

*Full Length Research Paper*

# **Sustainability assessment of land transactions and project benefits sharing in Papua New Guinea**

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There is an increasing concern that land transactions in Papua New Guinea are perceived by some landowners and key government officials as unsustainable due to inequitable sharing of benefits among the tripartite stakeholders. This paper investigates issues surrounding the perceived inequality of benefits derived from land transactions in forestry, mining, oil and gas projects in the South Pacific country using contiguous Western and Hela Provinces as case study. With regards to the land leasing practices of indigenous customary landowners, the paper adopts stratified random sampling to collect primary data from a representative sample of 180 indigenous landowners, state land officials and project operators in the two provinces. One research question and one overarching hypothesis are used to probe whether forestry and mining land transactions and profits sharing in the projects' areas are sustainable. Based on a chi square value of 2.133 and a p-value of 0.85% that are statistically significant at 0.01 levels, the paper accepts the hypothesis, which strongly suggests that land transactions and profits sharing in the two contiguous provinces are sustainable, contrary to criticisms. Since PNG's 22 provinces are largely homogeneous in terms of common land tenure, local Melanesian culture and languages spoken, it is contended that land transactions are consistent with PNG's national land policy. Results also suggest that project stakeholders in the country are consistently adopting land transactions that are convenient and sustainable. The paper, therefore, calls for government intervention to streamline national land transactions for consistency and sustainability under a common national land policy.

**Key words:** land transactions; sustainable benefits sharing; PNG land policy; forestry; extractive projects; Western; Hela; provinces.

## **INTRODUCTION**

In the context of this paper, a land transaction is a contractual agreement involving the transfer of ownership or tenure from the lessor (*freeholder or head lessor*) to the lessee for the use of land for a specified period (IGI, 2015). This paper aims to investigate the relationships

between land transactions (land dealings in Papua New Guinea (PNG) local parlance) and fairness of benefits sharing between landowners and project operators in the country, using contiguous Western and Hela Provinces as case study. The specific indicators of land transactions

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assessed by the paper are land size, lease period, compensation, land rental, royalty, equity, employment, spin-off businesses, community projects/programs, Incorporated Land Groups (ILGs), state leases, and royalty and equity certificates. The three case study sites used for the research are Wawoi Guavi Portions 7c and 8c Forestry Project Lease Area, Oktedi Mining Tailings Stockpile Mitigation Project Lease Area at Bige in Western Province, and PNG Liquefied Natural Gas (LNG) Conditioning Plant Lease Area at Hides in Hela Province.

Land transactions operated in many countries around the world, whether they are bespoke or generic (Hausples Papua New Guinea (2020) vary from one another, depending on the type of law of property ownership and possession that is adopted. Real property in this context comprises structural improvements on land, forest, mineral, oil and gas resources found on and beneath the earth surface. In addition, roads, canals, ponds, buildings and anything else permanently affixed to land are 'real property' (Thomas, 1996). Therefore, land transactions related to leases of land and property by project developers are embedded in lease agreements signed by lessees of land and property including forests, minerals, oil and gas resources rights by project developers. Leases consist of two types of land alienation schemes. The first one is the freehold scheme and the other is the leasehold scheme (Thomas, 1996).

The land transactions (dealings) in PNG are consummated based on two land tenure systems: customary and alienated land tenures. Customary land tenure is administered by custom whilst alienated land tenure is administered under respective land and resource laws. According to Lakau (1991), PNG previously had 97% of land under customary tenure whilst alienated land stood at 3%.

However, a more recent study by Chandler (2011) has found that the land under customary tenure has been further reduced to 86% and alienated land tenure increased to 14%. The increase in alienated land in PNG was caused by additional acquisition of land for public purposes and by agricultural-forestry and extractive resource project dealings (Chandler, 2011). Some of the lands acquired under the freehold scheme in the colonial era were for colonial plantations owned by European plantation owners. Later they were acquired and transferred to landowners and citizens of PNG through a Land Redistribution Scheme enacted by the Land Redistribution Act 1973 (Muroa, 2003). The 5.2 million ha of land acquired under the Special Agricultural Business Leases (SABL) scheme for forestry projects throughout the country are additional lands alienated by the state (Numapo, 2013). In addition, land acquired under the PNG LNG in 2009 and 2014 were also additional lands alienated by the state (Filer, 2019).

Acquisition of land in PNG for forestry, mineral, oil and gas resource projects is usually predicated on the basis that the purchased logs, mineral, oil and gas resources

are owned by the State according to respective resource laws. The State acquires these private lands and further leases the lands and the forest and extractive resource rights to project developers to extract the resources. The provisions in the Forestry Act 1991 Section 56 subsection 1, Mining Act 1992 Section 5 subsection 1, and Oil and Gas Act 1998 Section 6 subsection 1 declare that all purchased logs, minerals, petroleum and helium products are the properties of the Independent State of Papua New Guinea and all activities conducted under these laws are deemed to be in the national interest, as stipulated in the Forestry Act, 1991; Mining Act, 1992; Oil and Gas Act, 1998.

The state also acquires land in order to lease forestry, mineral, oil and gas resource rights to project developers under certain land and resource laws. Firstly, in the mining projects, the State grants *Special Mining Leases* and *Leases for Mining Purposes* to the tenement holder or project operator as required under Section 33 and Section 65 of the Mining Act, 1992. Secondly, under the Oil and Gas Projects, the State acquires surface land for establishment of oil and gas processing facility infrastructures under section 120 of the Oil and Gas Act, 1998. Finally, the land acquired for forestry project is done by agreement under section 57 of Forestry Act, 1991.

In comparison to the SABL scheme under lease-lease back stipulated in sections 11 and 102 of the Land Act 1996, customary landowners lease their customary land to the state, and in return the State grants State Leases to landowners to enter into sublease arrangement with the forestry and agricultural project developers. Apparently, a similar character of SABL under Lease-Lease Back Scheme is adopted in the mining and oil and gas project land transactions (dealings). The leases under mining and oil and gas projects are done under compulsory acquisition processes but the characteristics are similar in nature to the SABL under Lease-Lease Back Schemes in sections 11 and 102 of the Land Act 1996. The land transaction schemes employed have been adopted in several forestry, mining, oil and gas projects in PNG, according to the PNG LNG Office (<https://pnglng.com/About>, accessed on 09/09/2020).

The acquisition of land for all purposes is subject to the concept of compulsory acquisition of land. Prior to independence in 1975, PNG had adopted its land alienation and acquisition of forest and extractive resources system from the British Common Law system. The power of compulsory acquisition was first exercised in 1886 when the Administration in Papua required land at Hanuabada, Port Moresby, and the national capital, for a cemetery site (Amankwah et al., 2009). In Papua, until the Land Ordinance of 1906 was enacted, there was no statutory power for compulsory acquisition of land. The ordinance (section 23) together with the Land ordinance, (section 58) between 1911 and 1940, empowered the government to compulsorily acquire land, both alienated

and customary (unalienated).

