DISCUSSION PAPER

STRATEGY TO IMPROVE LIVING CONDITIONS IN INFORMAL SETTLEMENTS IN PAPUA NEW GUINEA: EVIDENCE FROM PORT MORESBY

Eugene E. Ezebilo
Patrice Savadogo

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Patrice Savadogo
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(b) The undertaking of research into social, political and economic problems of Papua New Guinea in order to enable practical solutions to such problems to be formulated.

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Authors’ contributions

Associate Professor Eugene Ezebilo conceived and designed the project, estimated the binary logistic regression model and conducted all the statistical tests required to arrive at the final model. He also facilitated primary data collection in informal settlements in Port Moresby and wrote the first version of the conceptualisation of informal settlement upgrade. Associate Professor Patrice Savadogo conducted literature review, wrote the first version of the introduction, literature review, results and conclusions sections of the manuscript. Associate Professor Ezebilo and Associate Professor Savadogo contributed in writing the first version of the materials and methods and discussion sections of the manuscript. They also contributed in writing the final version of the manuscript.
### Abbreviations and Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
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<tr>
<td>DLPP</td>
<td>Department of Lands and Physical Planning</td>
</tr>
<tr>
<td>GoPNG</td>
<td>Government of Papua New Guinea</td>
</tr>
<tr>
<td>LM</td>
<td>Lagrange Multiplier</td>
</tr>
<tr>
<td>NCDC</td>
<td>National Capital District Commission</td>
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<tr>
<td>NCDPPB</td>
<td>National Capital District Physical Planning Board</td>
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<tr>
<td>NHC</td>
<td>National Housing Corporation</td>
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<td>NGOs</td>
<td>Non-Governmental Organisations</td>
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<td>PNG</td>
<td>Papua New Guinea</td>
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<tr>
<td>QCA</td>
<td>Qualitative Content Analysis</td>
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<tr>
<td>UN</td>
<td>United Nations</td>
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<td>UNFPA</td>
<td>United Nations Population Fund</td>
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<td>WTLms</td>
<td>Willingness to live in a make-shift house</td>
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Abstract

The upgrade paradigm has been a widely accepted solution to informal settlements. However, implementing an effective upgrade program has been challenging for governments of most developing countries. This paper reports a study which examined informal settlement residents’ preferences for infrastructure and services provided by an upgrade project and their willingness to live in a make-shift house. It also examined guidelines for promoting an effective upgrade project. The data originated from interviews with residents of informal settlements in Port Moresby and was analysed using descriptive statistics, qualitative content analysis and binary logistic regression model. The results show that all the residents would support the upgrade project and would pay for service charges associated with infrastructure and services provided by the project. Piped water supplied by Water PNG and health care facility were the most preferred. In order for the upgrade project to be successful, residents should be fully involved in planning and implementing the project. Guidelines for an effective upgrade should include planning, framework preparation and implementation phases. Results from the logistic model revealed that willingness to live in a make-shift house is influenced by factors such as house and land ownership, frequency of crime in the area, household size, occupation, access to toilet and number of years lived in informal settlement. There is a need to develop an effective mechanism for restricting the emergence of new informal settlements. The findings contribute to urban development planning by providing guidelines for upgrading informal settlements in an effective and efficient manner. The findings will be useful for policy makers, planners and urban development managers in the informal settlement upgrade process.
The increase in informal settlements has been a challenge for governments of most countries (UN-Habitat, 2015; Brown, 2015). An informal settlement is a residential area where houses are often constructed on land that does not have security of tenure, building regulations are not complied with and the area lacks basic infrastructure and services. Factors such as population growth, rural-urban migration, inadequate affordable housing, weak planning and urban management, displacement caused by conflict, natural disaster and climate change contribute to the increase in informal settlements (UN-Habitat, 2015).

Informal settlements are often geographically, economically, socially and politically disengaged from the wider urban systems. However, the attitudes of governments to informal settlement has been either opposition and eviction or reluctant tolerance for upgrading it (UN-Habitat, 2015a). The upgrade of an informal settlement has been a widely accepted solution compared to eviction and relocation of residents of the settlement (Khalil et al., 2016; Mardeusz, 2014). This often involves land tenure regularisation and provision of basic infrastructure (Devas et al., 2004).

In order to address the adverse impact of informal settlements on the well-being of residents and the area hosting the settlements, there is a need for governments to be well-informed of the issues associated with it. This will assist the government in developing mechanisms for integrating settlements into the urban area system. One potential way of doing it is to upgrade informal settlements so that it can be at par with formal areas and to provide an effective mechanism that can be used to restrict the emergence of new informal settlements. Upgrading an informal settlement has the potential to assist residents to sustain their social and economic networks which is necessary for their livelihoods.

Upgrading an informal settlement involves the transformation of various dimensions of the settlement such as economic, social, organisation and environment (Dhabhalaburt, 2016). The goal of the upgrade is often to achieve settlement security. It is an intervention which is often used to rebuild collective socio-economic strength among informal settlement residents and long-term settlement security (Dhabhalaburt, 2016). For a settlement upgrade to be successful, the process of the upgrade should be undertaken in collaboration with key stakeholders such as local authorities and community groups from affected communities. Residents of the informal settlements to be upgraded should be well-informed about the proposed upgrade especially its benefits and costs, before commencing the upgrade. As informal settlements often have restricted access to facilities such as a market, it has the potential to increase the barriers that women face in accessing livelihood opportunities (Chant, 2014). For instance, women who reside in the informal settlements have the tendency to use more time to access basic services compared to those in formal areas (UNFPA, 2007). Furthermore, poor quality housing, eviction and homelessness has the potential to raise the risk of insecurity and violence against women and other vulnerable groups (McIlwaine, 2013).

Upgrading an informal settlement provides basic infrastructure and services which can improve quality of life of residents. However, it is important to consider the impact that the upgrade can have on low-income households (Lees et al., 2016). The upgrade has the potential to increase land prices and house prices which may contribute to restricted access to affordable housing to these households. Housing is one of the necessities, which is strongly linked to economic development of a country. It has the potential to trigger the growth of several sectors of the economy. However, housing is becoming a luxury good for majority of residents of major cities of Papua New Guinea (PNG) such as Port Moresby and Lae (Ezebilo, 2017). This is because the supply of houses has not been able to match with the demand for it, which pushed house prices up beyond the price that most households can afford (Ezebilo et al., 2017). The housing affordability problem has compelled some households to move to informal settlements where they can find houses they can afford (Ezebilo and Thomas, 2019). As some of
the informal settlements are located in areas that lack all or some basic social infrastructure such as piped-borne water and sewerage, good road networks and electricity, it lowers their welfare and opportunities for a more decent life. Further, the Government of PNG (GoPNG) loses revenue that would have accrued to it via building permits and service charges from the use of public utilities. The benefit that would have accrued to developers is not maximised because of lack of infrastructure and services.

In order for an informal settlement upgrade to be sustainable, there is a need to understand the socio-economic dynamics of residents and their willingness to accept the proposed changes associated with the upgrade. This study contributes to it by generating information from the residents and their leaders on the current situation of the settlements and the desired changes required as well as the nature of households that inhabit informal settlements. Government agencies that have the responsibility to implement upgrade of informal settlements often face the challenge of implementing the upgrade in an orderly manner because of lack of appropriate guidelines. Without correct guidelines, the upgrade may not be sustainable and it may result in conflict of interests, lack of support from key stakeholders and loss of public funds. This study contributes to developing appropriate guidelines that can be applied in the upgrade of an informal settlement in urban areas in PNG. It can provide lessons that urban development planners from cities in other developing countries can draw from.
Objectives of the study

The objectives of this study is three-fold as the following:

i. To examine the socio-economic characteristics of informal settlement residents in Port Moresby and identify the determinants of willingness to live in a make-shift house.

ii. To examine informal settlement residents’ preferences for infrastructure and services and community leaders’ perceptions of how an upgrade project should be implemented.

iii. To find the state-of-the-art guidelines that can be applied in the upgrade of informal settlements in a sustainable manner.

Findings from this study have the potential to assist municipal authorities, planners and urban development managers in upgrading informal settlements in an orderly manner. The findings also have the potential to contribute to the development of guidelines for informal settlement upgrade and in the choice of infrastructure and services to be provided in various informal settlements.
It is important to note that settlement upgrade is often an attempt by the government to reduce issues associated with access to land that restricts a country from achieving development in a sustainable manner (Potsiou et al., 2019). The inadequate or lack of social infrastructure and services in informal settlements tend to restrict residents from achieving their full potential. It contributes to the loss of government revenue as a result of several informal activities in the settlements in which beneficiaries do not pay tax. For instance, some informal settlements are known to be notorious in accessing services such as water and electricity illegally through illegal connections. Thus, they evade service charges and as a result, government loses revenue. This tends to have adverse impacts on a country’s economy. The upgrade of an informal settlement has the potential to address these externalities created by the inadequacies associated with the area.

