



**THE PAPUA NEW GUINEA**  
**UNIVERSITY OF TECHNOLOGY**

# **RESEARCH REPORT**

## **2015**

Compiled and Edited by  
**Professor Shamsul Akanda**  
Department of Agriculture

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## FOREWORD

On behalf of the Research Committee of Unitech, I am delighted to present the 2015 research Report of Papua New Guinea University of Technology. This is a compilation of the research activities of the thirteen academic departments of the university. I am very thankful to the Dean of Postgraduate School, Professor Shamsul Akanda, for compiling and editing the report.

Unitech has the largest postgraduate program in the country, with 200 postgraduate students at the present time. The majority of the students are from Papua New Guinea but there are also some from Caribbean and Pacific Islands who are here through Erasmus Mundus Program of the European Union. The presence of research students creates an atmosphere that is conducive to research. Supervision of postgraduate students and doing research go hand in hand.

The Papua New Guinean postgraduate students at Unitech are either sponsored by the university or by themselves. Whereas the government has instituted scholarship programs for undergraduate study (HECAS – Higher Education Cost Assistance Scheme - and AES – Academic Excellence Scholarship), no similar schemes are in place for postgraduate study. We are aware that the government plans to introduce scholarships for postgraduate studies soon, and we look forward to a substantial expansion of our postgraduate programs when that happens.

There is a well-attended weekly research seminar at Unitech. In 2015 academic year, this was Coordinated by Professor Shamsul Akanda, and currently in 2016, it is coordinated by another member of the Research Committee, Associate Professor Dr Subramaniam Gopalakrishnan. I am very grateful to both of them for their commitment to the seminars and to the postgraduate program as a whole.

Unitech has a Research Committee that funds research projects and staff attendance at national/international conferences. In 2015, a total of K176,000 was allocated by the Research Committee for various research projects, and K25,000 was used to support staff attendance at national and international conferences. Nonetheless, many requests for research funding and attendance at international conferences were turned down by the Research Committee, due to a shortage of funds. These funds need to be tripled or quadrupled. That would be a good investment.

I would like to take this opportunity to thank all heads of department, leaders of research units and members of the Research Committee for their fruitful work during the year 2015. I am also thankful to the Vice Chancellor and his Management Team for their continued support and commitment of funds even when the university budget is under stress. Above all, I thank the Dean of Postgraduate School, Professor Akanda, for preparing the 2015 Unitech Research Report.



Dr Augustine Moshi  
Pro Vice Chancellor Academic and  
Chairman of the Research Committee

# **THE RESEARCH COMMITTEE OF THE ACADEMIC BOARD**

## **1. TERMS OF REFERENCE**

In order that research activities within the University may be encouraged, coordinated, funded and monitored efficiently, the Academic Board set up a Research Committee under the following terms of references:

- (a) To promote and encourage research and development;
- (b) To formulate an overall research policy and appropriate guidelines;
- (c) To allocate funds for research and development within the University;
- (d) To prepare an annual report on the research conducted by the University.

## **2. CONSTITUTION**

### **Ex-Officio Members**

- a. Vice Chancellor
- b. Pro Vice Chancellor (Academic)

### **Appointed Members**

- c. One person appointed by the vice Chancellor who shall be the Chairman of the Committee
- d. Six persons appointed biennially by the Academic Board

## **MEMBERSHIP**

### **Ex-Officio Members**

Dr Albert Schram  
Associate Professor Augustine Moshi

### **Appointed Members**

Associate Professor Augustine Moshi (Chairman)  
Professor S. Akanda  
Dr. K. Pirapaharan  
Dr. S. Gopalakrishnan  
Dr. G. Arpa

### **In Attendance**

Deputy Bursar  
Mr Gabriel Paul, Executive Officer

# **Departmental Research Reports**

Agriculture

Applied Physics

Applied Sciences

Architecture and Building

Business Studies

Civil Engineering

Communication and Development Studies

Electrical and Communication Engineering

Forestry

Mathematics and Computer Science

Mechanical Engineering

Mining Engineering

Surveying and Land Studies

## **DEPARTMENT OF AGRICULTURE**

### **Head of Department: Professor Abdul Halim**

The Department of Agriculture is one of the 13 Academic Departments in Papua New Guinea University of Technology (PNG Unitech). It offers Undergraduate and Postgraduate Degrees in Agriculture, conduct agricultural research and disseminate the relevant information to the community. The undergraduate program consists of the Bachelor of Science in Agriculture (B. Sc. Ag) that is offered on regular basis, and the Bachelor of Agriculture and Rural Development (BARD), which is offered in distance mode through externalization process. There are four postgraduate programs, which include Postgraduate Diploma in Agriculture (PGD), Masters of Science in Agriculture (M. Sc. Ag), Masters of Philosophy (M.Phil), and Doctor of Philosophy (PhD). The PGD and M. Sc. Ag programs are coursed-based, while PhD and M.Phil are research-based.

The Department has 17 qualified academic staff (11 with PhDs, 5 with Masters and 2 on PhD studies overseas, 2 returned and awaiting confirmation of PhD). In 2015, 12 students graduated with postgraduate degrees (1 PhD, 5 Mphil, 2 MSc, 4 PGD).

The Department of Agriculture is committed in delivering quality teaching, research, outreach activities and post-graduate studies. It has well guided activities including research thrusts stipulated in the department's Five Year Strategic Development Plans (2005 – 2010 and 2011 – 2015). Strategic Plan for 2016-20 has already been prepared based on the University's Vision 2030 and Mission. The curriculum is enhanced through regular and periodic review in consultation with clients in the public and private sector. The Department has established strong collaborative research links with aid donors and the stakeholders including NARI, Trukai, and in the past with ACIAR and NZAID.

Regular publication of the scientific journal '*NIUGINI AGRISAIENS*' and academic staff publishing scientific papers regularly confirm the department's strong commitment in research in UNITECH. Strong collaborative research activities with PNG NARI, University of South Pacific (USP), CSU (Australia), National Research Institute (NRI) of Greenwich University (U.K), South Australian Research and Development Institute (SARDI) Australia,

University of Canberra, Australia and other NGOs, industries and institutions further cements our strong leadership in agriculture research. Other publications, compilation of abstracts of research done by the post graduate students, Annual Reports, Farm Report and Strategic Plan on annual basis also strengthens the department's research capacity.