The Wawoi Guavi Forestry Project in Western Province is operating on an alienated leased land acquired under the Forestry Act 1991 and Land Act 1996 (Muroa, 2003; Numapo, 2013; Baker, 2011). The mining projects including Oktedi, Pogera, Lihir, Ramu Nickel and Wafu Golpu are also operating on alienated leased lands acquired under the Mining Act 1992 and Land Act 1996 (Papua New Guinea Chamber of Mines and Petroleum, 2000; PNG Chamber of Mines and Petroleum, 2000; Papua New Guinea Mine Watch, 2013). Finally, the PNG LNG project facility infrastructures in Hides, Angore, Juha, Kutubu, Moran and Gobe and in Papa Lea near Port Moresby are operating on alienated lands acquired under the Oil and Gas Act 1998 (Papua New Guinea Oil Search, 2014, 2020; Filer et al., 2000; Minnegal et al., 2018). In other words, the three sites accommodating the three case studies examined in this paper are alienated leased lands.

With regards to this background, this paper is designed to assess the sustainability of PNG's system of land transactions in forestry, mining, oil and gas projects in PNG. This study is necessary because when land transactions are not efficient, projects implemented on land cannot be sustainable as frustrated landowners who feel sidelined by project developers might go on the offensive and seek legal redress or some other means to protest against unfair benefits sharing. In the process, they could destabilise investors' and State's plans for effective and sustainable management of forestry, mining, oil and gas projects on alienated lands in the country.

The paper is divided into four main sections. After the introduction in the first section, the second section presents the materials and methods (with sub-sections devoted to the nature of the problem investigated, research question and hypothesis, contributions to knowledge, conceptual framework and operationalisation of key concepts, literature review, case study sites, characteristics of land transactions in the study areas, project site descriptions and statistical determination of sample size). The third section presents the results and discussion, while the fourth section presents the conclusion and policy implications of the paper.

## MATERIALS AND METHODS

### Nature of the problem

The dual problem that this paper seeks to investigate is, firstly, the inconsistent payments of benefits from land transactions in Western and Hela Provinces in PNG including land rentals, royalty and equity amongst landowners in resource lease areas and in support facility infrastructure lease areas. It is argued that benefits such as land rental, royalty and equity benefits paid to landowners in resource areas differ from those paid to landowners in support facility infrastructure lease areas within the same forestry, mining, oil and gas projects in the two contiguous provinces. Secondly, the adoption of landowners' recognition certificate schemes, including

ILGs, State lease titles, royalty and equity certification schemes is inconsistent between resource lease areas and support facility infrastructure lease areas. These two inconsistencies (benefits sharing and title certification processes) in land transactions within the forestry, mining, oil and gas project areas have caused disharmony amongst respective landowners, State agencies and project developers. For example, at the 2019 National Land Summit (<https://dlpp.gov.pg>, accessed on 21/08/2020), the former Minister of Lands and Physical Planning - Honourable Tkatchenko - suggested that land laws and policies in PNG guiding land and resources should be reviewed in order to accommodate challenges faced during land transactions in the country (Post Courier Newspaper, 2019, Jan. 22). The present study is an attempt at investigating the feasibility of implementing the ex-Minister's suggestion.

A similar suggestion had been raised in 2019 by the Honourable James Donald, Member for North Fly Electorate, that the oil and gas Act 1998 should be reviewed to allow for fair land transactions (dealings) with provincial governments, local level governments and landowners with regards to the sharing of royalty, equity and other discretionary benefits (National Newspaper, 2019, April 11). It is contended that the disputed performance of the existing land and resource transactions and the sharing of benefits are causing disharmony amongst the state, project operators and the landowners. Without taking sides, our investigation is intended to reveal the true status of benefits sharing and landowners' recognition certificate schemes in terms of their fairness, consistency and sustainability in PNG.

There is a paucity of relevant previous studies addressing these land transaction challenges, which must be resolved to pave way for the sustainability of tripartite forestry, mining, oil and gas projects in PNG generally and in Western and Hela Provinces in particular. The authors of this paper have witnessed many of these challenges during their many years of professional practice and interactions as licensed property valuers and land managers around the country. If the challenges are not resolved and land transactions continue to be fractured along jurisdictional lines, there is serious doubt that PNG can attain the desired sustainability of its land policy and land resources as anticipated by PNG Vision 2050. This is the rationale behind this research paper.

Therefore, this paper is designed to assess the sustainability of forestry, mining, oil and gas projects in PNG, particularly in Wawoi Guavi Forestry, Oktedi Mining Tailings Mitigation, and PNG LNG-Hides Gas Conditioning Plant Lease Areas in Western and Hela Provinces, PNG. Towards this end, the paper attempts to answer a research question and test one hypothesis as outlined in following section.

### Research question, hypothesis and contributions to knowledge

#### Research question

How can the key performance indicators of sustainable land transactions in forestry and mining projects in Western and Hela Provinces, PNG, be assessed?

#### Hypothesis

*H<sub>1</sub>: "That there is a significant difference between the sustainability performance of land transactions in forestry and mining projects in Western and Hela Provinces."*

#### Conceptual framework

The conceptual framework for this paper targets the proposed

streamlined and unified forestry and extractive resource projects' land transactions (dealings) in PNG, based on the professional field observations and literature review of operations in the forestry, mining, oil and gas projects in Western and Hela Provinces (Muroa, 2003; Numapo, 2013; PNG Chamber of Mines and Petroleum, 2000; Filer, 2000). To further reinforce and exemplify the unified land transactions framework (Figure 1), the paper adopts the principles of *Systems Theory* and *Cybernetics Systems* (Hylighen and Joslyn, 1994).

At this juncture, the essence of this paper is to propose a unified land transaction model for Papua New Guinea for purposes of consistency and sustainability under a unified national land policy for the country. The systems theory and cybernetics systems provide a scientific explanation of how disintegrated knowledge, in the form of sub-systems, can be integrated under a single or unified system (Hylighen and Joslyn, 1994). The *systems theory* also explains the connections of different parts whilst the *Cybernetics* system explains how the different parts communicate and function in a unified body or main system. The big picture behind advocating for a unified land transaction system is to lay a solid foundation for PNG's sustainability in line with the objectives of PNG Vision 2050 and the UN's 17 SDGs aimed at transforming PNG because land is the pedestal for strategic national development (PNG Vision 2050 - <https://actnowpng.org>; accessed on 20/03/2021).

Nevertheless, it has been argued by Gershenson (2006) that although the synergy resulting from cooperation by the subsystems is generally advantageous, yet, selfish or subsystem optimisation precludes the reaching of a globally optimal cooperative arrangement. The *systems theory* and *cybernetic system* are a combination of theories that unify the disintegrated knowledge into a unified, structured system or body. This theoretical underpinning has been adapted into a framework that unifies forestry and extractive (mining, oil and gas) resource project land transactions in PNG. In other words, this conceptual framework is a fusion of existing disparate land transaction (dealing) concepts resulting in a single unified model.