The upgrade of an informal settlement is often implemented as a poverty alleviation project (Magalhaes and Eduardo, 2005). It is often expected that the project will contribute toward increasing the physical capital of residents of informal settlements as a result of the regularisation of land tenure and the increase in land value triggered by the infrastructure and services brought in to the informal settlement. The increase in human capital in the informal settlement as a result of an upgrade often contributes to an improvement in well-being and educational level of residents and an increase in job opportunities for them. The upgrade project has the potential to enhance the settlements’ social capital as a result of public participation in the design and implementation of the project (Magalhaes and Eduardo, 2005).

It is important to note that addressing the problems associated with informal settlements in PNG cities such as Port Moresby might generate additional problems such as housing affordability problems especially for low-income households who live in informal settlements. However, it will also provide more benefits to residents and the municipal authorities. The new issues that may emerge include the need for a more integrated and broad-based upgrade intervention processes. There is a need to consider interventions that can be used to address issues associated with public transport, traffic, road and intersection improvements and urban services of paramount importance in the city especially in high-density and high-use areas.

The implementation of informal settlement upgrade project is likely to be more complex and challenging in densely-populated areas than sparse areas. The densely-populated areas would attract more transaction costs through resettlement of some residents that occupy areas where trunk infrastructure such as piped-borne water, sewerage, electricity and good road networks will be constructed. This will require negotiation and compensation especially in PNG where most land is communally-owned (Wangi and Ezebilo, 2017). Thus, the upgrade may attract a lot of unexpected costs both for infrastructure and space where it will be constructed. Time is also needed for negotiation between municipal authorities and landowners.

The informal settlement upgrade project will attract costs for infrastructure and time required for negotiations with landowners. However, it has the potential to provide opportunities for the development of the underdeveloped segment of Port Moresby, which can increase the share of formal business activities in the city.

The integration of informal settlements to the entire structure of Port Moresby can generate social benefits to entire neighbourhoods of the city and will contribute to the removal of negative externalities brought by the settlements. The benefits include the construction of roads connecting the informal settlements to nearby neighbourhoods and the construction of other infrastructure.

As there is no simple solution to informal settlement, the problem is strongly linked to national economic wealth and the level of social and economic capital (Potsiou et al., 2019). Solutions to informal settlement are a function of consistent land policies, good governance and well-established institutions and systems. There is a need for guidelines to address issues that result in informal settlement development in urban areas.
Several papers which focus on the status of informal settlements and potential ways to address issues associated with settlements have been published by several authors. In an Indonesian study of status of informal settlements in Jakarta, Alzamil (2018) found that upgrading the settlements should be according to a comprehensive plan that includes priority improvements. Local communities should be involved in the upgrade of informal settlements because they have information of the most felt needs in the settlements. In a PNG study of assessment of Joyce Bay settlement in Port Moresby, ADB (2013) found that there is deteriorating living conditions in the settlement as a result of social exclusion, inadequate basic services, economic barriers and increasing inequality. There is a need to implement interventions to improve living conditions of the communities. In a Mexican study of the spatial, social and cultural construction of place in the context of informal settlements in Mexico, Lombard (2014) found that a focus on residents on place-making activities hints at the prospects for rethinking informal settlements.

Other papers include an Egyptian study of government responses to the informal settlement expansion in greater Cairo, El-Batran and Arandel (1998) found that informal settlement is a dominant factor in the urbanisation process and in the provision of housing for the urban poor. Settlements should not be seen as part of a country’s housing crisis but rather the urban poor’s contribution to its solution. In another Egyptian study of informal settlements, Hassan (2012) found that the traditional approaches of mainstream for the development of informal settlements is inadequate towards solving the social and economic problems in the settlements. Urban regeneration has the potential to address issues associated with informal settlements in Alexandria, Egypt. In a Chinese study of informal settlement residents’ satisfaction, Li and Wu (2013) found that local context is the main determinant of satisfaction. In Egypt, an urban upgrade project was used to upgrade El-Arab with the main aim of developing the physical and economic conditions of the area (Khalil et al., 2016). The upgrade focused on physical, waste management and urban agriculture. In a comparative study of Egyptian and Indian informal settlements, Ragheb et al. (2016) found that in order to make the upgrade of informal settlement successful, local culture in the settlement should be preserved, opportunities to continue intergenerational lifestyles and businesses should be provided.

Demolishing informal settlements does not help to build a harmonious society. In a study of urban planning and informal cities in southeast Europe, Tsenkova (2012) found that the formalisation of informal settlements in Serbia, Croatia and Albania emphasises the integration of informal land and housing into formal economy and validation of ownership through property titles. Response to formalisation of an informal settlement vary according to local contexts, type of settlement, government’s political orientations and pressure from target communities.

In a South African study of the socio-economic characteristics of informal settlement residents, Hunter and Posel (2012) found that government policy on informal settlements reflects a tension between two approaches that recognises the legitimacy of informal settlements and the removal of settlements. Upgrading informal settlements through in situ-development has the potential to make the process successful. In another South African study on informal settlement upgrade, Patel (2013) found that successful outcomes are strongly linked to the manner in which the upgrade process is implemented. Formal changes that result in successful outcomes are achieved by the continued and consolidated power and influence of the local communities. Following the end of apartheid in South Africa in 1994, South African Government embarked on the upgrade of informal settlements (Mardeusz, 2014). This was accomplished using the Reconstruction and Development Programme and the Breaking New Ground program. The implementation of the program transformed informal settlements into formal settlements especially in Cape Town. However, the programs were not able to match the rapid demand for housing. The upgrade was not able to address the high level of crime, poverty and unemployment in the transformed informal settlements (Myers, 2011).
In an Afghan study of policies to address and improve informal settlements, Collier et al. (2018) found that the process of upgrading settlements should be simple, cheap and have quick results. Visible improvements have the potential to generate support from local communities in short run, which can build support for longer-term reform. In Thailand, the upgrade of informal settlements is believed to be the solution to housing problem (Dhabhalabutr, 2016). This has resulted in the continuous upgrade of several informal settlements by the Thai Government, non-governmental organisations (NGOs) and international agencies. An example of a popular informal settlement upgrade program in Thailand is the Baan Mankong (BMK) that was applied in the upgrade of several informal settlements in Bangkok. In Nigeria, the government upgraded several informal settlements with the aim of increasing the quantity of formal housing and improving the quality of urban housing especially in the latter half of the 20th century (Ibem, 2011). Apart from the upgrade of informal settlements, Nigerian Government implemented initiatives that focused on the construction of subsidised housing units for low-income households. However, the initiative was not effective in reducing informal settlements as a result of mismanagement of resources. For instance, funds meant for the construction of 200,000 housing units was released by the government, only 25 percent of the units was completed (Ibem, 2011).
Informal settlements in Port Moresby

PNG has a Physical Planning Act for establishing mechanism for physical planning at the national and provincial levels of government (Independent State of Papua New Guinea, 1989). It provides powers for the planning and regulation of physical development and all land in the country is subject to the Act. According to section 28, subsection 1 of the Physical Planning Act 1989, Provincial Physical Planning Board is empowered to consider all physical planning matters within the province concerned. In Port Moresby, the National Capital District Physical Planning Board (NCDPPB) is responsible for planning development. The NCDPPB prepares development plans and assesses development proposals. In terms of monitoring of development in Port Moresby, the National Capital District Commission (NCDC) is responsible for it. However, houses without proper building plan have continued to be constructed on land without proper titles and basic infrastructure, that is informal settlement. This has been partly due to the migration of people from rural areas to Port Moresby in search of better source of livelihoods and services, which results in population growth and consequently increase in demand for houses relative to supply (Jones, 2012). Furthermore, the shortages of land with proper titles for constructing houses in formal settlements and the inability of the government to provide affordable housing to the growing city population contribute to the construction of houses in informal settlements (Ezebilo and Thomas, 2019). This suggests that informal settlements appear to be important for the provision of affordable housing, especially to low-income households.

It is important to note that 60 percent of the land in Port Moresby belongs to the State and 40 percent is communally-owned (NCDC, 2006). State-owned land often has proper titles and does not attract much transaction costs compared to customary land (Wangi and Ezebilo, 2017). This makes investors prefer investing in businesses associated with State land over customary land. However, State-owned land is almost exhausted. Some property developers have shifted their attention to customarily-owned land. In my experience, an average customary landowner often believes that they do not need titles and building permit from relevant authorities to construct their houses. This contributes to the development of informal settlements in various areas of Port Moresby. In 2006, 40 percent of Port Moresby residents lived in informal settlements and it was 45 percent in 2008 (NCDC, 2006; AusAid, 2008). The informal settlements on State land are often acquired by land invasion and occupation (Chand and Yala, 2008). For customary land, Chand and Yala (2008) reported that there has been evidence of the purchase and sale of land rights and houses. In 2008, there were 79 informal settlements in Port Moresby (UN-Habitat, 2010). However, informal settlements continued to grow as more people move from rural areas to Port Moresby.