Based on the above background, resource availability and practicability of execution, the following research focus areas have been identified:

## **RESEARCH FOCUS AREAS**

### **1. Crop Sciences**

- Evaluation of promising rice varieties for Papua New Guinea
- Crop improvement and adaptation to stress environments caused by climate change
- Use of *Trichoderma* spp. as a biocontrol agent against some selected soil borne pathogens
- Study of the production technology and practices of selected crops by farmers in different agro-ecological regions of Papua New Guinea
- Study of the production technology and practices of selected vegetables by farmers in different agro-ecological regions of Papua New Guinea
- Soil N and composting in sweet potato-based farming systems
- Symbionts as potential biocontrol agent for cocoa pod borer
- Development of a maize seed system for PNG
- Gene discovery in PNG wild rice: seed and grain characteristics
- Genetic transformation of taro
- Quantification of greenhouse gases (GHG) emissions from soils under major cropping systems of Papua New Guinea

### **2. Livestock Sciences**

- Conservation of farm animal genetic resources
- Utilization of crop wastes and agro-industrial by-products for feeding livestock and poultry
- Determining digestibility of locally available feed and fodder
- Determination of anti-nutritional factors in the fodder crops of PNG
- Development of suitable weaner piglets diet

- Smallholder Aquaculture development in PNG

### **3. Agricultural Economics**

- Analysis of marketing costs and margins spread of sweet potato sales produced from the highlands of Papua New Guinea
- Economic impact assessment of honey bee – coffee integrated farming in Eastern Highlands Province
- Economic impact of climate change on coffee and cocoa production in PNG: A Ricardian Approach
- Handbook on relevant production, trade and price statistics on agricultural, livestock and poultry products of PNG
- Agriculture sectoral growth in Papua New Guinea since political independence

### **4. Agricultural Extension and Rural Development**

- Evaluation of on-going extension approaches in PNG and their effectiveness in rural livelihood improvement
- Problems and prospects of retaining youth in agriculture in PNG
- Identifying the present farming systems in different regions of PNG and scope for improvement
- Examining household food security in peri-urban settlements
- Livelihoods of settlers in peri-urban settlements
- Return from Investment in Higher Education, Extension and Innovations in Agricultural Productivity
- Entrepreneurship Development among Rural People
- Women in Agriculture for Food Security
- Diffusion of Agricultural Innovations among Rural Community

### **5. Post-harvest**

- Survey on current status of mechanization in PNG: impact study of mechanisation on rural livelihood and environment.
- Development of post-harvest technology and post-harvest management systems for horticultural crops in PNG.



## **INTERNATIONALLY FUNDED RESEARCH/COLLABORATION**

### **1. SARDI project**

Enhancing role of small scale feed milling in the development of the monogastric industries in Papua New Guinea (<http://aciarc.gov.au/project/ASEM/2010/053>). A four-year project amounting A\$798, 863.00 with partners South Australian Research and Development Institute (SARDI), NARI, CLTC Banz, Livestock Dev Corp).

### **2. Transformative Agriculture and Development in Papua New Guinea (TADEP)**

The TADEP project comprises of other ACIAR-funded projects which includes Bougainville Cocoa (HORT/2014/099), Canarium (FST/2014/099), Sweetpotato (HORT/2014/099), Women's Business acumen (ASEM/2014/095), and PNG Cocoa (HORT/2014/096).

### **3. ACIAR (HORT/2015/087) Sweetpotato Crop Protection project**

The Sweetpotato crop protection project is a five-year project and is focused on sweetpotato weevils in PNG. It is a collaboration between Charles Sturt University, University of Southern Queensland, Unitech, NARI and FPDA.

### **4. Women's Business acumen (ASEM/2014/095), Improving Opportunities for Economic Development for Women Small Holders in Rural Papua New Guinea**

This is a four-year project under ACIAR funding. The collaborating institutions include University of Canberra, Pacific Adventist University, TADEP Bougainville 1, TADEP Bougainville 2, TADEP New Ireland, NARI, FPDA, and an NGO group – Baptist Union of PNG.

### **5. Early Learning Project**

The Early Childhood Education and Learning project is collaboration between University of Canberra and the Pacific Adventist University under the ACIAR funding. Unitech's Agriculture Department is involved in producing small agriculture-based modules for teaching trainee teachers for lower and upper primary school learning. This project is also tied to the TADEP project above.

## LIST OF PUBLICATIONS

### Peer-reviewed Journal Articles and Books

1. Elahi, K. (2015). Homo economicus in Neoclassical Economics: Some conceptual curiosities about behavioural criticisms. *Homo Oeconomicus*, 32(1): 23-51.
2. Dotaona, R., Wilson, B. A. L., Stevens, M. M., Holloway, J. and Ash, G. J. (2015). Screening of tropical isolates of *Metarhizium anisopliae* (Hypocreales: Clavicipitaceae) for virulence to the sweet potato weevil (*Cylas formicarius*). *International Journal of Tropical Insect Science*. DOI: 10.1017/S1742758415000211
3. Halim, A. (2015). High level policy dialogue on investment in agricultural research for sustainable development in Asia and the Pacific. Rama Gardens Hotel, Bangkok, Thailand. 8-9 December 2015. p. 21.
4. Maino, M. K. (2015) (Ed.). Agriculture Department Strategic Plan: 2016-2020. Department of Agriculture, Papua New Guinea University of Technology. Agriculture Department Printer, 33 pp.
5. Maino, M. K. and Akanda, S. (2015). Effects of *Meloidogyne incognita* on the yield and quality of sweet potato in the humid lowlands of Papua New Guinea. *Annals of Tropical Research*, 37:82-94.
6. Michael, P. S. (2015). Effects of alkaline sandy loam on sulphuric soil acidity and sulfidic soil oxidation. *International Journal of Environment*, 4: 42-54.
7. Michael, P. S. (2015). Effects of organic amendments and plants on chemistry of acid sulphate soils under aerobic and anaerobic conditions. *The Journal of Royal Society of New South Wales*. (**Accepted**).
8. Michael, P. S., Fitzpatrick, R. and Reid, R. (2015). The importance of organic matter on amelioration of acid sulphate soils with sulfuric horizons. *Geoderma*, 225: 42-49.

9. Michael, P. S., Fitzpatrick, R. and Reid, R. (2015). The importance of soil carbon and nitrogen in amelioration of acid sulphate soils. *Soil Use and Management* (**Accepted**).
10. Sawaraba, I. and Rajashekhar Rao, B. K (2015). Monitoring of river water for free cyanide pollution from mining activity in Papua New Guinea and attenuation of cyanide by biochar. *Environmental Monitoring and Assessment*, 187:4181-4190.
11. Rajashekhar Rao, B. K (2015). Kinetics of potassium release in sweet potato cropped soils: A case study in the highlands of Papua New Guinea. *Solid Earth*, 6: 217-225.
12. Walter, R. and Rajashekhar Rao, B. K. (2015). Biochars influence sweet potato yield and nutrient uptake in tropical Papua New Guinea. *Journal of Plant Nutrition and Soil Science*, 178: 393-400.

## **Conferences/Workshops/Seminars Attended**

### **Professor Abdul Halim**

- Return from Investment in Agricultural Education, Research and Outreach Extension Systems for Development: Some Policy Guidelines in the context of Pacific Island Countries. Rama Gardens Hotel, Bangkok, Thailand. 8-9 December 2015.
- Collaboration between PNG Unitech Agriculture Department and Charles Sturt University (CSU), Australia in the coming years – a proposal. Paper presented in the Graham Centre of CSU. 12 May 2015.

### **Professor Shamsul Akanda**

- Intra-ACP and Erasmus Mundus Staff Training 2015. Hosted by The University of West Indies and The Universidade do Porto, Barbados, 15-16 October 2015.
- Strategy Revision and Operational Planning Workshop held at Madang, PNG, 13-15 June 2015.