### Operationalisation of key concepts

To customise this conceptual framework, the authors have operationalised some key concepts that are embedded in Figure 1 as follows:

*i) Royalty* - Royalty is a percentage of a gross or net profit or a fixed amount paid to the creator of work or a product, which is determined through an agreement between the owner or the creator of the product and the manufacturer or distributor. For example, a right to receive payment based on the percentage of the minerals or other products produced at a mine or of the revenues or profits generated from the sale of those minerals or other products at a mine. It is simply a share of production income (Norton Rose Fulbright blog (2015). For the purpose of this study, royalty refers to mineral rent that the project operator pays to the State for leasing the resource extraction rights. The State then shares royalty with the landowners in the project area.

*ii) Equity* - In corporate project financing (that is asset-based finance where a large company may be able to borrow on the strength of the assets of the company itself rather than its individual projects), equity relates more to a method of funding a development project (Tuovila, 2020). This may include arrangements such as participation lending and forward funding. In participation lending, the lender will take a share of the proceeds of a scheme (project) and this may occur where a lender is taking a higher risk, by lending more or at more advantageous rates of interest. Equity capital (or shares) is the capital paid into or kept in the business by the shareholders or owners of the business. It is long-term capital and carries greater risks and attracts higher returns than debt capital.

The equity of a company consists of ordinary shares, and shareholders participate in the profits achieved by the company once prior demands have been met; these prior demands for payments will include creditors (trade creditors), holders of debt and preference shareholders. If a company finds that the total of accumulated and retained profits in the company's reserves have grown in relation to issued capital, then a script or capitalization issue can be made. The distinction between debt and equity depends on whether the money is borrowed (debt), and here the lender has no direct involvement in the project, or whether the money has been invested on the basis of sharing both the risk and the returns of the project (equity). Borrowed money needs to be repaid and interest will be paid on the outstanding amount until the debt is repaid. The equity returns for the person who puts up the money is determined by the success of the enterprise. The person shares the profits and if there are none, then there is no return. In relation to this study, equity is the share of money paid by a project operator to the State after the State pays off the sunk cost and capital investment. The State further shares the equity with the landowners.

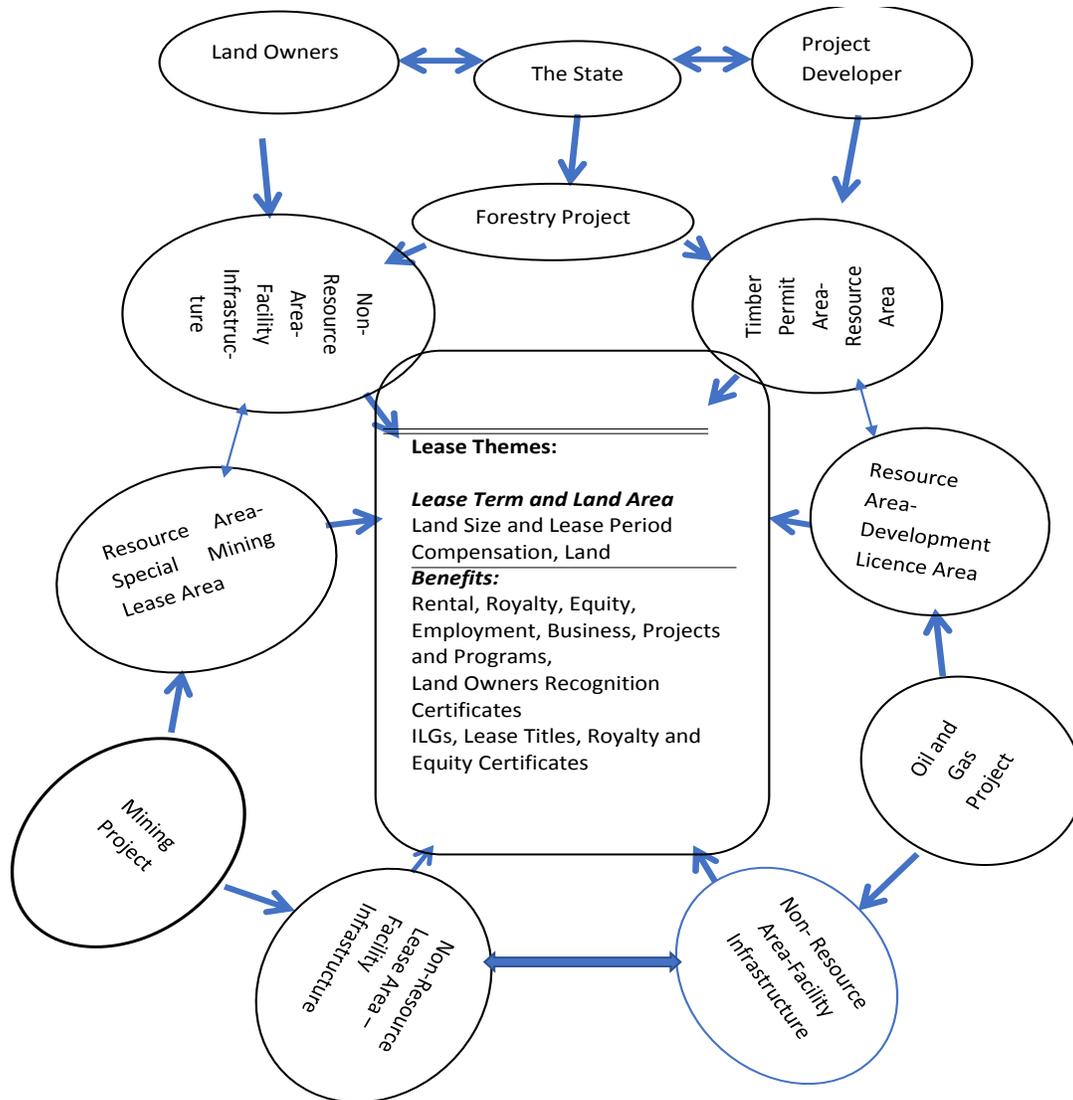
*i) Lease Rental Agreement* - A lease rental agreement is a legally binding document that creates a contract between the landlord (lessor) and the tenant (lessee), in respect of which the tenant agrees to pay rent for occupying or using the property, and both are binding by the terms of the agreement (Amankwah et al., 2009). For the purpose of this paper, the lease rental agreement refers to a lease agreement executed between the landowners, project developer and the State with regards to the benefits derived from the lease of their land for forestry, mining, oil and gas projects throughout the country.

*ii) Compensation* - Compensation is a reward given to someone in recognition of a loss, suffering or injury (<https://www.google.com>). In this paper, compensation is a payment made to landowners for damages done to the environment or improvement (betterment) achieved within or outside the leased land area, which the project developer ought to pay. The legal roots of compulsory land acquisition and compensation in PNG (Amankwah et al., 2009) have already been examined earlier in this paper under the introduction.

