A Conceptual Framework for Multipurpose Land Information System (MPLIS) Application for Land Management in Papua New Guinea

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Abstract

This study is an investigation of the weaknesses of the current Land Information System (LAGIS) used for land management in Papua New Guinea under the policy directives of the National Department of Lands and Physical Planning (DLPP). A questionnaire survey of 50 randomly selected users of LAGIS, including key heads of sections within the Department of Lands and Physical Planning (DLPP) was conducted in August, 2015, following a visit by the authors to the Department in Lae, Morobe Province, to undertake physical inspections of LAGIS infrastructure. Findings from the analysis of the first research question revealthat, improper management of land information, slow speed of information retrieval; outdated information, poor information dissemination, and poor user convenience are the major challenges facing LAGIS. However, the second research question directed at technocrats and professionals familiar with IT and GIS revealed an overwhelming agreement that Papua New Guinea is sufficiently endowed with most of the manpower resources needed for creating a sustainable database for a modern, integrated and multi-purpose LIS (MPLIS), and for maintaining it in the long term without having to heavily depend on foreign assistance. Based on these findings, it is recommended that the current LAGIS be overhauled by the DLPP and replaced with a sustainable 'MPLIS' for the benefit of all land information users in the country.

Keywords: *Land Information System, land, application, land management, Papua New Guinea*

1. Introduction

A Land Information System (LIS), as defined by Wade and Sommer (2006), is a geographic information system for cadastral and land-use mapping, typically used by local governments. One may ask: Why is LIS such an important part in administering land-related data? According to the International Federation of Surveyors (IFS), LIS is defined as follows: "A tool for legal, administrative and economic decision-making and an aid for planning and development". Land information consists of a database containing spatially referenced (and non-spatial) land-related data for a defined area on the one hand and, on the other hand, of procedures and techniques for the systematic collection, updating, processing and distribution of data. The "base of a land information system is a uniform, spatial referencing of data within the system, with other land-related data" (UNECE, 1996). It can be further defined as a system for Cadastral, GIS and land-use mapping used by various organisations that deal with land-related matters."At common law, the term "land" when applied to a particular parcel meant the surface of the Earth, the soil

beneath the surface to the centre of the Earth and the column of air above the surface. It included all things growing on or affixed to the soil, such as trees, crops and buildings. It also included all the minerals in the soil, except gold and silver, which at law belonged to the Crown as royal metals" (Hallmann 1994, 9.1)."'Land' includes land of any tenure, and mines and minerals, whether or not held apart from the surface, buildings or parts of buildings (whether the division is horizontal, vertical or made in any other way) and other corporeal hereditaments; also a manor, an advowson, and a rent and other incorporeal hereditaments, and an easement, right, privilege, or benefit in, over, or derived from land" (Law of Property Act 1925, Section 205(1)(ix)). "'Land' also includes land covered with water" (Land Registration Act 2002s 132(1)).Land, according to Hurni (1997), also "refers to spatial units where ownership, resource availability, boundary conditions and the policy and economic environments play an important role" for human existence and sustainability.

In Papua New Guinea, land is regarded as both a sacred and a life-line resource for the inhabitants (Amankwah, *et al*., 2001).Traditionally, land was deemed to be the source of people's livelihood. This phenomenon makes Land Management to be complex and difficult at times because of the strong traditional ties that bound the use of land in Papua New Guinea. Even before any law could have been enacted by early explorers, the traditional use or function of land was somewhat a system already in place. This system allowed the local people to maximise and benefit from land resources. Based on local customs, the definition of customary land system used varied from place to place. However, generally, land could have meant the physical soilonly that is, the land itself, a definition that does not include the trees, crops or any permanent fixtures. Customary law also recognises that a lineage or other groups may own the physical soil, whereas growing crops and other improvements on it may be claimed by other members of the community who have been invited to occupy the land.