In order to address issues strongly linked to urbanisation in PNG, the PNG National Urbanisation Policy 2010-2030 was developed (Office of Urbanisation, 2010). Some of the key components of the policy are the provision of infrastructure and services in urban areas, building the capacity to better manage urbanisation and the development of urban management policies and plans. In line with the current paradigm in addressing the problem of informal settlements, the NCDC in collaboration with the National Housing Corporation (NHC) and the Department of Lands and Physical Planning (DLPP) are on the verge of upgrading some informal settlements in Port Moresby. However, for the upgrade to be sustainable, it is important for informal settlement residents to be involved in the processes because they would be directly impacted by the upgrade. The residents also have vital information that would make the upgrade program succeed. This study contributes to it by making assessment of the socio-economic characteristics of residents and to sought the opinion of community leaders and other residents on the informal settlement upgrade program. This would assist informal settlement upgrade planners in developing effective mechanisms in the implementation of the upgrade program.
The data used in the study reported in this paper was obtained by interviews with residents and community leaders in 10 informal settlements in Port Moresby. Followed by the review of literature on guidelines being applied in the upgrade of informal settlements. The interviews were preceded by pre-test interviews that assisted us in testing the interview questions for simplicity and whether the interviewees can easily comprehend the questions before conducting the main survey. The questions for the interviews comprised open-ended and closed-ended questions that were developed through review of literature on the subject such as Patel (2013), Dhabhalabutr (2016), Ezebilo and Thomas (2019), ADB (2013), Hunter and Posel (2012) and Potsiou et al. (2019). First, we developed the questions and passed it to an academic who is very familiar with issues in informal settlements in PNG for his comments. His comments were addressed and sent back to him for feedback. This continued until he was satisfied with the questions. Second, we conducted pre-test interviews with 10 ordinary people and six community leaders of informal settlements in August 2020. During the pre-test, we asked the interviewees to provide us with feedback on questions that were difficult to understand and about some questions that may be missing in the interviews as well as sensitivity of any of the questions. The feedback received from the pre-test assisted us in finalising questions for the main interviews.

For the main interviews, 10 informal settlements in Port Moresby were selected using purposive sampling approach. This involved selecting the informal settlements purposefully from the settlements that the survey team (researcher and research assistants) were very familiar with using the team's judgement. We used the approach because informal settlements have continued to spring up here and there in Port Moresby, which makes it difficult to ascertain the correct number of the settlements to come up with a sample frame. The informal settlements that were selected for the study are the following:

- Bush Wara; Eight-Mile; Joyce Bay; Kipo; Mautana, Ogoniva; Ranuguri; Talai; Taurama; and Vanagi.

Before conducting the main interviews, we visited each of the informal settlements to see how they are arranged and to get more information about the settlements. In order to legitimise our survey in the settlements, we visited community leaders in each of the settlements to inform them about our study and to schedule interview meetings with them.

As there is no address listing or a list containing names of all people living in each of the settlements, we used convenience sampling approach to select informal settlement residents to be interviewed. This involves visiting any of the houses the interviewers come across in each of the selected settlements and any adult found in each of the houses visited were approached for interview. All the adults that were approached and accepted the interview proposal were interviewed. An academic who is very familiar with informal settlements in Port Moresby and can speak the common language spoken in the settlement (Tok Pisin) assisted in conducting the survey. Four research assistants who were trained in interview techniques also assisted us in conducting the interviews. The main interviews were conducted both during the day and evenings in September 2020. The variation of the period of the interviews was to enable us to interview people from various backgrounds. For instance, we were able to interview people who were on night shift at their workplace during the morning period of the day. We were able to interview people who work in the morning in the evening while some people who do not have free time during the week days were interviewed over the weekend. We visited each of the selected informal settlements using convenience sampling approach. In each of the settlements, we visited some houses and interviewed an adult in the house. If an adult is not available during our visit, we visited another house in the settlement. For interviews with community leaders, we scheduled the most convenient time in collaboration with them and interviewed them at an agreed location. A total of 231 people were interviewed, comprising of 195 residents and 36 community leaders.

The total number of questions for the residents was 46 and for community leaders was 23. However, 30 questions (Box 1) for the residents which are relevant to this study were used and 18 questions were used for community leaders (Box 2).
After explaining the aim of the survey, that is, to understand the socio-economic characteristics of residents of informal settlements and how to upgrade the settlements in a sustainable manner, the interviewee was asked whether they are willing to participate in the interviews. If their answer is "yes", they were told that their responses would be held in confidence and the responses would only be used for research purposes without reporting their names. The interviewees were asked a series of socio-economic and demographic questions as listed in Boxes 1 and 2. They were asked questions on infrastructure and services, housing, land and whether they would support an informal settlement upgrade project if it would cost them money. The interviewees were asked about the strategy that can be used to make the upgrade project sustainable.

<table>
<thead>
<tr>
<th>Box 1. Questions relevant to this study that were presented to resident interviewees</th>
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<tbody>
<tr>
<td>Gender of interviewee</td>
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<td>Province that interviewee belonged to</td>
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<td>Interviewee's occupation</td>
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<tr>
<td>Marital status</td>
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<tr>
<td>Family size (father + mother + children)</td>
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<tr>
<td>Household size (father + wife + children + relatives + friends living in the same house and eat together)</td>
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<tr>
<td>Age</td>
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<tr>
<td>Educational level</td>
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<tr>
<td>Income from formal activities</td>
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<tr>
<td>Income from informal activities</td>
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<tr>
<td>Spouse's income from formal and informal activities</td>
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<tr>
<td>Number of years that interviewee lived in an informal settlement</td>
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<tr>
<td>House the interviewee lived in (permanent/make-shift)</td>
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<tr>
<td>Number of rooms lived by interviewees family</td>
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<tr>
<td>Information on toilet in the house where interviewee lived (shared/not shared)</td>
</tr>
<tr>
<td>The extent of crime in the neighbourhood where interviewee lived</td>
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<tr>
<td>Access to clean potable water supplied by Eda Ranu (now Water PNG)</td>
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<tr>
<td>Access to electricity delivered by PNG Power Limited</td>
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<tr>
<td>Access to garbage removal services</td>
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<tr>
<td>The extent of the importance of informal settlement upgrade</td>
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<tr>
<td>The trunk infrastructure most needed in the informal settlement where the interviewee lived</td>
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<tr>
<td>The services most needed in the informal settlement where the interviewee lived</td>
</tr>
<tr>
<td>Whether landowners will support informal settlement upgrade if it will cost them money to register their land</td>
</tr>
<tr>
<td>Whether landowners will support informal settlement upgrade if it will cost them money to pay ground rent</td>
</tr>
<tr>
<td>Whether landowners will support informal settlement upgrade if it will cost them money through building plan permit</td>
</tr>
</tbody>
</table>
– Whether tenants will support informal settlement upgrade if it will cost more money in house rent
– Whether, if government upgrade settlement where the interviewee lived, will he or she support it
– Whether the interviewee is willing to pay for all infrastructures as a result of the upgrade of settlement where they lived
– How certain the interviewee is that they will pay for infrastructures as a result of settlement upgrade
– Type of land where the house that the interviewee lived was constructed (customary land/state land).

Box 2. Questions relevant to this study that were presented to community leader interviewees

– The interviewee’s gender
– The province in Papua New Guinea that the interviewee belonged to
– Age of the interviewee
– Marital status
– Highest education attained
– Number of years that the interviewee lived in settlement
– Number of years that the interviewee has served as a community leader
– The extent of the importance of informal settlement upgrade project
– The most needed infrastructure where the community leader lived
– The services most needed in the informal settlement where the community leader lived
– Whether the community leader would support an upgrade program being implemented where he or she lived
– If the upgrade program will cost money, will the residents support the program?
– If residents will support an upgrade program that cost money, what is the certainty that they will pay?
– Whether the community leader believe that landowners in informal settlement would pay for land registration
– Whether the community leader believe that landowners would pay ground rent
– Whether the community leader believe that landowners would pay for building permit
– Whether the community leader believe that tenants would pay more money in rent following upgrade of settlement
– How the community leader thinks that the informal settlement project should be implemented.
Data analysis

The data was analysed using descriptive and inferential statistics as well as qualitative content analysis (QCA). For descriptive analysis, we used mean, percentages and standard deviation which was presented in graphical and tabular formats. For QCA, it was used to analyse how community leaders believe that informal settlements should be upgraded to make it work well.