### LITERATURE REVIEW

Before any forest, mineral, oil and gas projects are commissioned, it is mandatory that the surface land must be alienated first before the State can lease the forest, mineral, oil and gas extraction resources to the project operator by way of development licenses and permits. These land transactions are done under Freehold Private and State Leasehold Schemes (<https://hausples.com>, accessed on 21/10/2020). Some of the lands acquired under *Freehold Scheme* in the past were colonial plantations owned by European Plantation owners. These parcels of land were later compulsorily acquired by the State and transferred back to some existing landowners and other citizens of PNG who faced a shortage of land under the Land Redistribution Scheme Act of 1973 (Muroa, 2003), which came into being straight after the first Commission of Enquiry into Land Matters in 1973. Further acquisition of land which contributed to the increase in alienated land from 3% to 14% was caused by State's alienation of 5.2 million ha of land for forestry and agricultural projects under the SABL scheme throughout the country, which resulted in the setting up of a Commission of Inquiry into SABL projects in 2011 (Numapo, 2013 June 24). One example of the SABLs is Wawoi Guavi Forestry Project in Western Province (<https://www.pngforests.files.wordpress.com-14wawoi-guavi.pdf>, accessed on 15/5/2020).

Apart from acquisition of land for forestry projects, the State also acquired more land under the mining, oil and gas resources



**Figure 1.** A Conceptual framework for forestry, mining, oil and gas projects' unified land transactions system  
 Source: Authors 2020.

projects and leased them out to project developers. The following are some of the mining projects currently operating in PNG: Oktedi, Pogera, Lihir, Ramu Nickel and Wafu Golpu PNG (Chamber of Mines and Petroleum, 2000; PNG Mine Watch, 2013). In addition to mining projects, the State also acquired land for oil and gas projects. The following are the oil and gas project fields under PNG LNG project: Hides, Angore, Juha, Kutubu, Moran and Gobe and their facility infrastructures (Filer, 2019). In relation to the former and latter, the land and resource dealings in PNG continue to be operated on the following basis: Firstly, the land belongs to landowners and therefore the State must alienate the land. For forestry projects the land is acquired for the project under Section 55 subsection 1 of the Forestry Act 1991 and Section 11 and 102 of the Land Act 1996. For mining projects, the State acquires land under Sections 33 and 55 of the Mining Act 1992 and for oil and gas projects, Section 120 of the Oil and Gas Act 1988 applies.

Secondly, the purchased logs, minerals, oil and gas resources belong to the State under certain provisions of the resource laws. Section 56 subsection 1 of the Forestry Act 1991 declares that the

purchased logs belong to the State whilst Section 5 subsection 1 of Mining Act 1992 declares that all minerals belong to the State.

Finally, Section 6 subsection 1 of Oil and Gas Act 1998 declares that all petroleum and helium resources belong to the State. The project operator comes around to lease the surface land in order to harvest the logs and extract the minerals and oil and gas resources. With this notion, the State alienates the land and leases both the land and the resources (timber, minerals, oil and gas) rights to the project operator. In return the project operator pays the landowners the following benefits: compensation for damage caused to the land and improvements, land rentals, employment opportunities, spin off businesses, community projects and programs. On the other hand, the project operator pays royalty and equity from the sale of the resources to the State. The state then pays some shares of royalty and equity to the landowners of the resource areas and the project facility infrastructure lease areas.

Among the benefits received by the landowners, some are consistent for both the resource area landowners and the facility infrastructure area landowners, whilst others are not. For example

in the mining project areas, landowners in the *Special Mining Lease Areas* are entitled to receive compensation, land rental, royalty, equity, lease rental, community projects, employment, business and community projects and programs, whilst the landowners of *Lease for Mining Purpose* are not entitled to royalty and equity but other benefits that are similar to what the land owners of *Special Mining Leases* receive. A similar arrangement obtains in the forestry project areas. However, in the Oil and Gas Projects, the sharing of royalty and equity among landowners of the project segment areas are contrary to those of mining projects. Section 170 of the Oil and Gas Act 1998 allows landowners of the project segment areas to share the royalty and equity fairly. This includes landowners of the resource areas and the support facility infrastructure lease areas.

At the global level outside PNG, forests contribute to the world's economic growth, create employment opportunities and reduce poverty in communities. In addition, forests provide ecosystem services that sustain agriculture, energy and water in both developed and developing countries of the world (Overseas Development Institute, (ODI), 2007). On the other hand, there are worldwide responses to climate change for achieving the 17 sustainable development goals of the United Nations (<https://www.un.org/sustainabledevelopment/climate-change/>, accessed on 20/10/2020). Furthermore, according to the United Nations Forum on Forests (2015), over 1.6 billion people in the world depend on forests for subsistence, use, livelihoods, employment and income generation. In addition, forests provide a wide range of goods and services that address the most pressing sustainable development challenges (United Nations Forum on Forests, 2015). Above all, global humanity depends on the world's forests for livelihoods and survival.

In light of the global climate change, PNG has adopted a National Forest Policy embedded in the National Land Use Policy (PNG Sustainable National Land Use Policy, 2018) that has encouraged PNG Forestry Authority, forest investors and landowners to actively participate in the development of reforestation, forest plantations and downstream processing with a view to mitigating the impacts of climate change by implementing the National Forests Plan 1996 under the Forestry Act 1991. One of the priorities in the National Forests Plan is to seek *Landowners' Consent* before entering their lands and beginning to harvest logs as stipulated in section 57 of the Forestry Act 1991. This is essentially important because 99% of forest lands in PNG are held under customary land tenure (ODI, 2007) and two thirds of the land are under forest cover in which each citizen has some rights for sustainable livelihoods (Price Water House Coopers, 2006).

## Project site descriptions

### ***i) Wawoi Guavi portions 7c and 8c forestry project in middle fly district of western province***

Wawoi Guavi forestry project (Figure 2) is in the Bamu Local Level Government Area in the Middle Fly District of Western Province. The project operates under the concession 01-07; it has five (5) portions of lease areas in the project with an approximate total land area of 77,783 hectares covering portions 5c, 6c, 7c, 8c and 9c. The data have been collected from questionnaires circulated to survey respondents in portions 7c and 8c. Portion 7c has 15,153 ha of land area whilst portion 8c has 11,110 ha of land totaling 26,263 ha of land. The duration of the project life is 30 years as per the concession; however, the State lease granted over portion 7c and 8c is for 70 years (Baker, 2011).

Though this project is a renowned enterprise in PNG, it has portrayed a lot of negativities due to social and environmental damages, human rights violations, lack of spin-off businesses and employment opportunities. Most of the people in the area view this project as the only source of income that provides social services in

the area as there is hardly any other government presence there. Yet, despite all the associated negativities, given adequate government support in terms of regulations, supervision and adherence to National Forest Plan standards, the government can begin to implement reforestation and all the development levies that accrue from it can be used to give back to the communities in terms of better road services, health and education infrastructures and services. Unlike minerals, oil and gas resources, forest is a renewable resource and with the existing leases on site, the government can utilise the alienated land by implementing reforestation programs and continue the forestry business in a more sustainable manner.

However, the sample population used for collecting data is based in Hides Gas Conditioning Plant lease area which has more data available than Juha and that is why and how Hela Province was adopted as part of the study area. Ultimately, there are three study sites where the sample population was interviewed through questionnaires for collection of relevant data: Wawoi Guavi Forestry Project at Portions 7c and 8c; Oktedi Mining Project Tailings Stock Pile Mitigation Lease Area at Bige and Hides Gas Conditioning Plant Lease Area of PNG LNG Project at Komo in Hela Province as earlier indicated.