- Regional Workshop on Improving Food and Nutrition Security Outcomes – What Role for Universities in the Pacific? Held at Nadi, Fiji, 3 – 5 June 2015.
- KPI and Strategy Workshop held at Lae International Hotel, Lae during 12-13 March 2015.
- Introduction to Mindset and Leadership Workshop held at Lae International Hotel, Lae on 17<sup>th</sup> May 2014.
- Strategy into Action Workshop held at Lae International Hotel, Lae, 19-21 July 2014.
- CARPIMS III Kick-off Meeting and Intra-ACP Project Management Meeting held at Fiji National University, Nadi, Fiji, 26-28 March, 2014.
- The BULA Project Scientific Committee Meeting held at The University of the South Pacific, Fiji, 16 September 2014.

**Dr. Macquin Maino**

- Visiting Research Scientist to The Tamil-Nadu Agricultural University (TNAU). Coimbatore, India. 9 – 21 December 2015.
- Workshop on “Planning, Monitoring and Evaluation towards Measuring Outcomes and Impacts”. Malaysian Agricultural Research and Development Institute (MARDI), Kuala Lumpur, Malaysia. 3 – 7 August 2015.

**Dr. Veronica Bue**

- Training Workshop on “Good Manufacturing Practices and HACCP Principles”. University of the West Indies, Bridgetown, Barbados. 2 – 6 November 2015. Funded by CTA-ACP.

**Messrs William Nano and Frank Vidinamo**

- Training Workshop on “Good Manufacturing Practices and HACCP Principles”. University of the West Indies, Trinidad and Tobago. 2 – 6 November 2015. A workshop funded by CTA-ACP. attended the workshop.

## **Unitech Research Seminar Presentation for 2015**

### **Dr. Patrick Michael**

The role of organic matter in amelioration of acid sulfate soils.

### **Dr Peter Manus**

Economic efficiency of smallholder peanut farming in the Markham Valley of Papua New Guinea

### **Dr. Maia Wamala**

Empowering subsistence rural farmers with innovative approaches in value-added products of traditional root and tuber crops for commercialization and mini rural agri-business in Papua New Guinea.

### **Dr. Veronica Bue, Mr. William Nano, Miss Betty Tiko**

Approaches for Rural Development: Experiences of The South Pacific Institute for Sustainable Agriculture & Rural Development.

**POST-GRADUATE STUDENTS' RESEARCH**

Table 1. Research conducted by postgraduate students under the supervision of departmental staff, 2015.

	<b>Title</b>	<b>Student</b>	<b>Supervisor</b>	<b>Funding source(s)</b>
<b>PhD</b>				
1	The effectiveness of <i>Trichoderma</i> spp. as biocontrol agent against selected soil-borne fungi	Gwendolyn Ban	Drs. Shamsul Akanda, Macquin Maino	Unitech GAP
2	The use of <i>Acacia magnum</i> in the rehabilitation of mined out sites in Hidden Valley Morobe Province	Lawrence Lewis	Dr. Rajashekhar Rao	CARPIMS
<b>MPhil</b>				
3	Prevalence of <i>Salmonella</i> and <i>Campylobacter</i> spp. in poultry as a source of food-borne disease in Papua New Guinea	Lydia Tasi	Dr. Jayaprakash	Unitech GAP
4	Effects of different levels of urea in urea molasses mineral block supplementation to weaned steer in the Markham Valley, Morobe Province	Arenu Mumbiangke	Dr. Jayaprakash	Morobe Provincial Government
5	Evaluation of 35 promising rice varieties under rain-fed and irrigated culture conditions	Henry Maino	Dr. Tom Okpul	Trukai Industries Ltd
6	Evaluation of chemical and organoleptic characteristics of selected rice varieties	Redley Oposa	Dr. Tom Okpul	Trukai Industries Ltd
7	Cocoa pod borer management: Symbiotic bacteria as alternative biological control against cocoa pod borer (CPB) <i>Canopomorpha cramerella</i>	Brian Takoboy	Dr. Macquin Maino	Department of National Planning & Monitoring/East Sepik Provincial Government
8	Cocoa pod husk (CPH) composting – quantification of Nitrogen loss and effects of amendments	Rokotamana Vitinaqailevu	Dr. Rajashekhar Rao	CARPIMS
<b>MSc</b>				
9	Influence of biochar material on N mineralization and N-use efficiency	Ruth Baiga	Dr. Rajashekhar Rao	Unitech GAP
10	Variation in morphology and the seed shattering genes of selected wild rice endemic to Papua New Guinea	Christian Bugajim	Dr. Tom Okpul	Unitech GAP
11	Investigating the fungus causing anthracnose in	Peter Buyoyu	Dr. Macquin Maino	Unitech GAP

*PNG University of Technology*

	<i>Barringtonia edulis</i>			
12	Isolation and molecular identification of endemic fungal pathogen of eaglewood ( <i>Gyneros ledermanii</i> )	Melanie Pitiki	Dr. Macquin Maino	Unitech GAP
13	Morphological and molecular characterization of <i>Colletotrichum spp.</i> causing anthracnose on yam ( <i>Dioscorea alata</i> )	Alomah Motamota	Dr. Macquin Maino	Unitech GAP
14	The study of genetic diversity of <i>Oryza schlechtri</i> in Papua New Guinea	Malcolm Kabiwega	Dr. Tom Okpul	Unitech GAP
15	Household dietary pattern of fish farmers in Potsy Village, Lae, Morobe Province	Zina Bird	Dr. Veronica Bue	BULA
16	The economics of marketing sweetpotato in the major distribution centres of Papua New Guinea	Burie Bogan	Dr. Peter Manus	Self

**FINAL YEAR UNDERGRADUATE STUDENT RESEARCH PROJECTS**

Table 2. Research undertaken by fourth-year BSAG students as a partial fulfilment of the degree program.

