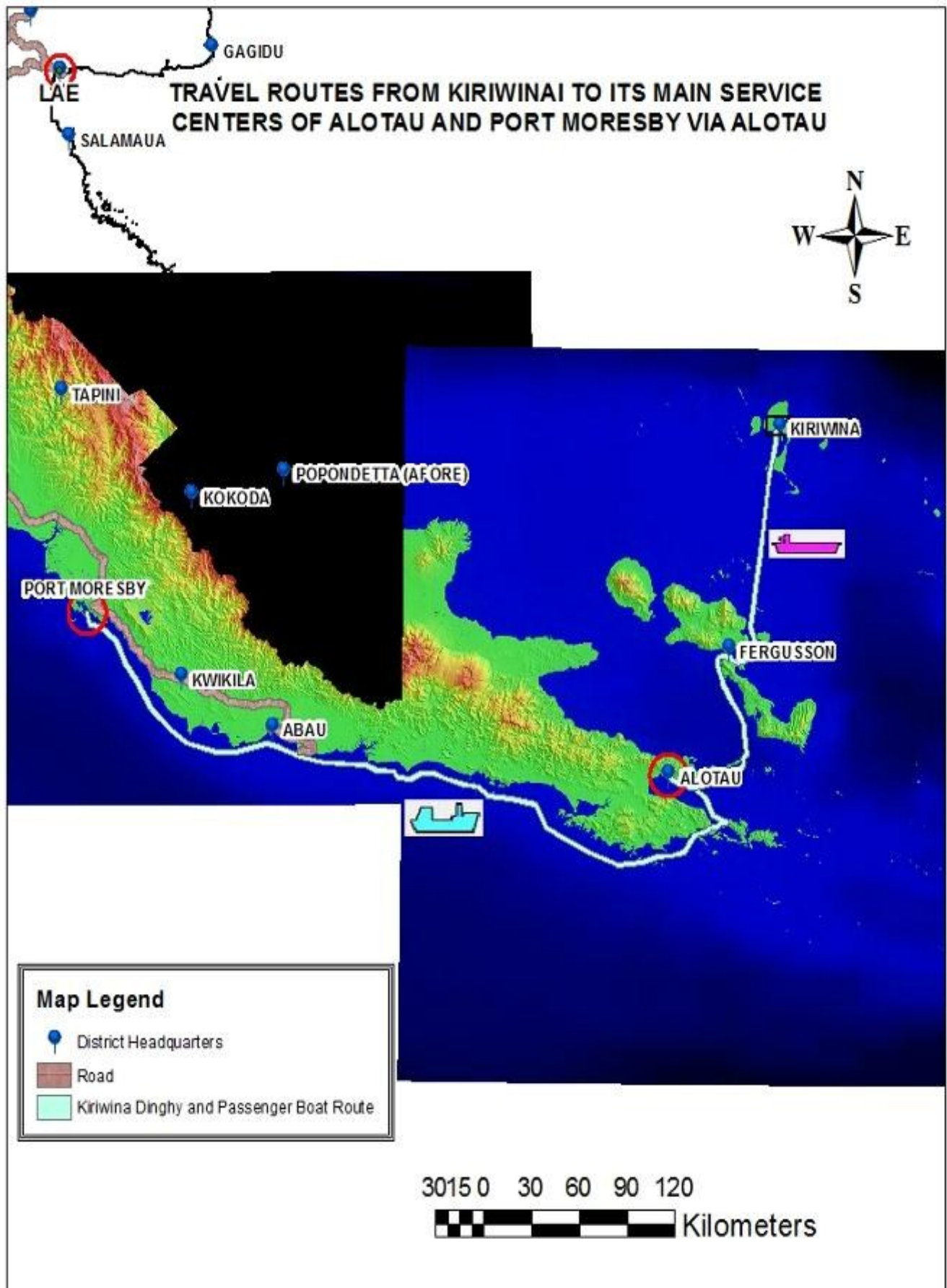






TRAVEL ROUTES FROM KIKORI TO ITS SERVICE CENTERS OF KEREMA AND PORT MORESBY VIA KEREMA







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