Therefore, in summary, the sample population from each site investigated consists of landowners of each of the three project areas, relevant State agencies responsible for each of the project lease areas and project operators' officers from each of the project lease areas. The facility infrastructure lease areas were included in the study in order to make comparisons with land transactions done in resource areas of forestry, mining, oil and gas projects and to establish their relationships.

### ***i) Oktedi mining project and tailings mitigation lease area***

Oktedi Mine Project (Figure 3) is an open cut mine located near head waters of Oktedi River in the Star Mountain Rural Local Level Government Area of North Fly District in the Western Province of Papua New Guinea. The Special Mine Lease Area has a total of 2,735 ha of land (Oktedi Annual Review, 2017). It is located above 200m (6,600 ft) on Mount Fubiland in a region of high rainfall and frequent earthquakes (Oktedi.com, 2020).

The tailings from the mining operations are directly dumped into Oktedi River systems and collected by dredging machine at Bige Tailings Stockpile Lease Area 100km downstream from the mine pit. OTML has dredged approximately 370 mountains of sand from the river at Bige since 1998. The dredging operations remove 85% of the tailings in the lower Oktedi River preventing sediments from further travelling downstream. The dredging operations will continue to the end of the mine life, but it has been predicted that the future impacts will be minimised (Oktedi Mining Limited, 2017).

The biggest challenge here is mitigation of the tailings dumped from the Oktedi Mine pit and stockpiled at Bige. The future impact after the mine ceases operation is the greatest challenge ahead to landowners, and provincial and national governments. At the same time, the opportunity is that the project has created employment and spin-off business opportunities for landowners and local communities within the lease area at Bige especially in favour of the landowners. Hence, the lease can continue to operate after the mine ceases to operate for another term of years.

### ***ii) PNG LNG project and hides gas conditioning plant lease area***

The US \$19 billion PNG LNG Project (Figure 4) is an integrated project that includes gas production and processing facilities extending from Hela, Southern Highlands, Western and Gulf provinces all the way to Central Province 20 kilometers outside of



**Figure 2.** Photograph of Kamusie main industrial area incorporating the log pond, airstrip, and base camp areas (Rimbunan Hijau Logging Camp at Kamusi (Wawoi Guavi) Logging Concession Area.

Source: PNG Mine Watch, <https://pngexposed.wordpress.com/tag/workers-conditions/>, accessed on 9/10/2020.



**Figure 3.** Oktedi Mining Project Tailings Mitigation Lease Area (LMP 85) and Mine Pit.

Source: PNG Mine Watch: <https://pngexposed.wordpress.com/tag/workers-conditions/>, accessed on 9/10/2020.

Port Moresby. ExxonMobil PNG Limited is the operator of the project on behalf of its five project partners. The gas is transported over 700 kilometres of onshore and offshore pipelines to liquefaction and storage facilities near Port Moresby (<https://www.google.com/search?q=Hides+Gas+Conditioning+Plant>, accessed on 21/11/2020).

The Liquefied Natural Gas (LNG) production began in April 2014 and has been supplying LNG to Asian markets including China Petroleum and Chemical Corporation (Sinopec), Osaka Gas Company Limited, Tokyo Electric Power Company Inc and CPC Corporation. The project has the capacity to produce more than 8.3 million tons of gas per annum but on an average of 6.9 million every year (<https://www.google.com/search?q=Hides+Gas+Conditioning+Plant>, accessed on 21/11/2020).

Though there have been negative reports about landowners' issues over nonpayment or delayed benefits of royalty, equity,

business development grants and development levies promised by the State and project operator, the project has largely met the expectations in the agreements. The following are the benefits provided by the project: employment opportunities to an estimated 3, 200 people of whom 86% were Papua New Guineans and 19% were women. More than K14.3 billion have been spent on services granted to PNG companies since 2010 and it has groomed 250 PNG businesses and provided 16 landowner companies with needed support services. Furthermore, approximately K930 million has been spent on community and infrastructure programs in education, health and women's empowerment, environment and agriculture (<https://www.google.com/search?q=Hides+Gas+Conditioning+Plant>, accessed on 21/11/2020).

The Hides Gas Conditioning Plant lease area is located outside the Township of Hides in Hela Province in PNG. The major challenge to the government and the project operator - Exxon Mobil



**Figure 4.** PNG LNG hides gas conditioning plant lease area.

Source: <https://www.google.com/search?q=Hides+Gas+Conditioning+Plant>, accessed on 21/11/2020.

- was displacement of landowners from the current site and relocating them to a new site that the government had to acquire in form of additional land for resettlement of the affected landowners and communities in the area. Though these challenges have persisted, all parties have collaborated and addressed the resettlement program. All impacted landowners have been compensated for their loss in the form of structures, food crops, and deprivation of rights to dwell on the land. In addition, employment, business opportunities and community projects are now visible in the area.

To date, the Hides Gas Conditioning Plant processes 1 billion cubic feet of gas gathered from eight wells in a day. At the plant, the gas condensate and water are separated and treated before being transported via a separate 700km pipeline to liquefaction facilities in the Central Province. The plant further produces 30,000 barrels of condensate daily, which are piped separately to Kutubu Central Processing Facility and later transported via pipeline to Kumul Terminal for export in Gulf Province <https://www.google.com/search?q=Hides+Gas+Conditioning+Plant>, accessed on 21/11/2020. The plant has 450 full-time employees directly employed in the Hides Gas Conditioning Plant facilities. Even so the site has a large Komo Airfield where the cargo and workers are transported in and out of Komo.

#### Summary of characteristics of land transactions in the project areas

Table 1 presents a summary of the characteristics of land transactions at the three study sites, namely: (i) Wawoi–Guavi Portions 7c and 8c Forestry Project (ii) Oktedi Mining–Bigge Tailings Mitigation Project Lease, and (iii) PNG LNG Project–Hides Gas Conditioning Plant Project Areas.

The data in Table 1 were compiled during our questionnaire survey and our review of relevant literature ranging from government policies, the Internet, published reports, books and personal interviews. Wawoi Guavi Forestry Project resource area landowners have been receiving royalty and equity from government since the commencement of the project. The

landowners of Oktedi Mining Tailings Stockpile Mitigation Lease Area at Bigge have not been receiving royalty and equity as stipulated under the Mining Act because it was claimed that the lessees for mining purposes were normally not entitled to royalty and equity. However, contrary to what the law stipulates, we gathered that Tabubil Township and Okmenga Hydro Power Station Lease Area landowners do, in fact, receive royalty and equity amongst other benefits like business spin-offs, employment and community projects (Post Courier.com.pg, accessed on 8/7/2020). The Hides Gas Conditioning Plant lease area landowners have also not been receiving royalty and equity because of the outstanding legal cases among the landowners and the state.