	<b>Title</b>	<b>Student</b>	<b>Advisor</b>
1	Effects of <i>Trichoderma</i> on some plant-pathogenic fungi	Natasha Sindang	Dr. Shamsul Akanda
2	Effects of <i>Trichoderma</i> against <i>Rhizoctonia</i> and <i>Fusarium</i> affecting bean plants under glasshouse conditions	Esther Hume	Dr. Shamsul Akanda
3	Effect of some seed-borne fungi on the germination of rice seed	Karo Karua	Dr. Shamsul Akanda
4	Identification of a strain of <i>Elsinoë batatas</i> causing scab disease on hybrid sweet potato	Stephen Thomas	Dr. Macquin Maino
5	Aibika ( <i>Abelmoschus manihot</i> ) genetic diversity at Unitech Farm	Walo Bogen	Dr. Macquin Maino/Mr. Robert Kei
6	Determination of LD50 of insecticide permethrin in controlling <i>Nezara viridula</i> at Unitech Farm cocoa block	Isaac Pep	Mr. Robert Kei
7	Evaluation of LC90 values of three insecticides against giant grasshopper ( <i>Valanga irregularis</i> ) damaging aibika ( <i>Abelmoschus manihot</i> ) leaves	Benjamin Bulda	Mr. Robert Kei
8	Effects of staking on yield of selected yam varieties	Orea Bengang	Dr. Patrick Michael
9	Effects of water use efficiency of selected rice varieties on plant biomass production	Polly Paiyan	Dr. Patrick Michael
10	Isolation and characterization of an endophytic fungi from eaglewood	Larisha-Clarie Sakin	Dr. Tom Okpul
11	Isolation and study of a micro-floral fungi of cocoa flowers	Philomina Polu	Dr. Tom Okpul
12	Using Simple Sequence Repeats (SSR) markers to verify identity of selected taro varieties	Magero Nurrie	Dr. Tom Okpul
13	Assessment of soil pollution caused by domestic activities in settlement area of Uniblock	Murphy Yomi	Dr. Rajashekhar Rao
14	Available Zn status of some sweet potato gardens on limestone-derived soils of Subaru Bonagi Village, Chuave District, Chimbu Province	Mark Jackson	Dr. Rajashekhar Rao
15	Determination of digestibility of forages and live-weight gain of sheep fed <i>Leucaena leucocephala</i> and Signal grass ( <i>Brachiaria decumbens</i> ) as a supplementary diet	Epe Vila	Dr. Gariba Danbaro
17	Performance of Muscovy ducks fed on rejects from biscuit factory mixed with fishmeal on Unitech Farm	Hadassha Ramo	Dr. Gariba Danbaro
18	Performance of broiler birds raised on millrun as a supplementary feed	Peninah Jacob	Dr. Jayaprakash
19	Growth performance of tilapia fingerlings fed on different levels of duckweed with refused coconut meal	Simu Simon	Mr. William Nano



20	Effects of brooding temperature on gut fauna and flora of chickens brooded for 21 days	Daniel Wendo	Mr. William Nano
21	Effects of different brooders on mortality percent of fry tilapia for 21 days	Allan Pinia	Mr. William Nano
22	Factors affecting net income of peanut production in the Markham Valley	Issac Makrui	Dr. Peter Manus
23	Price spread and producers' share of sweet potato farming in Lae District	Salome Hansel	Dr. Peter Manus
24	Price spread and producers' share of potato and cabbage produced in the Highlands region sold at Lae Market Centres	Cherryle Urum	Dr. Peter Manus
25	Constraints in accessing agricultural credits from the National Development Bank: A case study of some selected loanees in Morobe Province	David Buiyo	Dr. Khandakar Elahi
26	Factors affecting marketing of fresh and dry coconut in selected areas of Morobe Province	Wally Jalal	Dr. Khandakar Elahi
27	Factors affecting the efficiency of poultry production in Markham area: A case study of selected poultry farmers in Tanam Village.	Lesli Winuan	Dr. Veronica Bue
28	Evaluating UNITECH employees' preferences to different rice brands on shelves in Lae supermarkets	Koumba Archiebold	Dr. Veronica Bue
29	Evaluation of training in life skills offered by SPISARD to farmers in Munix village, Erap, Morobe Province	Norman Kokele	Dr. Veronica Bue
30	Income-earning strategies of unemployed youths in urban informal sector of Lae City	Edward Bue	Dr. Abdul Halim
31	Opinions of fish farmers of Kerowil village, Banz, Jiwaka Province for raising fish for livelihood improvement using local resources	Johnny Thomas	Dr. Abdul Halim
32	Problems and benefits of poultry contract farming of Niugini Tablebirds by growers in Tanam Village	Felix Kepas	Miss Betty Tiko
33	Opinions of women in marketing out cut-flowers in Lae City	Fidelis Hiamangi	Miss Betty Tiko

## **DEPARTMENT OF APPLIED PHYSICS**

**Head of Department: Dr Gabriel Anduwan**

The Department of Applied Physics runs two courses; the Applied Physics with Electronics and Instrumentation course and Radiation Therapy. These two courses are completely different courses that the department offers. On top of these courses are the service courses that the department offers to almost 10 departments out of the 13 departments in this University.

The Applied Physics course with electronics and Instrumentation with more emphasis on the principles of application to Physics are imparted to students. However, Radiation Therapy is a specialized field that deals with cancer treatment which is run by our department in collaboration with Angau Hospital. At the completion of the course, the students are expected to work with the Health department.

The department's teaching and research by each academic and some of our technical staff are;

### **Final Year (Undergraduate) Projects supervised and research conducted**

by

**Dr. Gabriel Anduwan** and **Kenny Michael**  
**Senior Lecturer**                      **Principal Technical Officer**

#### **1. Unitech Wireless Security System, Design and Implementation**

Abstract

Unitech Security system has been one of the issues that concern the most for the University community. When vehicles coming in and out of the gates without being detected, there is a very high probability of University properties being taken out of the gate, including children kidnapping. Security personals are just few and the campus is wide for securities to cover the all area of the campus. This is all because, where crime is increasing and everybody wants to take proper measures to prevent intrusion. In addition, there was a need to have surveillance cameras

placed at a strategic location throughout the campus that can be monitored through a central location such as Unitech Security office. The transfer of information can be done using wireless security system. The probability of receiving and viewing information can be done using mobile phone.

## **2. Unitech Laboratory Instruments: Database, Cost, Repair, Maintenance and Calibration**

Abstract:

The climax of all the theory work throughout the four years is concluded with students who did some laboratory maintenance, repaired very expensive instruments without a cost to the department, calibration and create database for such equipment. Having fixed some good number of equipment, students felt confident of them to know how to fix the equipment and for others purposes. Students have been introduced to trouble shooting of faulty equipment from the start and as such, students are as confident as any technical officer.

Final Year (Undergraduate) Projects supervised and research conducted by

Mr. Roberto Soto  
Senior Lecturer

### **1. Detection of Electromagnetic Waves.**

The idea that low frequency electromagnetic waves could be precursors to temblors remains controversial. If low frequency electromagnetic waves, really do precede some earthquakes, we could detect them by using a simple detector we will build. This detector will also enable us to investigate different sources of natural radio waves. As we know, an electromagnetic wave has both an electric and a magnetic component and fortunately, the slowly varying magnetic component can be easily detected due to the application of Faraday's law of induction, "a changing magnetic field induces a voltage inside a loop of wire". So we will use an antenna (just a solenoid – a cylindrical coil of wire wrapped around a long core), and some basic circuitry, to detect low frequency electromagnetic waves.

## **2. Small Projects on Design and testing of Basic Instrumentation.**

We will design and test Basic electronic instruments. The objective is for the students to understand basic design techniques of digital design (and analog) applied to instrumentation. We are designing a Digital Correlator and an instrument to generate pseudo-random noise that can be used for the students to add noise to signals and check the operation of filters they design, to recover signals immersed in noise.

A digital correlator can perform both; correlation and convolution. The pseudo-random noise generator, will be designed using a shift register.

Another design is the design of a Capacitance Meter.

## **3. Renewable Energy applications**

In this area of renewable energy, we will be doing research on generation of forms of energy (or extracting energy) from, the sun, the wind and from different types of organic waste. One of the areas of research is to generate gas from wood, coal, and organic waste, applying different methods/techniques. Specifically, we will be generating gas from chicken manure, pigs manure and possibly from cows manure. We will quantify the gas per kilogram of manure, and will measure/estimate also the calorific value of the gas.