The QCA can be classified into a manifest analysis and a latent analysis. Manifest entails the description of the actual responses of the interviewees whereas in latent, we need to seek the underlying meaning of the responses (Berg, 2001). In this study, we used the manifest technique to describe the actual responses of community leaders. In terms of inferential statistics, we used discrete choice model to determine factors influencing willingness to live in a make-shift house.

The Econometric Model

As willingness to live in a make-shift house ($\text{WTL}_{ms}$) is latent, i.e. not observable, let $I$ be the indicator variable, so that:

$$I = 1, \text{ if } \text{WTL}_{ms} = \text{yes}$$
$$= 0, \text{ no}$$

(1)

In this study, the response to the willingness to live in a make-shift house is a dichotomous choice, i.e. yes/no, which means that a binary discrete choice model can be used to analyse factors influencing interviewees willingness to live in a make-shift house (Greene, 2003). The probability $p$ that the interviewee will give a 'yes' response, that is, willing to live in a make-shift house is:

$$P[\text{yes}] = \frac{1}{1 + e^{-\beta I}}$$

(2)

The probability that the interviewee will give a 'no' response, that is, not willing to live in a make-shift house is:

$$P[\text{no}] = \frac{1}{1 + e^{\beta I}}$$

(3)

Manipulation of (3) and (4), gives:

$$1 - P(\text{yes}) = \frac{1}{1 + e^{\beta I}}$$

(5)

$$\frac{P(\text{yes})}{1 - P(\text{yes})} = e^{\beta I}$$

where $e^{\beta I}$ is the ratio of the probability of a 'yes' to the probability of a 'no' response, the logarithm of the odds ratio is the following:

$$\ln \left[ \frac{P(\text{yes})}{1 - P(\text{yes})} \right] = \beta I$$

(6)
Binary probit regression model can be used to analyse our data. However, the model has some restrictive assumptions that must be met such as normal distribution and homoscedasticity, that is, the variance around the regression line is the same for all values of the predictor variance. To find out whether our data meet the assumptions, we conducted Lagrange multiplier (LM) and normality tests. The calculated LM statistic was 45.72 and it is asymptotically distributed as Chi-squared $X^2$ with 10 degrees of freedom. Tabulated Chi-squared $X^2$ with 10 degrees of freedom at 0.01 statistical significant level is 23.21. As the calculated statistic is higher than the tabulated, the hypothesis that the model is homoscedastic was rejected at 1 percent statistical significant level. The test statistic for normality was calculated as 13.78 with 2 degrees of freedom using LM test. Tabulated Chi-squared $X^2$ with 2 degrees of freedom at 0.01 statistical significant level is 9.21. The hypothesis that the error term is normally distributed was rejected at 1 percent statistically significant level. The results indicate that the probit model cannot be used to model our data because its assumptions could not be satisfied. Thus, we used the binary logit regression model as an alternative to probit. The binary logit model was then used to continue our data analysis. The binary logit model was estimated using LIMDEP NLOGIT version 4.0.1 statistical package (Econometric Software Inc, New York, USA. See, Table 3) to examine factors which influence the interviewee’s willingness to live in a make-shift house. Our final binary logit model is the following:

$$WTL_m = B_0 + B_{1\text{INCOME}} + B_{2\text{HOUSE\_OWN}} + B_{3\text{CRIME}} + B_{4\text{GENDER}} +$$
$$B_{5\text{LAND\_T}} + B_{6\text{HH\_SIZE}} + B_{7\text{WORK\_GOV}} + B_{8\text{TOILET}} + B_{9\text{YEARS}} + \varepsilon$$

(7)

where $B_0$ is the intercept; $B_{1\text{INCOME}}$ is the coefficient associated with household income; $B_{2\text{HOUSE\_OWN}}$ is the coefficient associated with ownership of a house in informal settlement; $B_{3\text{CRIME}}$ is the coefficient associated with frequency of crime in the neighbourhood; $B_{4\text{GENDER}}$ is the coefficient associated with gender; $B_{5\text{LAND\_T}}$ is the coefficient associated with land type; $B_{6\text{HH\_SIZE}}$ is the coefficient associated with household size; $B_{7\text{WORK\_GOV}}$ is the coefficient associated with working for the government; $B_{8\text{TOILET}}$ is the coefficient associated with sharing of toilet by different families living in the same house; $B_{9\text{YEARS}}$ is the coefficient associated with number of years a person has lived in informal settlement; $\varepsilon$ is the error term which is logistically distributed.
Results

All the people who were selected for the interviews agreed to be interviewed, which indicate that they are interested in the subject of the study.

**Socio-economic characteristics of residents**

In terms of occupation, most of the interviewees were unemployed (64.6%) and only a few were self-employed (4.6%). See Table 1.

**Table 1. Characteristics of residents interviewees in relation to some variables**

<table>
<thead>
<tr>
<th>Description</th>
<th>Mean</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Occupation:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government worker</td>
<td>0.072</td>
<td>0.26</td>
</tr>
<tr>
<td>Works for an NGO or church</td>
<td>0.051</td>
<td>0.22</td>
</tr>
<tr>
<td>Works for a private firm</td>
<td>0.097</td>
<td>0.29</td>
</tr>
<tr>
<td>Self-employed</td>
<td>0.046</td>
<td>0.21</td>
</tr>
<tr>
<td>Retired from service</td>
<td>0.067</td>
<td>0.25</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.646</td>
<td>0.48</td>
</tr>
<tr>
<td><strong>Highest educational level attained:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>0.067</td>
<td>0.25</td>
</tr>
<tr>
<td>High school</td>
<td>0.082</td>
<td>0.28</td>
</tr>
<tr>
<td>Secondary school</td>
<td>0.366</td>
<td>0.48</td>
</tr>
<tr>
<td>Technical school</td>
<td>0.299</td>
<td>0.46</td>
</tr>
<tr>
<td>University</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Access to utilities:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water supplied by Eda Ranu</td>
<td>0.025</td>
<td>0.16</td>
</tr>
<tr>
<td>Electricity supplied by PNG Power</td>
<td>0.247</td>
<td>0.43</td>
</tr>
<tr>
<td>Garbage collection services</td>
<td>0.021</td>
<td>0.14</td>
</tr>
<tr>
<td><strong>Marital status of interviewees:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married = 1</td>
<td>0.71</td>
<td>0.45</td>
</tr>
<tr>
<td>Not married = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Land occupied by the interviewee:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>State land = 1</td>
<td>0.686</td>
<td>48,208</td>
</tr>
<tr>
<td>Customary land = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Age of the interviewee in years.</strong></td>
<td>38.18</td>
<td>8.01</td>
</tr>
<tr>
<td><strong>Family size.</strong></td>
<td>4.69</td>
<td>3.38</td>
</tr>
<tr>
<td><strong>Number of rooms interviewee lived in.</strong></td>
<td>2.12</td>
<td>1.18</td>
</tr>
<tr>
<td><strong>Annual household income from informal sources in Papua New Guinea Kina (PGK).</strong></td>
<td>39,795</td>
<td>32,142</td>
</tr>
<tr>
<td><strong>Total annual household income in PGK (formal plus informal income).</strong></td>
<td>54,497</td>
<td>48,208</td>
</tr>
</tbody>
</table>

Note: US$ 1 = PGK3.5; NGO is Non-Governmental Organisation.
Most of them had secondary school (36.6%) as their highest educational level, followed by technical school and none had university education. Only a few of the interviewees (24.7%) had access to electricity supplied by PNG Power and only 2 percent had access to garbage collection services. Only 2 percent had access to piped-borne potable water supplied by Eda Ranu (currently known as Water PNG) in a central location (Table 1). Majority of the residents buy water from water vendors and store it in large containers.

The findings show that more of the interviewees lived in houses built on State-owned land (68.6%) than on customarily-owned land (Table 1). On average, household income from informal activities account for approximately 73 percent of the total annual household income. The interviewees had an average family size of five persons and most of them were married and had an average age of 38 years.

In terms of the distribution of annual household income, interviewees who lived in permanent houses had more income than those who lived in make-shift houses (Figure 1). More of the interviewees that had income of less than PGK12,500 and from PGK12,500 to PGK19,999 lived in make-shift houses (32%) than those who lived in permanent houses (5.8%).

Figure 1. Household income distribution in relation to house type interviewees lived in

Most of the interviewees who lived in permanent houses had income that ranges from PGK20,000 to PGK250,000 and above (61.4%) than those who lived in make-shift houses (44.4%). See Figure 1.