#### Case study sites and statistical determination of sample size

The total population of landowners in the three study areas combined is estimated to be 2,800 (Table 2) from Wawoi Guavi Forestry areas, Bigge Dredging Lease areas and Hides Gas Conditioning Plant Lease areas. Out of this total landowner population, Wawoi Guavi Portions 7c and 8c Forestry Project Area has a total population of approximately 600 land owners, Oktedi Mining Tailings Mitigation Lease Area has 900 landowners, while the Hides Gas Conditioning Plant Lease Area has approximately 1,300 landowners. The numbers of landowners, State agencies and project operators are 2,800, 155 and 180 respectively, yielding a total population (sampling frame) of 3,135. Based on this number, a sample size of 355 respondents calculated using an appropriate statistical formula was selected for our questionnaire survey. However, only 180 completed questionnaires (approximately 51% of questionnaires distributed) were safely returned to us for processing due to the global Covid-19 pandemic restrictions ravaging the study area. Data analysis was undertaken with the aid of the Statistical Package for Social Sciences (SPSS) software and Excel software.

Geographically, Western and Hela Provinces (Figure 2) share boundaries as contiguous provinces and they share the PNG LNG project including Juha Gas Field in Western Province. Juha Gas Well is in Western Province but it is part of the PNG LNG Project.

**Table 1.** Summary of Characteristics of Forestry and Extractive Resources Projects in Western and Hela Provinces, PNG, 2021 (Note: 1 PGK = 0.28 USD on 17 April 2021).

Characteristics of land transactions	Forestry at Wawoi Guavi – Portion 7c & 8c lease area	Mining at oktedi tailings stockpile mitigation lease area	Oil and gas project at hides gas conditioning plant lease area
Enabling laws for land alienation	Forestry and land acts	Mining Act – lease for mining purposes	Oil and gas act
Land descriptions	Portions 7c & 8c	Lease for mining purpose (LMP) 85	PDL 7 – Hides 4 Gas Conditioning Plant Lease
Name of the project operator	Wawoi Guavi Company Limited - a Subsidiary of Rimbunan Hijau	Oktedi Mining Limited	Exxon Mobil PNG Limited
Name of the project	Wawoi Guavi Forestry Project	Oktedi Mining Project	PNG LNG Project
Project start date	1982	1997	2010
Lease period	70 years	20 years	30 years
Lease review period	Every 10 years	Every 5 years	Every 5 years
Land area	474,078 hectares	2,116 hectares	110 hectares
Mode of lease acquisition	Timber Permit 01-07 & Lease Acquisition	Lease Acquisition	Lease Acquisition
Land rental	Adopted (Between K101,000.00 and K200,000.00 annually)	Adopted (Above K200,000.00 annually)	Adopted (Above K200,000.00 annually)
Royalty	Adopted	Not Adopted	Not Adopted
Equity	Adopted	Not Adopted	Not Adopted
Employment	Adopted	Adopted	Adopted
Business spin-offs	Adopted	Adopted	Adopted
Community projects	Adopted	Adopted	Adopted
ILGs	Adopted	Not Adopted	Adopted but not utilised
State lease title	Adopted	Not Adopted	Not Adopted
Royalty and equity certificates	Not Adopted	Adopted Equity Share Certificate	Not Adopted

Source: Field Work, 2020.

However, the Gas Conditioning Plant facility is in Hides of Hela Province. Therefore, Hides Gas Conditioning Plant Lease area was adopted as a study site for Oil and Gas Projects.

The locations of these two provinces and the study sites are indicated in Figure 2 extracted from Google Satellite Maps. Western Province is located within the coordinates of 7°20'142' 0'E.

The approximate geographical locations of the three specific study sites (Figure 5) are as follows: (i) In Western Province, Wawoi Guavi Forestry Project (Latitude 7.47785 and Longitude 142.34809) on portions 7c and 8c logging project in the Middle Fly of Western Province (ii) Oktedi Mining Project Tailing Mitigation Lease Area (Latitude 5.93299 and Longitude 141.13412) at Bige in the North Fly District of Western Province, and (iii) Hides Gas Conditioning Plant Lease Area of PNG LNG Project

(Latitude 6.00328 and Longitude 142.81014) at Komo in Hela Province. Wek

## RESULTS AND DISCUSSION

A reminder of our research question: How can the key performance indicators of sustainable land transactions in forestry and mining projects in Western and Hela Provinces, PNG, be assessed? Using a bar chart, Figure 6 presents a comparison of performance of resource lease agreements based on the benefits received by landowners from the three types of projects: (i) Wawoi-Guavi portions 7c and 8c Forestry Project (ii) Oktedi

Mining Tailings Mitigation Project Lease at Bige and (iii) PNG LNG – Hides Gas Conditioning Plant Project Lease areas.

The comparison of performances is based on the following indicators (benefits received): lease/rental payments, environmental damage compensation, royalty, equity, employment spin-off business, community projects and programs. Apart from, the benefits that the landowners receive, the comparison also examines whether the landowners recognition certificates (for ILGs, state lease titles, royalty and equity certificates) are adopted in each lease area or not. Survey results indicate that the forestry project ILG has adopted the recognition certificates, while in the

**Table 2.** Sampling frame and sample size for the questionnaire survey, 2020.

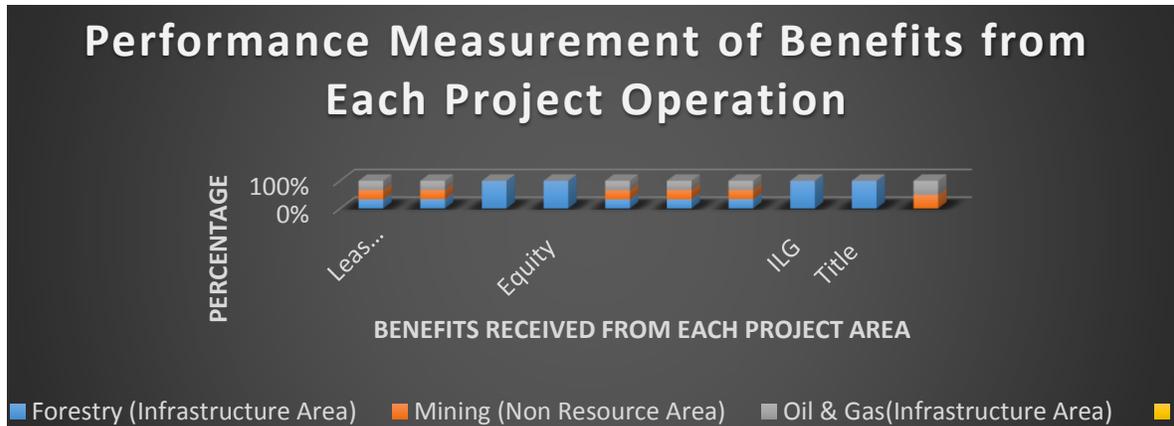
Project lease area	Landowners	State agencies	Project operators
Wawoi Guavi forestry areas	600	60	40
Bige dredging lease areas	900	45	60
Hides gas conditioning plant lease areas	1,300	50	80
Sub-total	2,800	155	180
Sampling frame (N)	<b>3,135</b>		
Sample size (n) where e = confidence level of 5% (that is 0.05)	$n = N / [1 + N (e)^2] = 3,135 / [1 + 3,135(0.05)^2]$ $= 3,135 / 1 + 7.8375 = 3,135 / 8.8375 = 354.74 = 355$ (approximately) = 355 out of which <b>180</b> responses were finally achieved due to the Covid-19 pandemic restrictions.		