According to historical records, Captain John Moresby (after whose name the Capital City of Port Moresby derived its name) had entered the shores of Fairfax Harbour on HMS Basilik in February, 1873 (Howard, 1974). Pressure for land annexation immediately grew because of the politically motivated intentions of the former colonial powers such as Germany, France, the Netherlands, Australia and Britain. The first land annexation occurred in the early 1880s by the British Government through the Australia colonies where part of New Guinea was annexed. The exercise enabled agents of the Queensland Government to declare a Protectorate over New Guinea in 1883 (Rowell:http://guides.naa.gov.au/papua-new-guinea/appendixes/4.aspx, Accessed 28 September, 2015).

This scenario implies that most of the former colonial powers were motivated by political gains for land admiration than for any other reasons, which eventually resulted in a scramble by colonial powers for control of different parts of New Guinea. This then led to the implementation of different rules and regulations by different colonial powers in their own domains as administrators of land.This was the case before Papua New Guinea's independence and whoever was in control had to specify their ideology on the management of land. Consequently, Papua New Guinea as an independent and sovereign nation adopted some of the common law in force in the colonial era, a law that today seeks to work on equalising with the traditional aspects of land management in the country. Integration of both the common law and traditionally viewed law for land administration is what needs to be addressed critically by the Government of this day so that strategies designed for land administration could work equitably in all parts of the country.

The purpose of this paper is to investigate the general level of users' satisfaction with the existing LIS in Papua New Guinea with a view to developing a suitable conceptual framework for the application of a sustainable Land Information System (LIS) for efficient land administration in Papua New Guinea. The paper is divided into four sections. Following the introduction in section one, section two presents the research problem, contributions to knowledge, conceptual framework and research method. The research findings and discussion are presented in chapter three, while the concluding section is devoted to the conclusion and recommendations.

2. Nature of the Problem, Contributions to Knowledge, Conceptual Framework and Method

2.1 Nature of the Problem

Today we see different tensions in most land dealings (e.g. subsequent transactions using land as collateral for lending purposes, land transfer, subleases, etc.) both in the urban and rural areas of Papua New Guinea and land issue has thus become a major concern in recent years. The government has devised several techniques and methods to minimise land disputes but it seems that nothing is really working. Consequently, there seems to be an increasingly complex problem with land administration in the Department of Lands & Physical Planning. The on-going problem in land administration results from a lack of properly administered land information data that could enhance the quality of information and thereby enhance investment and policy decisions relating to the use, planning, storing, retrieval, display and updating of land data. This paper, therefore, focuses on identifying the best possible approach to data management system that could yield high speed and accuracy in Land Information System in realtime. Having a well-managed knowledge-base to determine the quality and accuracy of data for Land Information System is paramount in the public sector today. The Department of Lands& Physical Planning in PNG is faced by a huddle of land issues; so this research will help minimise the many challenges facing land administration in the country as well as improve the data management system. In essence, a well-managed data system equipped with appropriate data could provide well-informed decisions. This knowledge is important for the dissemination of land information to the users or holders of land. LIS deals with information that is significant and important as well as the negativity in any land dealings so that amendments can be made. This will further educate the majority of people in the country who lack proper information that could help reduce land disputes.

State land is managed by the Department of Lands and Physical Planning, including all processes of town planning, survey, valuation, land management, title registration and leases. Such organised processes based on knowledge of data should provide transparency for communal interests in land. On the other hand, customary land should be well coordinated by the Government through the Department of Lands & Physical Planning so as to assist customary land owners when registering their land as recommended in the DLPP guidelines, provided that the data system in place is accurate and efficient. For example, in nearby Fiji it appears that the level of users' satisfaction with the LIS is higher than the level of satisfaction with the LAGIS in Papua New Guinea. When Fiji realised the need to streamline land management approaches in 1992, it started the development of a national land information system. Land ownership in Fiji is classified into three major categories, namely customary land, State land and freehold land. Challenges in the administrative environment, different ownerships of land and the need for land

development, pushed the Government to adopt automation of land data recording systems. This involved the coordination and standardization of land data recording and land use management by all statutory bodies resulting in significant benefits and competent land use management. Therefore, if it works well for Fiji, it should work well for Papua New Guinea within the same South Pacific Region. These are some of the reasons informing the present study.