Of all the four regions in PNG, Southern Region had the highest number of ordinary residents who lived in permanent houses (42.2%). See Figure 2. Highlands Region had the highest number of ordinary residents who lived in make-shift houses (41.9%).
Only a few of the interviewees who lived in make-shift houses belonged to New Guinea Islands (5.8%). It was also a few interviewees who belonged to New Guinea Islands that lived in permanent houses (10.1%) - Figure 2.

In terms of the distribution of income in relation to the type of land that the interviewee occupied, the income of the interviewees who occupied customary land was generally higher than those who occupied State land (Figure 3). Most of the interviewees whose income was less than PGK12,500 (3.2%) and between PGK20,000 to PGK32,999 (28%) occupied State land.

Figure 2. House type lived in relation to regions interviewees belonged

Figure 3. Income distribution of interviewees in relation to land type they occupied
For interviewees who had income of PGK250,000 and above, there is no difference between those who occupied State land (1.6%) and customary land (1.7%).

In terms of the type of land occupied by the interviewees in relation to the region they belonged, Southern Region had the highest occupant of customary land (54.8%) whereas Highlands Region had the highest occupant of State land (40.6%) - see Figure 4. New Guinea Islands had the lowest occupants of both customary and State land (8.1% and 8.3% respectively).

**Figure 4. State-owned land and customary land in relation to region occupants belonged**

Residents’ willingness to live in a make-shift house

Of all the 195 ordinary resident interviewees, 167 (85.6%) answered all the questions that were relevant for inferential statistical analysis. Thus, 167 observations was used for statistical analysis.

The results revealed that of all the interviewees, 45 percent lived in make-shift houses (i.e. temporary shelter) and 55 percent lived in permanent houses (Table 2). On average, their households earned a total income (informal and formal income) of PGK54,497. Most of the interviewees owned a house in informal settlements (82%) and only a few (18%) lived in rented houses. The results showed that most of the interviewees lived in a neighbourhood where there is frequent crime (80%).
Table 2. Description of variables used in statistical analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Mean</th>
<th>Std.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WTLms</td>
<td>Type of house that interviewee lived in: Make-shift = 1</td>
<td>0.45</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Permanent = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INCOME</td>
<td>Interviewee’s annual household income in PGK (PGK)</td>
<td>54,497</td>
<td>48,208</td>
</tr>
<tr>
<td>HOUSE_OWN</td>
<td>Interviewee owns a house in informal settlement: Yes = 1</td>
<td>0.82</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td>No = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRIME</td>
<td>Frequency of crime in the neighbourhood: Frequent = 1</td>
<td>0.80</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Not frequent = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GENDER</td>
<td>Interviewee’s gender: Female = 1</td>
<td>0.41</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>Male = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LAND_T</td>
<td>Ownership of land where interviewee lived: State = 1</td>
<td>0.69</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Customary = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HH_Size</td>
<td>Interviewee’s household size (number of persons)</td>
<td>8.7</td>
<td>4.77</td>
</tr>
<tr>
<td>WORK_Gov</td>
<td>Interviewee is employed by the government: Yes = 1</td>
<td>0.07</td>
<td>0.26</td>
</tr>
<tr>
<td></td>
<td>No = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOILET</td>
<td>Interviewee lived in house where toilet is shared by different families:</td>
<td>0.84</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Yes = 1, No = 0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEARS</td>
<td>Number of years that the interviewee has lived in informal settlement</td>
<td>13.3</td>
<td>8.79</td>
</tr>
</tbody>
</table>

Note: ‘household income include formal and informal sources of income; US$ 1 = 3.5 Papua New Guinea Kina (PGK)

Forty-one percent of the interviewees were female and 51 percent were male. More of them lived on State land (69%) than customary land (31%). Most of the interviewees lived in houses where toilets are shared by different families and have lived in informal settlements for an average of 13.3 years (Table 2).

In order to understand factors influencing residents’ willingness to live in a make-shift house, binary logit regression models were estimated. (Table 3). The log likelihood test is highly statistically significant, which indicates that the estimated model has an acceptable goodness of fit. Further, more than 80 percent of the interviewees were correctly predicted to be in the group to which they actually belonged. This reveals that the binary logit model displays a good fit. Using the marginal effect to rank the importance of coefficients, the most important coefficients are those associated with house ownership, frequency of crime in the neighbourhood, occupation and land tenure type.

The coefficients associated with house ownership, frequency of crime in the neighbourhood and the sharing of toilet by different families were positive and statistically significant. This indicates that interviewees who own a house in informal settlement, experience crime frequently where they live and lived in a house where toilet is shared by different families were willing to live in make-shift houses. Coefficients associated with land tenure type, household size, occupation and number of years lived in informal settlement were negative and statistically significant (Table 3). This indicates that interviewees who occupied State land, have large household size, work for the government and have lived in informal settlement for many years were not likely to live in make-shift houses.
Table 3. Binary logit results on factors influencing willingness to live in a make-shift house

<table>
<thead>
<tr>
<th>Variable</th>
<th>Binary logit</th>
<th></th>
<th></th>
<th>Binary marginal effect logit</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coeff.</td>
<td>SE</td>
<td>t-value</td>
<td>Coeff.</td>
<td>SE</td>
<td>t-value</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.73</td>
<td>0.95</td>
<td>-2.86***</td>
<td>-0.66</td>
<td>0.22</td>
<td>-2.94***</td>
</tr>
<tr>
<td>INCOME</td>
<td>-0.0001</td>
<td>0.0004</td>
<td>-1.23</td>
<td>-0.0001</td>
<td>0.0001</td>
<td>-1.23</td>
</tr>
<tr>
<td>HOUSE_OWN</td>
<td>4.04</td>
<td>0.78</td>
<td>5.18****</td>
<td>0.56</td>
<td>0.06</td>
<td>8.89****</td>
</tr>
<tr>
<td>CRIME</td>
<td>3.31</td>
<td>0.89</td>
<td>3.69****</td>
<td>0.51</td>
<td>0.09</td>
<td>5.86****</td>
</tr>
<tr>
<td>GENDER</td>
<td>0.17</td>
<td>0.43</td>
<td>0.39</td>
<td>0.04</td>
<td>0.10</td>
<td>0.39</td>
</tr>
<tr>
<td>LAND_T</td>
<td>-1.59</td>
<td>0.75</td>
<td>-2.11**</td>
<td>-0.38</td>
<td>0.16</td>
<td>-2.31**</td>
</tr>
<tr>
<td>HH_Size</td>
<td>-0.14</td>
<td>0.06</td>
<td>-2.24**</td>
<td>-0.03</td>
<td>0.01</td>
<td>-2.25**</td>
</tr>
<tr>
<td>WORK_Gov</td>
<td>-2.56</td>
<td>1.27</td>
<td>-2.03**</td>
<td>-0.39</td>
<td>0.09</td>
<td>-4.41****</td>
</tr>
<tr>
<td>TOILET</td>
<td>1.02</td>
<td>0.55</td>
<td>1.85*</td>
<td>0.22</td>
<td>0.10</td>
<td>2.12**</td>
</tr>
<tr>
<td>YEARS</td>
<td>-0.13</td>
<td>0.03</td>
<td>-4.06****</td>
<td>-0.03</td>
<td>0.01</td>
<td>-4.02****</td>
</tr>
</tbody>
</table>

Log likelihood function: -74.20
Restricted log likelihood: -114.67
Chi squared: 80.94
Probability [Chi squared > value]: 0.0000
Hosmer-Lemeshow chi-squared: 36.62
P-value: 0.0000
McFadden Pseudo R-squared: 0.35
% correctly predicted: 80.23
Number of observations: 167

****, ***, **, and * are 0.1%, 1%, 5% and 10% statistical significant levels; dependent variable is house type (HOUSE_T)

Coefficient associated with income had expected sign but was not statistically significant. Coefficient associated with gender was not also significant. In terms of marginal effect, interviewees who owned a house in informal settlement, lived in the neighbourhood where crime is frequent and lived in a house where different families use the same toilet were 56 percent, 51 percent and 22 percent more willing to live in make-shift houses. Interviewees who occupied State land, have many persons in the household, worked for government and have lived in informal settlement for many years were 38 percent, 3 percent, 39 percent and 3 percent less likely to live in make-shift houses respectively.
Most important infrastructure and services as perceived by residents

The results revealed that almost all the interviewees (97.4%) reported that potable-piped water supplied by Eda Ranu (now Water PNG) is the most important infrastructure needed in the informal settlements where they lived (Figure 5). Only a few of the interviewees reported that sewerage and good paved road networks are the most important infrastructure (1.5% and 1.02% respectively).

None of the interviewees reported that electricity supplied by PNG Power is of most importance.

In terms of the most important services needed in the informal settlement, almost all the resident interviewees (98.4%) reported that health care facility is the most important where they lived (Figure 6). Only a few of the interviewees reported that police station and open space for recreation are the most important (1.02% and 0.51% respectively).
All the interviewees did not believe that schools, market facility and bus station/stop are of importance where they lived (Figure 6).