## **4. We will design and test an Earth movement Sensor: Analog Electronics Application**

This is another research, as small project in the area of analog electronics design. We will be designing a simple seismic sensor

## **5. Virtual Classroom.**

The research area will be: classified as area of Education, because we will be assessing/evaluating, the impact on learning abilities of the students when Google classroom and Learning Management Systems are used, compared to the face to face teaching.

## **6. Design of a Sign Discriminating Field Mill**

We will construct and analyze a symmetric rotating field mill. The rotating field mill will consist of a ‘stator’ in the form of a sectored disc which is alternatively shielded from and exposed to an electric field to be measured by a similar disc, the ‘rotator’ connected to ground potential. The magnitude of the emf induced in the impedance to ground supposed to be proportional to the magnitude of the field and could be amplified and calibrated to measure the field strength. The algebraic sign of the emf can be used to determine the field direction uniquely.

Using this technique, we will develop a measurement of both magnitude and sign of the fair weather electric field.

### Final Year (Undergraduate) Projects supervised and research conducted by

#### **Dr Dapsy Olatona**

##### 1. Renewable energy

- a. We carry out renewable energy research into Solar and Tidal power generation.

Our solar interest focuses on using solar energy to power small cooling appliances. As these progresses, we intend to also look into using it to “enhance” much bigger cooling and cryogenic appliances.

- b. We carry out investigations of tidal/Hydro energy as a generalised power supply to rural areas and island villages of PNG. Our research interest in this area has focused primarily on Sawa Sawaga Passage in Milne bay. We are however also interested in Buka passage and any other passages with large & sustainable power generating capacity that can be considered worthy of grid connectivity. A publication is submitted to UPNG centre for renewable energy following a paper presentation in November 2015

##### 2. Spectroscopy

We are currently setting up a spectroscopy laboratory for the investigation of liquid and solid samples

##### 3. Alarm System

We are currently researching into remote alarm warning systems capable of sending SMS to alert responsible officers about mechanical breakdown of equipment of large commercial value (eg the blood bank, Mortuary and Hospital cool room where they store expensive vaccines and medicines.)

Final Year (Undergraduate) Projects supervised and research conducted by

**Mr. David Kolkoma**

**Cancer Registry ( Student Project)**

The purpose of collecting cancer patient data is to utilize the data for cancer control and prevention. We need a broad base of information about cancer patients, such as how the disease is diagnosed and treated, and the outcome.

Cancer Registration system is a way forward for cancer control and curability of the cancer disease around the globe. This project reports on the cancer registry systems at Angau Cancer Unit, Lae, PNG, how it is updated and improved from where it is today. It emphasizes also on the types of cancer registries, its functions and the characteristics that make up the cancer registry system around the world.

Although the emphasis is more on other cancer registries and how information of patients is collected, it contains much on the Hospital-Based Cancer Registry system which Angau Cancer Unit operates under.

**ABSORPTION SPECTRUM OF *BETA* -CARYOPHYLLENE– AN INITIAL PHASE STUDY OF THE DEVELOPMENT OF *CANNABIS* DETECTOR.**

**ABSTRACT (Original work done by Hellen Osora, MSc 2013)**

The cannabis detection system can be developed using essential oil characteristics of the *Cannabis* plant which is responsible for the aroma. The *Cannabis* contains a significant amount of odour characteristic terpene called Beta-caryophyllene (BCP), C<sub>15</sub>H<sub>24</sub>, a hydrocarbon compound. It is

a sesquiterpene (SQT) which contributes to the aroma and flavour. This sesquiterpene is a volatile oil which vaporises at low boiling point. The *Cannabis* odour is in the form of a gas that absorbs UV radiation of the electromagnetic spectrum. The absorption spectrum of the sensimilla (female) *Cannabis* samples was determined from the fresh and air dried samples collected from Ife and Ufeto villages in the Eastern Highlands Province (EHP) of Papua New Guinea. The water distillation method was utilized for the extraction of essential oil from processed *Cannabis*. The distillation was conducted in Clevenger apparatus in which boiling, condensing and decantation was done. The presence of the hydrocarbon was verified using a gas detector model GV-100S gas pump and Polytec tubes. The colour of the polytec tube changes from yellow brown to blackish colour. The sample oil extracted from the *Cannabis* was used to determine the absorption spectrum of *Cannabis*. The absorption spectrum ranges from 450 nm - 200 nm. This was established using an Ultra Violet – Visible (UV-Vis) spectrometer model BIO 50 UV-Vis. Several peaks were observed within this range thus indicate a number of hydrocarbon compounds within this range. A Thin Layer Chromatography (TLC) was carried out. Eluting solvents used was n-hexane/ethylacetate (10:1) and 2M H<sub>2</sub>SO<sub>4</sub> used as a spraying agent. The result confirms that, there are a number of hydrocarbon compounds with absorption spectrum ranging from 450nm-200nm. The results obtained so far are very encouraging as these data now lays the foundation for further research into developing a *cannabis* detector. The electronic detector based on the frequency range 450nm-200nm can be designed and fabricated.

## **Latest Progress**

**Authentic samples of Beta-caryophyllene ordered from Australia now available on hand waiting for analysis to compare absorption spectrum with the result from the cannabis samples for verification. Then the electronic detector design can proceed.**

## DEPARTMENT OF APPLIED SCIENCES

Head of Department: Dr Janarathanan Gopalakrishnan

### Introduction

The Department functions with two sections: Applied Chemistry and Food Technology. Food Technology courses are only offered in PNG University of Technology in the whole of the South Pacific. Our department, based on the current market scenario and other developments, keeps track on the curriculum, and suitable changes and revisions to the curriculum is done. Both the sections updated their curricula during 2013. During 2015, minor changes / revisions to the curricula of both the sections were done. The research activities of the two sections are provided below.

### Research interests: Applied Chemistry Section

Name	Research interests
Dr. Janarathanan Gopalakrishnan	Synthetic inorganic chemistry, inorganic heterocyclic chemistry, organophosphorus chemistry, transition metal phosphates, coordination chemistry of selected N-based ligands, inorganic chemistry in traditional practices
Dr. Subramaniyam Gopalakrishnan	Synthetic organic chemistry, medicinal chemistry, nanotechnology, food chemistry
Mr. David Timi	Organic chemistry, phytochemistry
Mr. Justin Narimbi	Analytical chemistry, environmental chemistry, instrumental methods for analysis
Dr. Anthony Harakuwe	Food analysis and value-addition, chemical/science education, environmental and forensic chemistry, analytical chemistry, instrumental methods for analysis, volcanic ash and CO <sub>2</sub> analysis, computers in science and education, Mumu modification, PNG cookware design, traditional medicines, cement and concrete, CCA studies, natural products &



	medicinal plants, phytoremediation studies
Mr. Jayson Wau	Organic chemistry, phytochemistry
Mrs. Sandy Puy	Analytical chemistry, environmental chemistry