2.2 Research Questions and Contributions to Knowledge

The present study is only the first stage of a wider study planned to take place in another three years or so to enable the researchers monitor the progress achieved by the Independent State of Papua New Guinea in implementing a versatile LIS for the country. Meanwhile, two research questions were answered in the present study as a means of making contributions to knowledge. The issues examined are as follows:

i) What is the general level of users' satisfaction with the existing land-related data Information system in Papua New Guinea?

ii) Does Papua New Guinea have adequate resources to manage, sustain and derive maximum benefits from a modern LIS system in the long term?

This paper will make significant contributions to knowledge by laying a solid foundation for the design and take-off of a sustainable Land Information System for Papua New Guinea, where no efficient system currently exists. The only relevant facilities currently being used to facilitate land administration in the country at present are the land cadastral and GIS (LAGIS) applications that are not sufficient in themselves for addressing all issues relating to the whole gamut of decisions in land administration, property development, valuation and taxation (rating) for sustainable urban and rural development.

2.3 Conceptual Framework

This paper adopts the multipurpose land information system (MPLIS) as the conceptual framework (Tulloch, 1999; Federal Geodetic Control Committee, 1988) that is considered appropriate to the vision for improving Papua New Guinea's land information. Some of the most basic information about land, and much of what municipalities and other local governments would like to include in an MPLIS, pertains to *land interests*. Issues regarding ownership, zoning, rights-of-way and easements, political jurisdictions and taxation are all examples of legal interests in land that are defined in terms of nature and extent. In Papua New Guinea, the nature of an interest in land refers to the rights and restrictions affecting the use of the land and its resources, while the extent of land interests refers to the boundaries of those interests in space and time. At the same time, these land interests have evolved over time and they have shaped the nation's land records system. Therefore, having an efficient and effective data information concerning land is vital for any land management "dealings" (subsequent transactions in land) in the country. A LIS is an effective system that gives accurate and precise information for the users and holders of any interest in land, bearing in mind the fact that "landed property" is a complex and dynamic bundle of rights or interests (Figure 1).The ownership interests associated with land can be compared to the sticks shown in Figure 1, with each stick representing a right or interest in land and in modern society the number and variety of interests in land are considerable (Federal Geodetic Control Committee, 1988). In many countries, including PNG, the largest and best recognised collection of privately held rights, according to the FGCC (1988), are those

associated with *fee simple absolute ownership*, also called *fee simple* or just *fee*, which most people think of as private land ownership rights. One person may own rights to use the land surface, another the minerals underneath the surface, another lease, and another mortgage. Overriding these interests are public interests, such as the right to tax, the right to navigate, the right of eminent, and the rights to limit the use of land (executive or zoning power) in order to protect the common health, safety, and welfare (public good). Given these complex relationships, a multipurpose land information system (MPLIS) is what is needed to fix the multifarious land administration problems currently facing Papua New Guinea. The current system in place is filled with defects due to the high degree of mishandled land information and corrupt practices in the public sector; in particular, the DLPP. If the correct system had been put in place in PNG, it is contended that land grabbing would not have been as rampart as what is witnessed in today's system.