**Figure 5.** Location map of the study areas.  
 Source: Google Satellite Maps, October 2020.

Oktedi Tailings Mitigation Lease area clan accounts are the vehicle used to channel benefits to landowners

instead of ILGs. Similarly, like in Oktedi Mining Project Tailings Mitigation Lease Area, the PNG LNG–Hides Gas



**Figure 6.** Bar chart assessment of project benefits sharing at Wawai Guavi, Oktedi Tailings Mitigation and PNG LNG Hides Gas Conditioning Plant Lease Projects  
Source: Fieldwork, 2020.

Conditioning Plant Lease area has adopted clan accounts as a means of channeling lease payments and other benefits to landowners, though ILG is mandatory in the Oil and Gas Act 1998.

The results further indicate that all three lease areas fairly receive the following benefits: land rental, environmental damage compensation, employment and spin-off business opportunities, community projects and programs, but not royalty and equity. The Oktedi Mining Project gives royalty and equity to Tabubil Township and Oktmenga Hydro Power Station Lease areas though they are leases under *Lease for Mining Purposes* like Tailings Stockpile Mitigation lease area, according to interviews held with Oktedi Mining Limited Officers and newspaper announcement (<https://postcourier.com.pg/ok-tedi-mine-villages-paid-K7.2m/amp/>, accessed on 20/8/2021).

In comparison with PNG LNG Project, according to the provisions of the Oil and Gas Act 1998 regarding benefit sharing and lease agreements, the landowners from resource areas and non-resource areas where facilities exist are equally beneficiaries of royalty and equity. However, the study reveals that due to prolonged court cases amongst landowners and between them and the state, the release of royalty and equity payments to landowners has been hampered throughout the project footprint including the Hides Gas Conditioning Plant lease areas. This does not mean that landowners in the mining, oil and gas resource areas do not receive royalty; they are entitled to it according to the mining, oil and gas laws but practically they are not receiving it. In order to test the significance and sustainability of the benefits received by the landowners, the authors subjected the bar chart data to Pearson Correlation analysis as indicated in Table 3.

The correlation coefficient of 0.389\*\* obtained from the comparison of project operations and benefits received by landowners appears to indicate a positive relationship

with a level of statistical significance of 0.01 between the two variables. Therefore, in the context of this study, it may be submitted that the ten types of benefits received from the operations of the projects as illustrated in Figure 6 (Bar Chart) have a combined positive but not very strong relationship with the project operations. This result indicates a level of sustainability that needs to grow stronger. Therefore, it is contended that the following are some of the causes of the fairly positive correlation (i) the inconsistent sharing of royalty and equity benefits amongst the landowners in the Special Mining Lease Areas and Lease for Mining Purpose Lease Areas as revealed in Oktedi Mining Project land dealings (ii) Incorporated Land Group (ILG) is not adopted as a vehicle for channeling benefits to landowners in the mining project areas unlike in forestry, oil and gas project areas (iii) the mining, oil and gas projects have not adopted lease titling system in facility infrastructure lease areas like in the forestry project areas, and (iv) the royalty and equity certificate system were not introduced in forestry, mining, oil and gas projects until recently when Oktedi Mining Project changed ownership to the State and people of Western Province, when the equity certificates began to be issued by the government to landowners in the Oktedi Mining Project. However, the positive correlation coefficient may also be contended to have been caused by consistent benefits throughout the three project lease areas, including lease rental, environmental damage compensation, employment, spin-off business opportunities and community projects. In the same manner, Oktedi Mining Project is paying royalty and equity for Special Mining Leases and Leases for Mining Purposes, though government policy and the Mining Act do not allow it.

A reminder of our hypothesis ( $H_1$ ): "That there is a significant difference between the sustainability performance of land transactions in forestry and mining

**Table 3.** Correlation coefficients of sustainability of project benefits against project operations (Forestry, Mining, Oil and Gas).

Variable	Correlation coefficient	Variable 1	Variable 2
Sustainability of project benefits (V1)	<b>Pearson correlation</b>	1	0.389**
	Sig.(2-tailed)		1
	N	180	180
Project operations (V2)	<b>Pearson correlation</b>		
	Sig. (2-tailed)	0.389**	1
	N	180	180

\*\*Correlation is significant at 0.01 level (2-tailed)  
Source: Field Work, 2020.

**Table 4.** Test of hypothesis.

Parameters (land dealing themes in forestry, mining, oil and gas projects)	Observed	Expected	(O-E) <sup>2</sup>	(O-E) <sup>2</sup> /E	Results
Land rentals	36	30	36	1.2	$\chi^2 = 2.133$
Equity	28	30	4	0.133	
Royalty	32	30	4	0.133	df = 6
ILG	30	30	0	0	
Lease Title	26	30	16	0.533	<i>P Value = 0.85</i>
Royalty and equity certificates	28	30	4	0.133	

Source: Author's field Work, 2020

Test:  $P > 0.01$ : There is insufficient evidence against the Hypothesis ( $H_1$ ). Hence, the Hypothesis is accepted while the Null Hypothesis is not accepted.

projects in Western and Hela Provinces.”

Based on the findings indicated in Table 4, the Chi Square Test Value is 2.133 and the Probability Value (P Value) is 0.85 or 85%, which is statistically significant at 0.01 levels. The results from the test of our hypothesis indicate that the land transactions in forestry, mining, oil and gas projects show a very strong positive relationship with project operations. Hence, the hypothesized unification, consistency and sustainability of the six indicators of land transactions (dealings) in forestry, mining, oil and gas projects in Hela and Western Provinces of Papua New Guinea is accepted and worthy of policy support by the government.

The combined effect of these two sets of findings is consistent with the lessons learned from our literature review and our field experiences as property professionals, which indicate that some indicators of sustainability of land transactions in forestry, mining, oil and gas projects are consistent and significant, while some are inconsistent within project operations across the study area. The characteristics and performance of land transactions in forestry, mining and oil and gas projects are similar in some areas whilst they differ in others.

Furthermore, from the literature review, Wawoi Guavi

forestry project land transactions with regards to landowners' benefits such land rentals, royalty and equity payments, employment, spin off business and community projects and programs, have performed very poorly. This has resulted in many challenges for the landowners, the state and the project operators (PNG National Forests Authority, <https://www.pngforests.files.wordpress.com-14wawoi-guavi.pdf>, accessed on 15/5/2020). For example, the forestry project landowners argued that land and waterway rentals were paid once only in every 10 years, and limited employment opportunities and lack of spin-off business opportunities were rampant in their areas. Similarly, the roads and community projects are substandard, and, in addition, the State has failed to carry out reforestation from the fees paid to the State by the project operators. However, during the study, the landowners complained that the project operators barely paid the landowners reasonable land rentals, royalty, equity, employment opportunities and social services.

Oktedi Mining Project has been performing to the expectation of the landowners and the government in terms of paying landowner benefits on time and fully, according to agreements. The only challenge they have is the unfair sharing of royalty and equity benefits in the project foot print area, although it is the prerogative of the

government to share with the landowners as it deems fit.