### **Research interests: Food Technology Section**

<b>Name</b>	<b>Research interests</b>
Mr. Reilly Nigo	Renewable and Clean Energy, Animal Feed Development, Thermal Processing, Food Drying studies
Dr. Lydia Yalambing	Food nutrition
Mrs. Rag Gubag-Sipou	Food microbiology
Ms. Elizabeth Nasing	Antimicrobial Studies in Foods – Food Safety & Therapeutic Uses, Food microbiology – Water Safety, food safety, Antioxidants – Public Health/Food Safety, Product Development
Mrs. Sogoin Denano	Food safety and food security; compliance studies
Mr. Zeipi Toksy	Food chemistry
Mr. Nigel Kiaka	Industrial solid and liquid waste management

### **Research Output: Peer Reviewed Journals**

1. Gopalakrishnan, J., Swarnalatha, U. and Rao, M.N.S. 2015. Halogenation reactions of phosphiniminocyclotrithiazenes: search for new inorganic heterocycles, *Synth. React. Inorg. Met.-Org. Nano-Met. Chem.*, 00, 0000-0000; DOI: [10.1080/15533174.2015.1066804](https://doi.org/10.1080/15533174.2015.1066804) (abstract available online)
2. Gopalakrishnan, J. 2015. A deep analysis on widely used condensation route for preparing aminophosphines: synthesis and spectral characterization of an aminobis(chlorophosphine), (NC<sub>4</sub>H<sub>8</sub>N)[P(*i*-Pr<sub>2</sub>N)Cl]<sub>2</sub>, *Synth. React. Inorg. Met.-Org. Nano-Met. Chem.*, 00, 0000-0000; DOI: [10.1080/15533174.2015.1040163](https://doi.org/10.1080/15533174.2015.1040163) (abstract available online)

- Gopalakrishnan, J. 2015. Electron impact mass spectral fragmentation patterns of two six-membered Phosphiniminocyclothiazenes, (Ph)[(C<sub>6</sub>H<sub>11</sub>)<sub>2</sub>N](R<sub>2</sub>N)PN-S<sub>3</sub>N<sub>3</sub> – A comparison, *Phosphorus, Sulfur, and Silicon*, 190, 1-7; DOI: [10.1080/10426507.2014.938744](https://doi.org/10.1080/10426507.2014.938744)
- Gopalakrishnan, J. 2015. Analysis of salt solution and ash obtained from *Piper aduncum* that claimed to cure cancer in Papua New Guinea, *J. Coast. Life Med.*, 3(8), 630-635; DOI: [0.12980/JCLM.3.2015JCLM-2015-0025](https://doi.org/0.12980/JCLM.3.2015JCLM-2015-0025)
- Gopalakrishnan, J. 2015. Physicochemical analysis of traditional vegetal salts obtained from three provinces of Papua New Guinea, *J. Coast. Life Med.*, 3(6), 476-485; DOI: [10.12980/JCLM.3.2015JCLM-2014-0120](https://doi.org/10.12980/JCLM.3.2015JCLM-2014-0120)
- Gopalakrishnan, J. 2015. A review on traditional salt production practices around the world, *J. Inst. Chem. PNG*, 5, 23-48
- Gopalakrishnan, S. 2015. Comparison of antimicrobial activity of crude extract and synthesized silver nanoparticles from medicinal plant *Ficus Pungen*, *J. Inst. Chem. PNG*, 5, 5-12.
- Gopalakrishnan, S. 2015. Yield variation of silver nanoparticles by different methods and antibacterial activity of *Flagellaria Indica* against a series of human pathogenic bacteria, *J. Inst. Chem. PNG*, 5, 49-56
- Gopalakrishnan, S. 2015. Evaluation of antimicrobial activity of green synthesized silver nanoparticles, *J. Inst. Chem. PNG*, 5, 57-70

### **Research Output: Conferences / Symposia / Workshops**

- Gopalakrishnan, J. Potion from *Piper aduncum* ash for cancer cure in Papua New Guinea: myth, mystery or chemistry, The 15<sup>th</sup> International Congress of the International Society for Ethnopharmacology (15<sup>th</sup> ISE Congress) held in Petra, Jordan (5-8 May 2015)

2. Nasing, E. APEC Food Safety Cooperation Forum – Regional Workshop: Coordinated Research Initiative for the Implementation of Antimicrobial Resistance Control Strategies (CTI 25 2014A (SCSC)) – Santiago, Chile (Oct 2015)

## **Research Projects**

1. **Tertiary butyl based sterically hindered bidentate ligands: synthesis and coordination studies** [funded by PNGUoT Research Committee] – undertaken by Mr. Rahamie Par for M.Phil. degree (Jul '14). Principal supervisor: Dr. J. Gopalakrishnan. Two bidentate tert-butyl based nitrogen ligands were synthesized. Complexation studies were carried out under different reaction conditions (like solvents, mole ratios of ligands and metal substrates), etc. Dark blue shiny crystals and green powdery solid were obtained for cobalt and nickel salts respectively. Analyses of the complexes are underway.
2. **Studies on simple and cost-effective water purification methods using plant products: studies with tuber products** [funded by PNGUoT Research Committee] - undertaken by Mr. Kaupa Philip for M.Phil. degree under Graduate Assistantship Program - from Feb '15. Principal supervisor: Dr. J. Gopalakrishnan. It has been found that the dried and pulverized peels of banana could remove the heavy metals from water by the complex formation between the metal ions and the amide oxygens and nitrogens of the peels. Similarly, the pulverized peels of tuber products like tapioca, taro and yam are also expected to show the same results and Papua New Guinea is rich in these tuber products. Two tuber products (sweet potato and cassava) are considered for the study. A study would be conducted based on which attempts would be made to devise a simple and cost effective water purification method.
3. **Studies on traditional vegetal salts produced in Six Provinces of Papua New Guinea** - undertaken by Ms. Hannah Kurua for M.Phil. degree under self-sponsored category - from Feb '15. Principal supervisor: Gopalakrishnan, J. Data collection on the usage of various plant species for salt production by different tribes of people are on progress.

4. **Biosynthesis and efficacy of silver nanoparticles on plant parasitic nematodes, *Rotylenchulus reniformis* under laboratory conditions using *Euodia Anisodora* green extract** [funded by PNGUoT Research Committee]. Principal investigator: Dr. S. Gopalakrishnan. Extraction, synthesis, characterization of AgNps, studies on namatodes have been completed. This research has been extended to anti malaraial activities and which is on progress.
  
5. **Biological Assessment of Phytosynthesized Silver Nanoparticles** [funded by Dept. of Applied Sciences PNGUoT & LNSDC] - undertaken by Mr. David Timi for Ph.D. degree - from Feb '14. Principal supervisor: Dr. S. Gopalakrishnan. Assessment of the nematicidal activity of phytosynthesized AgNPs against plant parasitic root-knot nematode, *Meloidogyne incognita*. *M. incognita* is a soil borne worm-like microscopic pest that affects agricultural crops. Molecular work for species identification and laboratory test are completed. Green house test and field trials are in progress at the moment. Most of the work on microbiological assessment of phytosynthesized AgNPs on pathogenic bacteria and fungi is completed. The determination of the minimum inhibition concentration of the AgNPs to be completed. To start the work on assessment of the efficacy of the AgNPs against *Plasmodium falciparum*.
  