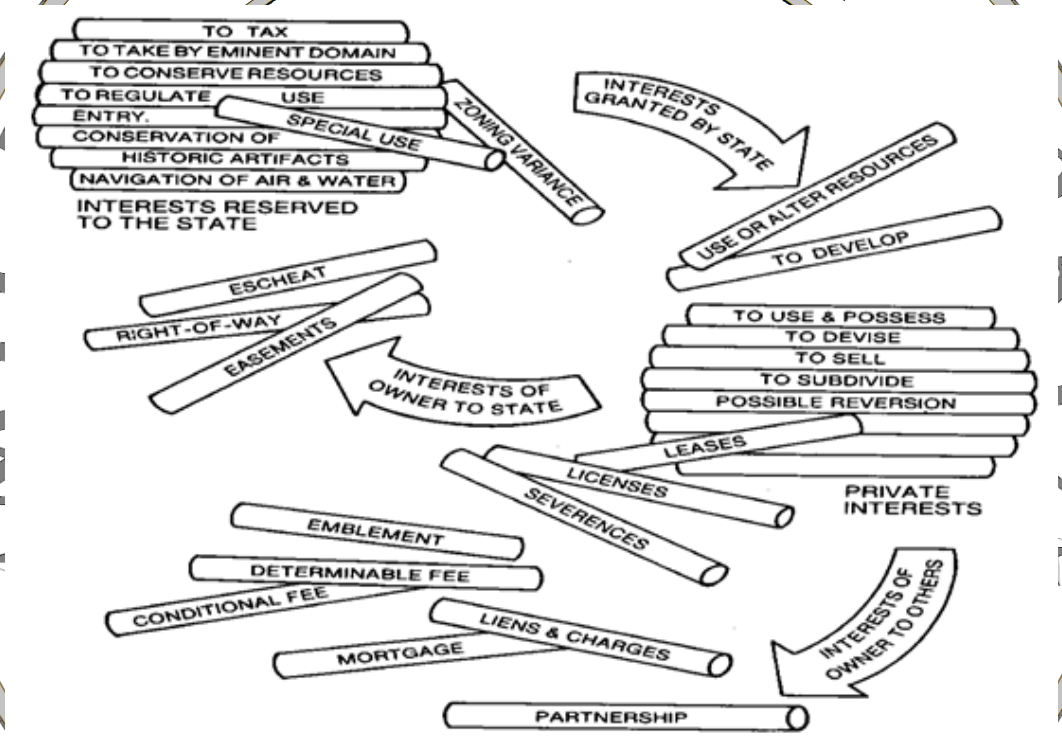

Fig 1. Land as a Bundle of Rights or Interests: A Rationale for MPLIS
Source: Federal Geodetic Control Committee, USA (1988)

A Multipurpose Land Information System (MPLIS), with carefully integrated framework, is the key to effective land information data management. This, on the other hand, helps the effective land administration system that is affordable and accessible to users, holders of any land interest and the interested general public who wish to enquire on such information. A well-integrated system also helps in resolving common land disputes and enhancing mechanisms in solving them. However, regular update in keeping the system also further enhances the use of the system more efficiently and effectively. The suggested system, therefore, would be an electronic filing system that would better accommodate all the necessary land information data that is useful for any intended purpose. The system would be so accurate that it would be able to provide the registration, portion, subdivision, lot number, amenities and legal interests in land such as water

supply, electricity supply and all other necessary information that would be of importance when describing a particular real property or land. Our questionnaire survey shows that most of the land information system data is still kept in the traditional paper filing system. This method takes a long time in processing and retrieving information when needed. As a matter of fact, paper filing system is prone to manipulation which then leads to malpractices and corruption. However, the Department of Lands and Physical Planning is always looking for better ways of filing system such as the one used for property taxation and rating by municipalities in the advanced countries in the hope of reducing malpractices. A recent study shows that the Department of Lands and Physical Planning once used the Land Information System (LIS) but later replaced it with the Land Acquisition Geographical Information System (LAGIS). However, the proposed enhanced PNGLIS is considered a much better system than the LAGIS as it gives more detailed information (data) than LAGIS.

At this juncture, it is important to understand the organisational structure of the Papua New Guinea's National Department of Lands & Physical Planning. Understanding the overall structure will help to integrate the data required for the entire organization (i.e. the DLPP) and those users of real estate and stake-holders in the real estate industry. The flowchart in Figure 2 shows the organizational structure of the Department of Lands & Physical Planning in Papua New Guinea, which can be applied as the pedestal for designing the proposed MPLIS.