In terms of whether informal settlement residents would bear costs associated with upgrading the area where they lived, the results revealed that all the interviewees who “owned land” in the area would pay for land registration and ground rent. They would also pay for permit for building plan.

All interviewees who are renting a house in informal settlements reported that they would pay any additional house rent as a result of the upgrade of the areas where they lived. All the interviewees would pay service charges for infrastructure and services associated with the upgrade of informal settlements where they lived.

Almost all the interviewees (96.4%) had 100 percent certainty level that they would pay for service charges following the upgrade of the informal settlements where they lived. Only a few of the interviewees (2.6%) had 50 percent certainty level whereas 1.03 percent had certainty level of 75 percent and 0.52 percent had the certainty level of less than 15 percent. This indicates that on average, informal settlement residents are more likely to pay service charges for infrastructure and services following the upgrade of the informal settlements where they lived.
All the community leaders who were approached for interviews agreed to be interviewed. In total, 36 leaders were interviewed of which Church leaders had the highest number of interviewees (33.3%). Village Court, women in business and block committee had the lowest – all at 2.8 percent (Figure 7).

Figure 7. Community leaders in relation to the group they belonged

Most of the community leaders belonged to Southern Region (44%), followed by Highlands Region (39%) and none is from New Guinea Islands (Figure 8).

Figure 8. Region that community leaders belonged to
The results revealed that of all the leaders, there were more men (58%) than women and they have an average age of 39.7 years (Table 4). On average, the leaders have lived in informal settlements for 40 years and have served as leaders for 10 years. Most of the leaders had high school as their highest education attainment (50%) followed by secondary school (25%). Most of the leaders were married (75%), only a few were single (Table 4).

Table 4. Description of the characteristics of community leaders

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENDER</td>
<td>Interviewee's gender: 1 is female; 0 male</td>
<td>0.42</td>
<td>0.50</td>
</tr>
<tr>
<td>AGE</td>
<td>The interviewee's age in years.</td>
<td>39.67</td>
<td>6.55</td>
</tr>
<tr>
<td>YEARS</td>
<td>Number of years the interviewee has lived in settlement</td>
<td>21.0</td>
<td>9.87</td>
</tr>
<tr>
<td>LEADER</td>
<td>Number of years that the interviewee has been a leader</td>
<td>10.06</td>
<td>5.18</td>
</tr>
<tr>
<td>No.FORMAL</td>
<td>Interviewee has formal education: Yes = 1; No = 0</td>
<td>0.27</td>
<td>0.17</td>
</tr>
<tr>
<td>PRI_S</td>
<td>Primary school is the interviewee's highest education: Yes = 1; No = 0</td>
<td>0.17</td>
<td>0.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No = 0</td>
<td></td>
</tr>
<tr>
<td>HIGH_S</td>
<td>High school is the interviewee's highest education: Yes = 1; No = 0</td>
<td>0.50</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No = 0</td>
<td></td>
</tr>
<tr>
<td>SEC_S</td>
<td>Secondary school is the interviewee's highest education: Yes = 1; No = 0</td>
<td>0.25</td>
<td>0.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No = 0</td>
<td></td>
</tr>
<tr>
<td>TECH_S</td>
<td>Technical school is the interviewee's highest education: Yes = 1; No = 0</td>
<td>0.03</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No = 0</td>
<td></td>
</tr>
<tr>
<td>UNI</td>
<td>University is the interviewee's highest education: Yes = 1; No = 0</td>
<td>0.03</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No = 0</td>
<td></td>
</tr>
<tr>
<td>MARITAL</td>
<td>Interviewee is married: Yes = 1; No = 0</td>
<td>0.75</td>
<td>0.44</td>
</tr>
</tbody>
</table>

In terms of how informal settlement upgrade program should be implemented for it to work well, the results from interviews with community leaders revealed the following:

- Almost 60 percent of the community leaders that were interviewed reported that for the upgrade project to work well, informal settlement residents must be involved in planning the project. Some of the residents must be employed, especially the youths, in the upgrade program during the implementation phase:

  *For the upgrade program to work, residents must be involved in the program and engaged in the implementation phase of the program.*

  *Implement the upgrade program in collaboration with residents to understand their needs and engage youths to work in the program.*

- More than 10 percent of the community leaders reported that proper awareness on the upgrade program, especially in terms of its benefits, costs and how it will be implemented, should be conducted in the informal settlements. The awareness will encourage residents to support the program:

  *First create awareness about the upgrade program throughout the informal settlements so that everyone can understand the program, especially how it will be implemented.*

  *Discuss with residents to seek their support because several survey works have been conducted in some of the informal settlements in the past and we were promised development but to date nothing has been implemented.*

- More than 10 percent of the community leaders reported that there is a need to develop a criteria that can be used to identify residents that are qualified for issuance of land titles and procedures for
registration of land and providing infrastructure:

Give land titles to people who built houses in informal settlements and have lived there for more than five years.

The informal settlement upgrade program must be carried out in orderly manner by developing procedures in collaboration with community leaders.

• The most preferred infrastructure and services should be established first to engender support from residents before establishing less preferred infrastructure and services:

  Improve road conditions to facilitate the development of other infrastructure. Access road will pave way for piped water, sewerage and electricity.

  Piped-potable water supplied by Eda Ranu (now Water PNG) and electricity connected by PNG Power and health care facility should be established in the informal settlements first before other infrastructure and services.
Potential guidelines for upgrading informal settlements in PNG

The guidelines for upgrading informal settlements are often designed to reduce land-related problems that restrict countries from achieving sustainable development (Potsiou et al., 2019). It provides steps, priorities for recognising informal tenure and weak ownership rights as well as how to provide clear ownership titles and registration. It also provides a description of expected challenges, benefits and rationale concerning how an upgrade program should be implemented as well as what should be done prior, during and after the program.

According to Potsiou et al. (2019), for guidelines on informal settlement upgrade to be effective and efficient, it requires a series of comprehensive and consistent land policies and economic reforms for management of land. It includes property registration, pro-growth planning and permits for flexible development, property valuation, fair taxation and affordable housing policies. There is also a need for an established funding mechanism, professional education, professional ethics and an effective role for the private sector (UNECE, 2009).

The informal settlement upgrade guidelines can be classified into the following phases: The strategy phase; framework preparation phase; and upgrade implementation/construction phase.

The strategy phase

The strategy phase consists of the following activities:

• **Seek support from the government and other key stakeholders.** Seek support from policy makers and planners so that the upgrade program can receive support. Involve key government agencies such as DLPP, NHC, Department of Justice and Attorney General and, utility providers such as Water PNG and PNG Power. Others include municipal authorities such as NCDC, local level governments, customary landowners, civil society organisations and community leaders of informal settlements being upgraded.

• **Conduct assessment on the characteristics of the informal settlements to be upgraded.** It involves making assessment of socio-economic characteristics and infrastructure and services. Others include assessment of the governance structure, land ownership and tenure and identification of emerging issues associated with the informal settlements.

• **Conduct consultation with communities in the informal settlements.** Community leaders in the informal settlements are identified and consultations are held with them to discuss the upgrade program.

• **Conduct cost-benefit analysis to determine the consequences of not upgrading the informal settlements.** The costs and benefits associated with the upgrade program to both the government and landowners are determined. The upgrade is often implemented if the benefit outweighs the cost.

• **Discuss and agree on the appropriate informal settlement upgrade strategy with key stakeholders.** In order to reduce transaction costs, all key stakeholders must agree on a strategy to use before the upgrade program can be implemented.

• **Develop a communication strategy.** As informal settlement residents often come from different walks of life, various communication pathways are required to reach the different groups of residents.

• **Document an upgrade strategy report.** As there are several key stakeholders involved in the upgrade program, there is a need to document the strategy that has been agreed on by the stakeholders.
The framework preparation phase

This phase consists of a series of steps based on the plan of action that was considered in the strategy phase. The following steps make up the framework preparation phase:

- **Determine informal settlement areas to benefit from upgrade program.** Develop a scale of preference that contains a list of informal settlements in which the settlements to be upgraded appears at the top of the list.

- **Determine legal and regulatory issues.** Determine how to address the issues associated with land ownership and tenure.

- **Determine appropriate actions to be taken for the upgrade of informal settlement to work.** Identify actions to be taken in order to convert informal settlement to formal settlement in collaboration with beneficiary communities.

- **Define property registration processes.** Provide a guide on the procedures that landowners would follow to access titles and building permits as well as any other registrations required to formalise the informal settlements.