6. **Quantifying tilapia (*Oreochromis niloticus*) diets in inland aquaculture ponds in Papua New Guinea using stable isotope analysis** (project as part of M.Phil. Research). Principal investigator: Mr. Justin Narimbi. The high cost of fish feed is an impediment to the sustainability and growth of the aquaculture industry in Papua New Guinea (PNG). The contribution of formulated feed and natural food to the growth of the Genetically Improved Farmed Tilapia (GIFT) is poorly understood in PNG. Stable isotopes, in combination with standard growth measurements and stomach content analysis, may provide more insight into the role of different sources of nutrients in the growth of GIFT. A 90-day feeding experiment was conducted at the Highlands Aquaculture Development Centre (HAQDEC) located in Aiyura, Eastern Highlands Province from July to November 2014 to estimate the relative contributions of different food sources in the diet of GIFT. Juvenile GIFT were stocked in fertilised earthen ponds and fed with locally formulated fish feed three times daily for six days (T1) and weekly (T2) based on 5%

body weight but later reduced to 4%. Growth was measured every 21 days, while pond water quality was monitored daily from before the first feeding. Algae, detritus and plankton, as well as sediment organic matter and muscle tissue, were sampled for stable isotope analysis at the conclusion of the experiment. Results showed that feeding the GIFT weekly, complemented by appropriate pond fertilization and increased profitability. The research also demonstrated that stable isotope methods, in combination with standard growth measurements and, to a lesser extent, stomach content analysis, can be used to better understand the utilisation of different sources of nutrients in the production of GIFT. This study forms the basis for further work on selection of alternative feed ingredients, and feeding and fertiliser strategies for GIFT in PNG.

7. **Biogas Development from Household and Market wastes** [funded by Department of Applied Sciences, PNGUoT]. Principal investigator: Mr. R. Nigo. A prototype design has been completed with some preliminary data being collected. The project has potential of reducing organic wastes around markets and household with Lae City. Several feed stocks have been studied for their gas yields. Need to do heating and combustion test and eventual field studies.
8. **Hybrid solar wood drying system for agricultural commodities such as coffee and cocoa** [funded by Department of Applied Sciences, PNGUoT]. Principal investigator: Mr. R. Nigo. A prototype hybrid drying system has been developed and the preliminary studies have indicated very good and promising performance. Performance studies on lab scale have been done. Design modification is underway for comparative performance studies.
9. **National Fisheries Authority – Unitech Laboratory Accreditation** (consultancy) – Joint NFA-Applied Sciences UNITECH project. Team leader: Mr. R. Nigo. PGK 3.5 million has been allocated to this project. The target is to get the lab accredited by June, 2016. Upgrading of the rooms and power upgrading of the whole Department is completed. Purchasing and setting-up of equipment is progressing well.
10. **Food Safety short courses / Training for industries** (consultancy) – this is a training program running in three stages annually. Team leader: Mr. R. Nigo. Modules have been

written and training delivered to the food industries. The training is becoming popular in food and allied industries and also government/semi-government organizations like NAQIA and Department of Health. The training is ongoing and receiving wider audience

11. **Cholera project.** Principal investigator: Ms. E. Nasing. The project was done at Unitech in collaboration of PNGIMR. The project was completed.
12. **Product development on molasses with Ramu Agri-industries Ltd.** Principal investigator: Ms. E. Nasing. Preliminary studies and data collection are in progress.
13. **Morobe Provincial Public Health Division Organizational structure and associated impediments.** Principal investigator: Mrs. S. Denano. Interviews with the provincial public health authorities were carried out and the structure to investigate possible impediments within, which impair the proper functioning of the department/division through all tiers of government (national, provincial and local level government) is mapped out.

### Completed Projects (2015)

#### Applied Chemistry Section – research projects with final year students

No.	NAME	Project Topic	Supervisor
1	JOE Apala	Pharmacological Studies on <i>Piper celtidiforme</i> Opiz. (PIPERACEAE). Phase 2: Bioassay guided isolation of active constituent(s)	Mr.J. Wau
2	VERONICA Api	Studies on <i>Morinda citrifolia</i> oil. Phase2: Validation and comparison of <i>Morinda citrifolia</i> “noni” oil against existing claims and results	Mr.J. Wau
3	UNDIAX Ben	How safe is our drinking water on campus?	Mrs. S. Puy
4	RAYMOND Enep	Determination of Minimum Inhibition Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of Silver Nanoparticles	Mr.D. Timi
5	JASON Iyap	Determination of Minimum Inhibition	Mr.D. Timi

		Concentration (MIC) and Minimum Bactericidal Concentration (MBC) of Silver Nanoparticles	
6	MAX Kambase	Determination of Phytochemicals, Synthesis of AgNps from Bryophyllum inophyllum, and comparison of size of AgNps	Dr.S. Gopal
7	KAVIE Kambiri	Synthesis of AgNps from Alstonia Scholaris and Antifungal activities	Dr.S. Gopal
8	LEONNIE Kanau	Preparation and analysis of vegetal salts from two foliage collected from Aseki village	Dr.G. Jana
9	LUCINDA Karagu	Assessing the loss of chromium from CCA treated timber	Dr.S. Akoitai / Dr. A. Harakuwe
10	MARSHALL Kilala	Synthesis of AgNps from Bridelia Minutiflora Hook and studies on Antimicrobial &Antifungal activities	Dr.S. Gopal
11	IAN kuta	Oxalate content in common vegetables	Dr.G. Jana
12	Maria Mai	Gold Analysis in Asaro River Waste Heavy Sand	Mr.D. Timi
13	PRISCILLA	Synthesis of AgNps from Acalypha Wilkesiana muell and Antimicrobial activities	Dr.S. Gopal
14	MARTIN Marca	Studies on essential oils. Preliminary: Mathematical derivation and optimization of <i>Cymbopogon citratus</i> oil extraction method	Mr.J. Wau
15	ANNA Mopio	Assessing the loss of copper from CCA treated timber	Dr.S. Akoitai / Dr. A. Harakuwe
16	DEHU Nelson	Analysis of volcanic ash obtained from Mount Tavurvur of East New Britain Province	Dr.G. Jana
17	JEAN Novulu	Diosindigo A – A Possible Taxonomical Marker of the Family Ebenaceae	Mr.D. Timi
18	FLORENCE Ongoglo	Production of lye solution from ashes continuation from last year	Mrs. S. Puy
19	JEREMIAH Raymond	Chromium in soils around CCA treated soils	Dr.S. Akoitai / Dr. A. Harakuwe

20	TIM Walker	Preparation and analysis of vegetal salts from the garden foliage of Unitech campus	Dr.G. Jana
21	DUNU Zavitave	Copper in soils around CCA treated poles	Dr.S. Akoitai / Dr. A. Harakuwe