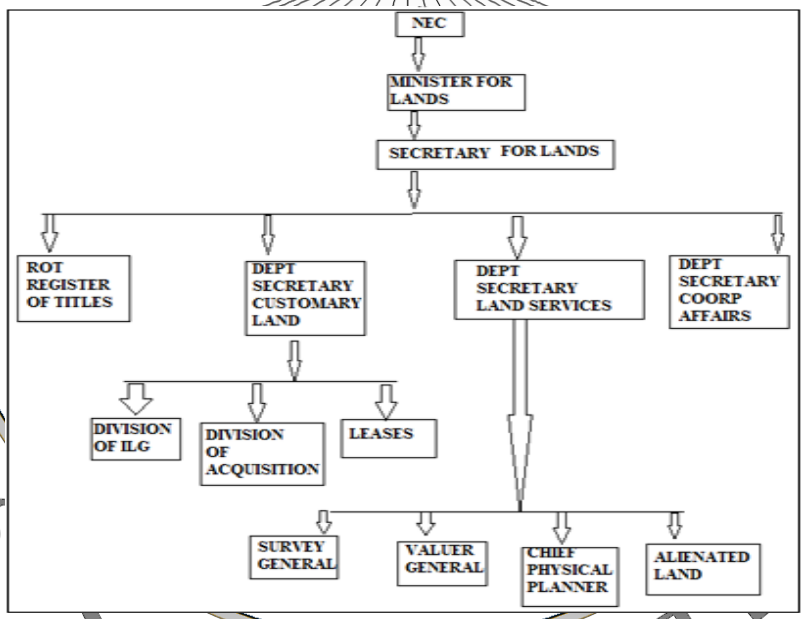

Fig 2. Organisational Structure of the National Department of Lands and Physical Planning (DLPP), PNG.

Source: Department of Lands and Physical Planning, Port Moresby, PNG, 2015.

It should be noted that all the divisions have their own divisional directors in the 12 regions of the country, the Momase, Highlands, Papuan and the New Guinea Islands., while their respective offices are located at their regional headquarters. From the above flowchart, it can be seen that the National Executive Council (NEC) is the crown-owner and driver of all the land administration issues in the country that are to be presented to the Government. The Government through the NEC gets directions from the Minister of Lands & Physical Planning. Subsequently, the Minister's delegate, who is the Secretary to the DLPP, oversees every function in the

Department. The Department, under the Minister's delegate (Secretary) has four (4) main functions: (i) the ROT (Register of Titles) which takes responsibility for all Land Titles in the Country (ii) the Deputy Secretary for Customary Land, that is the section responsible for ILGs and Land Acquisition (iii) the Deputy Secretary for Land Services, where all Survey Information is kept, including the office of the Surveyor General, the Valuer General, the Chief Physical Planner, the Alienated Land section and the Deputy Secretary for Corporate Affairs office, which deals with the welfare of the staff of the department.

Understanding the organisationalstructure, therefore, can be useful in disseminating all necessary information that could be built-in and displayed for maximum benefit of users and land interest holders. For example, in any land development, the Chief Physical Planner is usually the agent responsible for making sure that the development is up to the standard as gazettedunder the Physical Planning Ac 1968. Then, from the information and data collected, surveys are carried out under the direction of the Surveyor General. Having completed all necessary surveys, the valuation process for the land or any interest therein is done through the Valuer General. Finally, the Office of the Director of Alienated Lands oversees all alienated lands, State leases and prepares the titles for final submission to the Registrar of Titles (ROT). Having a clear understanding of the current structure within the DLPP can help enhance the integration of Land Information System (LIS) that can be used effectively and efficiently in further disseminating invaluable information to the users, interest/estate holders and land developers at large.

A MPLIS consists of an accurate, current and reliable land record cadastre and its associated attributes and spatial data that represent the legal boundaries of land tenure and provides a vital base-layer capable of integration into other geographical systems or as stand-alone solution that allow data retrieval, create, update, store, view, analyse and even publish land information to potential clients or customers and the general public at large. Such vital information can be first analysed for the purpose of advertising.Common information disseminated through the use of LIS data-base should include, land parcel (s), which are the basic units for access and control of land and land-use decisions. Others include current and reliable land information necessary for many public programs such as land planning, infrastructure development and maintenance, environmental protection and resource management, emergency services, social service programs and economic development. Furthermore, appropriate research and proper review mechanisms must be put in place. A good and well-defined database for MPLIS enables the land reforms and policies which involve enactments of appropriate laws to correct mistakes or loopholes that give rise to abuse of processes and corrupt practices in land administration and land management. Review of current database is compulsory because of the on-going land grabbing problems and mis-use of the process in Papua New Guinea. Such a database for LIS must be central to all necessary information gathering, processing, storage and retrieval for maximum benefits.