- **Upgrade process is documented, fees and penalties established.** Document the upgrade process and provide policy instrument for the control of development in areas being upgraded. Also establish registration fee and penalties for non-compliance in collaboration with key stakeholders.

- **Determine the institutions that will be primarily involved in the implementation of the upgrade program.** It is advisable to have a smaller group while other institutions can play advisory role. For instance, in Port Moresby, the main implementing agency should be NCDC in collaboration with DLPP and NHC.

- **Determine the administrative system that will be used to activate communication strategy; prepare legal framework; allocate administrative and technical facilities; and provide technical advice.**

Upgrade implementation/construction phase

This phase consists of various administrative and legal functions, fee collection, registration and monitoring of development. This phase includes the following:

- **Develop criteria that residents who are genuine landowners or squatters should meet to qualify for land titles.** The criteria can include proof of ownership of land, proof of long-term occupancy of a piece of land, willingness to pay annual ground rent and willingness to get an approved building permit and to do any adjustments on houses built if the case arises.

- **Determine areas where trunk infrastructure will be constructed.** Housing developments in informal settlements are not often well organised. Thus, spaces for infrastructure are not provided. Areas where infrastructure will be constructed should be discussed with beneficiary communities and customary landowners where applicable.

- **Submission and processing of documents associated with land registration, building permits and claims.** All residents that meet the minimum requirements for the issue of land titles and those that require building permits are advised to file their applications with the appropriate agency. Residents who qualify for either relocation or compensation will also file their applications.

- **Construction of trunk infrastructure and services.** The most preferred trunk infrastructure and services lacking in the informal settlement are provided.

- **Continue the registration of developments in the informal settlement.** Informal settlement residents face different situations. Some of them may require more time to be able to meet the cost of registration. It is important to consider this group of residents by including flexibility in the process.
• *Appropriate legal actions are taken against residents that refuse to comply with the upgrade processes.* Municipal authority such as NCDC to takes legal action against informal settlement residents who refuse to comply with the processes.

• *Identify an entity to implement penalties against residents or property owners that refuse to comply with set rules.* The entity should be effective and efficient in carrying out its duties. Penalty can be in terms of charges, which should be paid on the due date or it will attract interests.

• *Monitoring and evaluation of the upgrade processes.* It is necessary for the implementing agency to have an effective and efficient monitoring mechanism so as to make the process sustainable. This will assist the agency to ascertain whether the upgrade program is working well.
Discussion

The findings from this study revealed that ordinary residents and community leaders of informal settlements of Port Moresby would support an upgrade project of the areas. However, for the project to be sustainable, the residents of informal settlements should be involved in the project, which should reflect their interests. Appropriate guidelines for the implementation of the project should be established. Informal settlement residents are better placed to have information on how the upgrade project can be implemented in a sustainable manner. Our findings are in line with that of Alzamil (2018), who found in an Indonesian study the status of informal settlements in Jakarta, that in upgrading the settlements, the local communities should be involved. Our findings are also in line with that of Ragheb et al. (2016), who found in a comparative Egyptian and Indian study that an informal settlement upgrade project would be successful if local culture there are preserved and the opportunities of intergenerational lifestyles and businesses are provided. This suggests that in the course of implementing a settlement upgrade project, the residents of the areas should be involved in the planning and implementing, in collaboration with key government agencies that have been given the responsibility to implement the upgrade.

Piped-borne potable water supplied by Water PNG and health care facility are the most important facilities for the informal settlement residents. The importance they attached to potable water and health care facility indicate that these are the most felt needs in the informal settlement. It suggests that the informal settlement upgrade project will be more acceptable by the residents if their immediate needs (water and health care) are provided first. Our findings conform to that of Patel (2013) who found in a South African study on informal settlement upgrade that successful outcomes are linked to the influence of the local communities. Alzamil (2018) found in an Indonesian study that a settlement upgrade should follow a comprehensive plan that includes priority improvements. Thus, for the upgrade project to be successful, it is important to conduct need assessments so that the immediate needs of the residents can be identified before implementing the project. This has the potential to minimise the tendency of conflict of interests between residents and upgrade implementing agencies.

In addition to the most preferred infrastructure and services, community leaders suggested the need to also construct good road networks where it is needed first to provide space for moving in other infrastructures. This is important because it is often difficult to establish main water pipes and electric poles without road access to the areas. Thus, when it comes to the upgrade of informal settlements, accessibility matters. If the settlements are not accessible, it will be extremely difficult to deliver infrastructure and services. This suggests that, if the intention is to upgrade informal settlements in Port Moresby, key government agencies such as NCDC, Department of Works and DLPP should consider providing access road first to the settlements. The road networks will assist the agencies in the movement of materials for the construction of health care facilities and moving in pipes and other material needed for piped-borne potable water.

We found that the upgrade implementing agency has a lot to gain from the consultation with residents of informal settlements. There is a need for the agency to plan the implementation of the upgrade project properly in collaboration with key stakeholders. Effective and efficient feedback mechanisms should be included in the implementation of the project. Our findings are in line with the guidelines for the formalisation of informal construction by Potsiou et al. (2019). If the intention is to upgrade informal settlements successfully, there is a need to implement the upgrade in an orderly manner. The implementing agency should consider adopting the guidelines developed by Potsiou et al. (2019) and adapt it to PNG conditions. The guidelines should include a strategy, framework preparation and upgrade implementation phases. This has the potential of making the upgrade meeting internationally acceptable standards. The agency should note that the nature of the upgrade project depends on the local contexts of the informal settlement being upgraded as reported by Tsankova (2012). Thus, the nature of implementation of the project should be based on a case by case basis, which imply that it must be planned thoroughly. Lessons drawn from each of the upgrade project will play an important role in implementing other projects. This calls for the evaluation of completed upgrade project and lessons identified. It is important for the upgrade process to be simple, cheap and provide quick results as suggested by Collier et al. (2018). Furthermore, the upgrade program should include a mechanism that can be used to restrict the
emergence of new informal settlements. For instance, offenders can be asked for penalty in the form of huge fines while people who discourage the emergence of informal settlements by reporting activities of offenders to appropriate authorities are rewarded.

Land ownership and tenure often generate a conflict situation in an informal settlement upgrade project, especially in terms of making land available for constructing infrastructure. For the project to work well, there is a need for the regularisation of land tenure as reported by Devas et al. (2004). This can increase land prices and consequently increase house prices (Lees et al., 2016). In our study, we found that almost 70 percent of the informal residents that were interviewed lived in houses constructed on State-owned land. If the intention is to regularise their occupancy, there is a need to develop guidelines or criteria that residents will need to meet before they can be given a State lease (title). Some community leaders that were interviewed suggested that the Government should consider issuing titles to people who have built houses in informal settlement and lived there for at least 10 years. It may be a daunting task to determine how many years a resident has continuously lived in a particular settlement. In order to develop a workable criteria, the upgrade implementing agency should develop the criteria in collaboration with key stakeholders including representatives of various groups of people that live in the settlement. It is important to provide appropriate information to residents that meet requirements for the issuance of State lease on the procedures and costs associated with the lease. For people who occupied customary land, there is a need for them to provide a proof of ownership of the land before formalising their lands. As constructing infrastructure in an area needs land, it is important to have consultation with the residents during planning of the upgrade project and landowners where appropriate. This has the potential to reduce the tendency of some residents resisting the use of portion of the land where they live for constructing infrastructure, and has the potential to garner support from landowners for the program.

The findings show that residents would pay for service charges associated with the infrastructures that have been constructed as a result of the upgrade project. This suggests that informal residents are aware that the infrastructure and services provided during the upgrade project will need to be paid for. Thus, government has a lot to gain from the project, especially if it is implemented properly. The service charges paid by residents for water and electricity will boost government revenue. It can also boost some businesses in the settlements, which can create more jobs. Currently, some informal settlement residents access piped water and electricity through illegal means and government lose revenue as a result of leakages. If a proper upgrade project is implemented, it has the potential to block the leakages and the government will also get money from building permits and ground rent.

One of the characteristics of a typical informal settlement is often the presence of temporary (make-shift) houses, especially in squatter settlements. However, in some cases, permanent houses are constructed even in squatter settlements. People who constructed permanent houses often have higher tendency to resist an upgrade project that may result in the loss of part of their house than those who have make-shift houses. As the upgrade of an area is associated with transaction costs, it is important to consider the characteristics of houses (whether make-shift or permanent). In our study, we found that more than 50 percent of the interviewees lived in permanent houses. This indicates that there may be much negotiations during the upgrade project especially if some of the permanent houses are located in areas where infrastructures are to be constructed. It is important to do a thorough negotiation that can result in a “win-win” situation for both residents and the government, and for landowners in the case of informal settlements on customary land. The informal settlement residents should be satisfied with the upgrade project before implementation as reported by Li and Wu (2013). This will provide the upgrade implementing agency an idea of the potential cost of the upgrade.