Results also indicate that the PNG LNG project has not been faithfully disbursing royalty and equity benefits to landowners including Business Development Grants and Development Levies, which is the responsibility of the State. However, Exxon Mobil argued that the project is delivering land rentals, employment opportunities and spin-off businesses by building landowner companies (PNG LNG, <https://www.google.com/search?q=Hides+Gas+Conditioning+Plant>, accessed on 21/11/2020; <http://www.oilsearch.com>, accessed on 23/08/2020).

The Hides landowners have been receiving land rentals according to Filer (2019), which was also confirmed by this study. Therefore, it is contended that some of the resource and land administration policies and laws in PNG are stagnant, whilst the forestry, mining, oil and gas projects' land benefits including the landowners' recognition certificates are administratively "evolving away from an inconsistent land transaction system toward a consistent or uniform and sustainable land transaction system."

## CONCLUSIONS AND POLICY IMPLICATIONS

This study has answered one research question and tested one hypothesis to assess the sustainability of land transactions in Papua New Guinea, using two contiguous provinces - Western and Hela Provinces - as case study. To answer the research question: *How can the key performance indicators of sustainable land transactions in forestry and mining projects in Western and Hela Provinces, PNG, be assessed?*, the study compared land transactions in forestry, mining, oil and gas projects in the three study areas (Wawoi-Guavi, Oktedi and Hides). Findings indicate that the three areas fairly receive such benefits as land rental, environmental damage compensation, employment and spin-off business opportunities, community projects and programs, but not royalty and equity. Findings also indicate that due to prolonged court cases amongst landowners and between them and the State, the release of royalty and equity payments to landowners has been hampered throughout the project footprint including the Hides Gas Conditioning Plant lease areas. These are important operational challenges that militate against the sustainability of benefits sharing. Consequently, the correlation coefficient of 0.389\*\* obtained from the comparison of project operations and benefits received by landowners appears to indicate a not very good positive relationship with a level of statistical significance of 0.01 between the two variables. The result indicates a combined positive but not very strong correlation between project benefits and project operations. Secondly, the study tested the hypothesis, which states: *"That there is a significant difference between the sustainability performance of land*

*transactions in forestry and mining projects in Western and Hela Provinces."* Analysis of data yielded a Chi Square Test Value of 2.133 and a Probability Value (P Value) of 0.85 or 85%, which are statistically significant at 0.01 levels. Therefore, there is insufficient evidence against the hypothesis ( $H_1$ ). Hence, the hypothesis is accepted, while the null hypothesis is not accepted. The findings from the tested hypothesis also indicate that land transactions in forestry, mining, oil and gas projects show a very strong positive relationship with project operations resulting in our acceptance of the hypothesis.

## RECOMMENDATIONS

In view of these key findings, certain policy recommendations are inevitable. To make land policy implementation in PNG seamless, a uniform land transaction (dealing) system requires an overhaul of existing land-related policies and laws governing forestry, mining, oil and gas land transactions in PNG. This emerging trend is underscored by the strong and positive hypothesis results. Finally, in view of the above, the following policy recommendations should be thoughtfully implemented by the government and other project stakeholders for purposes of land policy sustainability in PNG:

- (i) The government should review the forestry, mining, oil, gas, and land policies and laws toward unifying and reinforcing the following land transaction indicators: lease rental, royalty, equity, ILGs, land titling system, and royalty and equity share certificates in forestry, mining, oil and gas projects in PNG.
- (ii) All purchased logs, minerals, petroleum and helium resources are the property of the State and, therefore, the royalty and equity are rightfully the property of the State. On this basis, the State should share royalty and equity fairly with all landowners within the project footprint regardless of whether the land has been alienated under compulsory process or by agreement through lease-lease back processes. In the same manner, whether the leased land is in the resource area or not, all the benefits discussed in this paper should be uniform across the board in forestry, mining, oil and gas projects.
- (iii) The National Forests Authority should consider reviewing its forestry land transactions (dealing) policy and unify the benefits and lease schemes within each project footprint or lease area. Currently, it has been observed that the state lease titles have been issued to project operators or landowners' companies, instead of landowners under their clan names or ILGs while the State further issues sublease titles to project operators.
- (iv) The sharing of royalty and equity are totally inconsistent. In the Oil and Gas projects, the law allows for fair sharing of royalty and equity with resource area landowners and facility infrastructure area landowners

whose lands are not part of the resource areas. However, in the mining projects, royalty and equity are only paid to resource area landowners and not non-resource area landowners. On the other hand, the mining projects do not utilise ILG as vehicle to channel benefits to landowners, instead they adopt family and clan accounts, whereas in the Oil and Gas projects, the law allows for adoption of ILGs like forestry projects. However, due to land ownership issues, the PNG LNG projects in the Hides Gas Conditioning Plant lease areas have adopted family and clan accounts as means of channelling benefits.

(v) The Mineral Resources Authority (MRA) and the Department of Mineral Resources and Geo Hazards who are the State agencies for mining projects in the country should consider reviewing the mining policy and Mining Act 1992 to facilitate fair sharing of royalty and equity among the landowners in the *Special Mining Lease* and the *Lease for Mining Purposes*. In addition, the ILGs should be empowered to become the landowner's vehicle for channelling of benefits and to further accommodate surface titling system in all facility infrastructure lease areas, including townships. This will ensure that all base titles are registered under landowners' names while the sublease titles are registered and issued to project operators. In addition, royalty and equity certification system should be introduced in the review of mining land transaction (dealing) policy and provisions in the Mining Act 1992 as Oktedi Mining Project has given a classical example by issuing equity share certificates to landowners.

(vi) The Department of Petroleum and Energy should review its Oil and Gas resource policy and provisions in the Oil and Gas Act 1998 to cater for registration of State Lease Titles in facility infrastructure lease areas as well as introduce royalty and equity share certificates.

(vii) The Department of Lands and Physical Planning (DLPP) should review the Land Act 1996 to cater for compulsory lease-back scheme in forestry, mining, oil and gas projects with the introduction of surface land titling system for mining, oil and gas projects. Base lease titles should then be issued to landowners and ILGs and sublease titles issued to project operators.

(viii) The ILG (Amended) Act 2009 should be reviewed to separate clan recognition and certification from ILG incorporation. In this way, it will avoid land ownership disputes as clan identification and certification have nothing to do with land ownership. It is the land ownership and land boundary sketch map that cause land ownership and boundary disputes. Therefore, clan recognition should be separately treated from land ownership and determination of land boundary. At the same time, clan identification certificates will be helpful to forestry, mining, oil and gas projects especially when it comes to opening clan accounts for payment of landowners' benefits. This process of clan identification and certification does not really need land ownership identification and does not require land boundary sketch

map and so forth.

ix) Finally, further research needs to be done on the following broad topics: (i) surface land titling system in mining, oil and gas projects (ii) creation of base titles under landowners and sublease titles under project operators to test the viability and sustainability of such titling system (iii) the royalty and equity certificates system and (v) clan recognition and certification apart from ILGs.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interest

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