2.4 Method

This study was undertaken by recourse to a survey questionnaire survey of 10 members of staff in all the 4 sections at the Department of Lands and Physical Planning in Lae, the second largest city in Papua New Guinea and headquarters of Morobe Province, one of the 12 Provinces in the country. This survey was complemented by a structured survey of another batch of 40 private property information users in Morobe Province, using purposive sampling technique with a view

to determining their perceptions about the weaknesses and strengths of the existing Land Information System in the country. The 40 private respondents comprised 35 males and 5 females, aged between 25 years and 65 years, all of who had at one time or the other visited the Department of Lands and Physical Planning either to conduct a property search, process a building plan application for planning consent or to make enquiries concerning land tax or other issues. The consent of each of the 50 participants in the survey was sought and obtained before an interview was conducted. Data collected was analysed using simple descriptive statistics as there was lack of complex data to justify the use of a stronger statistics at this stage of the study, which will need to be repeated in about three years' time to monitor the progress achieved with improving the land information system in the country.

3. Findings and Discussion

3.1 Findings

The responses collected from the 50 property information users who participated in the questionnaire survey were analysed to answer the first research question, while the responses gathered from only the well-informed technocrats who are knowledgeable about government apparatus and academicians/researchers in the country's universities were used to answer the second research question. The findings are as follows:

i) What is the general level of users' satisfaction with the existing data information systemin Papua New Guinea?

Thirty four percent (34%) of the respondents indicated that they were not satisfied with the quality of management of land information in the country, while the slow speed of information retrieval (26%) and outdated information (16%) were also expressed as the huddles confronting the users of land information (Table 1). Poor user convenience (10%) and poor information dissemination (6%) were also indicated as reasons for some user's disenchantment with the existing land information system in the country. However, the survey revealed that ability of the system to handle the complex bundle of rights in land (4%), fraudulent practices (2%), and lack of transparency (2%) were not considered as serious problems by land information users. These findings show that most of the problems facing the current land information system in Papua New Guinea are more of a strategic and technical nature, rather than being riddled with corruption-related complaints. It is also interesting to note that the ability of the system to handle the complex bundle of rights in land (4%), which forms the bedrock of the conceptual framework used for this paper, was not considered as a serious problem by land information users.

Table 1. Users' Levels of Satisfaction with Existing Land Information System in PNG

Sl. No.	Type of Problem Faced	Frequency	Percentage of Total
1.	Improper Management of Information Technology (IT)	17	34
2.	Transparency	1	2
3.	Speed of Data Retrieval or Supply	13	26
4.	Outdated Facilities	8	16
5.	Fraudulent Practices	1	2

6.	Data Users' Convenience	5	10
7.	Poor Dissemination of Information	3	6
8.	Ability of System to Handle the Complex Bundle of Rights in Land	2	4
	Total	**50**	**100**

Source: Authors, 2015

ii) Does Papua New Guinea have adequate resources to design, manage, sustain and derive maximum benefits from a modern LIS system in the long term?

The researchers went further to investigate whether the country has adequate human and capital resources to manage and sustain a modern Multipurpose Land Information System. As hinted earlier in this paper, this second question was targeted at only those respondents who were considered as possessing sufficient awareness or knowledge of government's policy directions and budget priorities on the one hand, and those who were professionally or academically aware of the connection between IT and land administration, property valuation, physical planning, geomatics (including land surveying), land law, built environment, *inter alia*. These respondents accounted for 10 out of the 50 survey respondents and they comprised the Regional Valuer, Regional Land Surveyor, Regional Planner, Regional Senior Land Administrator and six senior academic members of the Department of Surveying and Land Studies teaching at the Papua New Guinea University of Technology in Lae where full-time undergraduate and postgraduate degrees in Geomatics and Property Studies have been run for more than three decades. All of the respondents to the second research question (100%) overwhelmingly agreed that Papua New Guinea is sufficiently endowed with most of the manpower resources needed for creating an efficient database for a modern LIS and maintaining it in the long term without having to heavily depend on foreign assistance.