In terms of willingness to live in a make-shift house, we found that the main drivers include the ownership of a house in the settlement, frequency of crime in the neighbourhood, land ownership type and occupation. It is important to consider these factors in planning an informal settlement upgrade project. Residents who owned a house in an informal settlement were likely to live in a make-shift house. This suggests that people who could not afford housing in formal settlements tend to move to informal settlements where they construct a temporary shelter. Thus, make-shift houses appear to contribute to providing affordable housing to low-
income households and people who do not have a steady job. Thus, before implementing an upgrade project, it is important to consider that the upgrade has the potential to increase house prices in the informal settlement, which can restrict access to affordable housing to low-income households. This conforms with the assertion of Lees et al. (2016), who concluded that upgrade would increase land and house prices. The upgrade project has the potential to attract infrastructure and services to informal settlement and most make-shift houses converted to permanent houses. The infrastructure and services contribute to increase in house prices which may be above what some households can afford. In order to address the potential housing affordability problem triggered by the upgrade of informal settlements, the government should consider facilitating the construction of affordable houses in the settlement so that low-income households can have access to houses they can afford.

Informal settlements are often associated with high rates of crimes. Our findings show that neighbourhoods dominated by make-shift houses are likely to be associated with frequent crimes. A possible reason for the frequent crime in the neighbourhoods is that some of the residents who live in make-shift houses are unemployed and they are more or less people on transit. As the houses there are temporary, people who are engaged in crime can easily move away from their abodes without any trace. This may provide them an incentive to live in make-shift houses. Our findings are in line with that of Naceur (2013) who found that upgrading of informal settlements has a positive effect on the perception of safety in settlements in Batna, Algeria. If the intention is to address the issue of safety in the informal settlements of Port Moresby, the main focus should be on areas dominated by make-shift houses because these tend to be crime hotspots. Furthermore, some criminals tend to use make-shift houses as their hide-outs.

We found that informal settlement residents who lived in houses built on State-owned land were less likely to live in make-shift houses. This indicates that the upgrade project may be associated with a lot of transaction costs with people who occupy State-owned land as a result of negotiations linked to land where infrastructure should be constructed. State-owned land which is often desired by developers is almost exhausted (Wangi and Ezebilo, 2017). Thus, the occupants of State-owned land in the settlement may find it difficult to release a portion of the land for establishing infrastructure. In negotiations with the occupants of State-owned land, the implementing agency should remind them that the land belongs to the government. Thus, the government is obliged to use portion of the land for constructing infrastructure.

The findings revealed that government workers who lived in informal settlements were less likely to live in make-shift houses. A possible reason may be that the workers get their salaries regularly, which gives them the opportunity to either pay for house rent in a permanently constructed house or to construct their own permanent house. It is important to note that residents of informal settlements come from all walks of life, including government workers. Thus, it is important to conduct a socio-economic impact assessment and potential ways to manage shocks that may arise before implementing the upgrade project. This will assist both the implementing agency and settlement residents to be fully prepared to host and implement the project.

If the intention of GoPNG is to upgrade informal settlements, it is important for the upgrade planners and policy makers to understand that settlement is part of the urbanisation process and contribute to providing affordable housing for the low-income households. Informal settlements should not be perceived as an urban problem. It should be seen as part of the solution to affordable housing for the low-income households. It is important for the process of the upgrade to be simple, cheap and provide good results within the short term. In order to engender local community’s support, it is important to provide improvements that are visible to them within a short term. If the upgrade project is implemented in an effective and efficient manner, it can improve the social capital and welfare of informal settlement residents. It is important to note that upgrading informal settlements may encourage the emergence of new settlements and an increase in house prices above what majority of residents can afford. Thus, these should be considered before implementing an informal settlement upgrade in PNG. A potential way to address the concern of the emergence of new informal settlements is to provide an effective mechanism to discourage the emergence of new settlements. The government should consider using economic instruments such as taxes and rewards. This involves developing a mechanism that makes people who develop a new informal settlement to pay ground rent of twice the value of the land to government every
fortnight. People who report illegal development to government are rewarded in cash. Affordable housing in an upgraded informal settlement can be promoted by facilitating large scale private developers to construct low cost houses there.
Conclusion

This study aimed to investigate the strategy that can be used to improve the living conditions and welfare of informal settlement residents. The findings show that upgrading a settlement by providing infrastructures and services can improve the conditions of the settlement and people who live there. However, for the upgrade project to be effective and sustainable, informal settlement residents should be involved in the planning, implementing and in selecting the infrastructure and services they need. Informal settlement provides affordable housing for low-income households while upgrade of the settlement may result in an increase in the price of housing above what they can afford. This should be considered in an upgrade project by providing programs that can assist these group of households access affordable housing. Furthermore, upgrading of an informal settlement is often associated with regularisation of the land tenure which include the issuance of land titles to residents that meet established requirements. It is important for all the key stakeholders involved in the upgrade project including representatives of the various groups in the informal settlement to be involved in determining the requirements. In order for the upgrade project to be implemented in an effective and orderly manner, effective guidelines and feedback mechanisms should be established before implementing the project.

The informal settlement residents are willing to pay for service charges of infrastructure and services provided through upgrading the settlements. However, they prefer that piped-borne potable water supplied by Water PNG and health care facilities should be provided first before others. Good road networks should be provided in the settlement to improve accessibility there so that other infrastructure and services can easily be provided. The upgrade of an informal settlement may generate transaction costs as a result of negotiations of where the infrastructure should be established and whose portion of land should be used. Thus, it is important to conduct appropriate consultations with all interest groups and affected residents before implementing the upgrade project. In order to avoid the grabbing of customary land, only genuine owners should be given land titles. Genuine customary landowners must be identified with an effective mechanism such as incorporated land groups registration. It is important to provide an effective mechanism that has the potential to discourage the spring up of new informal settlements. The use of economic instruments such as taxes and subsidy with strict implementation may produce good results. The findings contribute to more understanding concerning how informal settlements can be upgraded in a sustainable manner by considering the preferences of residents and impact of the upgrade on disadvantaged groups. This will assist policy makers, planners and urban development managers in developing guidelines for the planning and implementing informal settlement upgrade projects and restrict the emergence of new informal settlements.


De Soto (2000) emphasised that formalising customary land holding systems by the State through the issuance of instruments such as land titles promotes a means of securing land ownership rights, allows for access to credit and stimulates investment in the rural areas of developing countries. He stressed that the lack of a legal title can inconvenience the poor and further asserts that it can complicate the process of property transactions and obtaining credit (De Soto, 2000). Although convincing, one drawback to De Soto's view is that he did not consider the degree of land tenure differences in developing countries and developed countries. He disregarded communal ownership and promoted that individual and private title could lead to greater prosperity in developing countries. In a subtle stance, De Soto insinuated that customary land tenure regimes were inferior to the Western property structures and he failed to acknowledge that attempts to replace communal ownership may be unsuccessful and may unintentionally undermine existing traditional institutions that prevail in developing countries and some developed countries that have undergone land rights reform for their indigenous people.

It is inevitable that developing countries and their indigenous societies are evolving in the wake of modernity and economic progress. The influence of neo-liberalism has become a powerful process and a 'normal' way of life throughout the world, and the dominant logic of neo-liberalism currently in place states that everybody must participate in the mainstream economy as individual subjects or miss out on economic possibilities (Howlett et al., 2011).

This continued push for economic growth in various developing countries is prompting governments to look at indigenous land tenure systems and embark on land reform programs to bring customary land into the formal statutory institutional framework (Ho and Spoor, 2005).

Land reform is not a new phenomenon. They were a crucial element for social transformation in socialist societies like Russia, China, Eastern Europe, parts of Asia and Africa in the 20th Century. The socialist movement was confined to redistributive reform of land by the transfer of rights in land from large landowners to smallholders and the landless (Lipton, 1974 in Muller et al., 2009).

The arguments for customary land tenure reforms by the governments in some developing Pacific Island countries such as PNG is largely based on economic development and growth reasoning. Underlying this preoccupation is a belief that customary land tenure systems are a notable bottleneck to a properly functioning rural land market (Anderson, 2006).

This economic development perspective that customary land tenure is a serious constraint to the land market in developing countries has been widely highlighted in the World Bank research reports; "World Bank Experience in Land Management & the Debate on Tenure Security", and Land Policies for Growth and Poverty Reduction. However, in contrast, Ubink (2009) highlights that research by Cotula et al. (2004) and, Durand-Lasserve and Selod (2007) found that land titling initiatives have failed to establish conclusive evidence of the expected social and economic impacts of land titling. According to Durand-Lasserve and Selod (2007), customary land systems provide security of tenure even though they are not formally recognised by the State.