3.2 Discussion

This study was designed to investigate the general level of user's satisfaction with the existing LIS in Papua New Guinea with a view to developing a suitable conceptual framework for a sustainable Land Information System (LIS), capable of being used for efficient land administration in Papua New Guinea. Designing an appropriate system or mechanism is one of the key issues in improving the current LAGIS in the Department of Lands and Physical Planning. Two research questions informed the focus of the present research. First, the research is required to establish whether there is an acceptable level of users' satisfaction with the existing data information system in Papua New Guinea. The findings reveal that a total of 34% of the respondents interviewed indicated that they were not satisfied with the improper management of Information Technology (IT). Another 26% were not happy with the slow speed of data retrieval or supply, while 16% indicated that the outdated facilities being used throughout the country was a serious disappointment. Nevertheless, the survey also revealed that fraudulent practices (2%) and lack of transparency (2%) were not considered as serious problems by land information users. The second research question sought to establish whether Papua New Guinea possesses adequate resources to design, manage, sustain and derive maximum benefits from a modern LIS system in the long term. Findings obtained from an elite group of respondents who were knowledgeable in IT applications in property law, land administration, valuation, urban and regional planning, *inter alia*, revealed that the country has sufficient human and financial resources to maintain and sustain an efficient Multipurpose Land Information System

(MPLIS).Such an integrated system of organised data must be user-friendly, consistent, and reliable and can be able to extract useful information in real time. However, the respondents advised that an overhaul of the existing system is long overdue. This will help enhance the strength of the current system by identifying or magnifying strengths and improving on the weaknesses. If need be, on-going research is necessary for maximisation and further advancement of the system. The current manual filing (paper) system should be converted to modern electronic filing system to accommodate the changes in technology for efficiency in data retrieval in real time.

4. Conclusion and Recommendations

It can be seen from the above findings and discussion that it is of paramount importance for PNG to have a well-defined framework of land information system that works efficiently and effectively for all land dealings in the country. Access to information (that is deemed to be common) through an LIS system is equally important for public officers as well as the public. Avoidance of efficient information management system usually results in corruption, mismanagement, misrepresentation, professional negligence and abuse of the system by those individuals who are ignorant. Such a proper LIS can enhance and sustain the integrity of a national information centre (NIC) for all information users, land developers and managers.

In the case of customary land, which constitutes about 27% of all lands in the country, where land rights are communally owned by Incorporated Land Groups (ILGs), proper management of data and information is important. This will protect land owners from misrepresentation by providing easy up-to-date information whenever needed. In PNG such rights in customary lands are usually attached to traditional cultures or customs. Investigations revealed that the current methods and structures of land administration, including the land registration system (e.g. LAGIS), land administration processes, court systems, etc., need an overhaul. A new system must incorporate all land dealings to address current issues and minimise the chaotic trends in land dealings in both the urban and rural areas.

It can safely be concluded from the investigations conducted that the key to proper land management is an effective data-based land information system (LIS) that works. A well-managed, land-based information centre for all users and stakeholders is, therefore, the way forward for cost-effective land development and other land endeavours in Papua New Guinea. The proposed MPLIS is a well-organised tool that can supply land-related information for administrative and economic decision-making for purposes of planning and development. Such land-related information system consists of spatially and non-spatially referenced data for defined land areas, lots, subdivisions, properties, Incorporated Land Groups (ILGs) and all other issues that are land-related. The information can be stored in a systematic way and updated, processed, retrieved and distributed to potential developers or users in real-time across the 22 provinces in the country.

However, whenever the need arises, mandatory updating of data or information is necessary to keep up with emerging frontiers of technology and the level of sophistication of planning information stipulated by the 1968 National Planning Act of Papua New Guinea, as amended. Correct merging of systems that provide accurate land information toward the building up of the MPLIS is recommended; this also saves time, money, cost and avoids undue errors and deficiencies for effective and efficient functioning of the system. Therefore, the starting point for

a better future is an urgent overhaul of the current LAGIS to pave way for a well-defined and up-to-date MPLIS system. It will be a system that is not biased but pivotal to land-related information supply to all users and the general public at large. Understanding the different categories of property data and organising them according to scientifically conducted needs assessment criteria is also imperative. Integrating technology into the system and its respective manipulation for the benefit of everyone is essential and should be the central goal of the Government and the Department of Lands and Physical Planning (DLPP) of Papua New Guinea. These imperatives would require more concerted research efforts for purposes of city, local, provincial and national sustainability.

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