**Food Technology Section – research projects with final year students**

No.	Student Name	Project Title	Supervisor
1	Joyce Bilua	The microbiological quality of water/cordial	Mrs. Rag
2	Michael Nano	Further studies on second generation biofuel development from cocoa pod wastes	Mr. R. Nigo
3	Maur Veronica	Concluding Studies on design and manufacture of solar sorption refrigerator	Mr. R. Nigo
4	Stephanie Joppa	Further Studies on Operation of mini Digester for BIOGAS PRODUCTION using factory (fish), market and farm wastes as an alternative for clean energy source in food processing	Mr. R. Nigo
5	Vennesa Abo	Animal Feed (Pallet) Feeds using Hybrid Drying System: Feed Production Using Solar-Wood Hybrid Drying System	Mr. R. Nigo
6	Joshua Tame	Zero Waste Approach to Biodiesel Production from Coconuts	Mr. R. Nigo
7	Theresa Moris	Further studies on mineral content of indigenous green leafy vegetables of PNG.	Dr. L. Yalambing
8	Tanya Silingin	Micronutrient fortification and formulation studies	Dr. L. Yalambing
9	Kaka Kautia	Determination of fat and NaCl in canned meat products sold in Lae.	Dr. L. Yalambing
10	Henry Krisby	Determination of beta-carotene content (chemical method) of indigenous banana varieties of PNG	Dr. L. Yalambing
11	Naroko Ada	Nutrition survey; data collection on malnutrition and micronutrient deficiencies in and around Lae,	Dr. L. Yalambing



		Morobe Province.	
12	Dickson Tombo	Further Studies into the Antibacterial Properties of Selective Indigenous Vegetables and Fruits in Lae.	Ms. E. Nasing
13	Joa Krihive	Quality Assurance studies: Nestle PNG Ltd	Ms. E. Nasing
14	Stephanie Lema	Food Product Development and Safety Studies on Molases: Ramu Agro Industries	Ms. E. Nasing / Mr. R. Nigo
15	Venesa Vindu	Further Studies on Virgin Coconut Oil (VCO) extraction using enzymes (mannanase) from digestive gland of Giant African Snail (GAS).	Mr. Z. Toksy
16	Kolkia Kerenga	Further Studies on Formulation of protein-energy rich feed for children to elevate malnutrition	Mr. Z. Toksy / Dr .L. Yalambing

### **University Research Committee Seminar Presentation**

1. **Subramaniam Gopalakrishnan.** Evaluation of radical scavenging, cytotoxic effect and antibacterial activity of biologically synthesized silver nanoparticles using *Pittosporum Bryand* (April 2015)
2. **Janarthanan Gopalakrishnan.** Inorganic polymers: from discrete molecules to ceramic materials (August 2015)

## DEPARTMENT OF ARCHITECTURE AND BUILDING

Acting Head of Department: Mr. Daniel Wasi

Research interest for the staff members from the Architecture and Building Department are as follows;

Academic Staff	Research Interest
<b>Daniel Wasi</b> <i>Principal Technical Instructor &amp; Acting HOD</i>	<ol style="list-style-type: none"><li>1. Building Construction Waste in Papua New Guinea</li><li>2. Motivation and Performance of Indigenous Contractors.</li><li>3. Small National Contractors Management skill development</li><li>4. Safety and Cultural obligation of Small National Contractors</li><li>5. Motivation and Productivity of Small National Contractors</li><li>6. Growth of Small National Contractors</li></ol>
<b>Professor C Gonduan</b> <i>Architecture Course Director</i>	<ol style="list-style-type: none"><li>1. User Behavior in Institution Housing: a periodic observation and assessment of indigenous user behavior in PNGUOT housing.</li><li>2. Environmental Stress: An assessment of the built environment wear and tear in response to user overload.</li><li>3. Shifting Cultural Influence in Domestic Architecture Design in Indigenous Environments and Societies</li><li>4. Bamboo Ply as alternative Building Material in Rural PNG.</li></ol>
<b>Dr. Andrew Sariman</b> <i>Senior Lecturer</i>	<ol style="list-style-type: none"><li>1. Thermal Performance of UNITECH Housing</li><li>2. Design Faults in Existing Housing</li><li>3. Climatic Data for Architects in Papua New Guinea</li><li>4. Effectiveness of Shading Devices</li><li>5. Design Studio Learning</li><li>6. Thermal Performance Comparison Between Steel Metal and Traditional Thatched Roofs</li><li>7. Quality of Concrete Masonry Block Manufactured form Sand</li></ol>

	<p>Obtained from Sea Shore around Papua New Guinea</p> <p>8. Building Energy Studies</p>
<p><b>Ali Bou</b> <i>Principal Tech Instructor</i></p>	<ol style="list-style-type: none"> <li>1. Natural Preservation of Wooden Marine House Pile for Coastal PNG</li> <li>2. Convenient Roofing for Rural PNG</li> <li>3. Mangrove Farming: Future Sustenance for Coastal Rural PNG</li> <li>4. Convenient Flush Toilet for Coastal Rural PNG</li> </ol>
<p><b>Jerry Walliah</b> <i>Senior Tech Instructor &amp; Building Course Director</i></p>	<ol style="list-style-type: none"> <li>1. The utilization of Building Quantity Surveying and Estimating skills in PNG</li> <li>2. The Building Construction Health and Safety Practices: Understanding the structural construction safety practices in PNG</li> <li>3. The suitable portable concrete block machine for rural development</li> <li>4. The suitable portable concrete paving machine for rural development.</li> </ol>
<p><b>George Elisha</b> <i>Senior Technical Instructor</i></p>	<ol style="list-style-type: none"> <li>1. Construction defects in small scale building construction in Papua New Guinea.</li> <li>2. Cost economics of small scale building superstructure.</li> </ol>
<p><b>Christopher Dobunaba</b> <i>Technical Instructor</i></p>	<ol style="list-style-type: none"> <li>1. Urban development and Land-use in Papua New Guinea</li> <li>2. Urban design and urban landscape architecture in urban PNG settings.</li> </ol>

### **Conference Attendance in 2015**

Mr Jerry Walliah attended the National Education Conference at the University of Goroka from the 23rd - 25th September, 2015. He presented his paper titled *“Teachers’ Welfare: the Significant Enabler in Improving the Quality of Education delivery in Papua New Guinea”*

## **List of Publication**

There are no staff publications in 2015, due to heavy teaching load and the major review of the syllabus (Architecture and Building Course Syllabus). With another staff departing last year the teaching load of staff was further increased.

The course review will result in a reduction of the undergraduate architectural program duration from five years to three years. The department proposes to also the introduction of a Masters of Architecture program by course.

With the establishment of the course advisory board for both the architectural and building course and the appointment of external course advisors at the end of the 2015, this would mean now the revised course will be run through the board and advisors for their approval before submission for approval by the university.

## **DEPARTMENT OF BUSINESS STUDIES**

### **Head of Department: Dr Luis Alamil**

Research across the four main disciplines represented in the department is encouraged; Economies, Management, Information Technology, and Accounting.

The following research activities were undertaken by academic staff members in the Department of Business Studies during 2015 Academic year

#### **Work-in-Progress**

1. Alamil, L. Integrated Financial Management System: Towards Strengthening Public Sector's Financial Management Practices in Papua New Guinea.
2. Alamil, L. Social Entrepreneurship: An Exemplified Approach to Socia-Economic Development in Papua New Guinea (in cooperation with Dr. Joyce, HoD of Department of Tourism, UPNG)
3. Mainga, W. Exploring Project Learning, Project Competencies and Project Efficiency in Project-based firms (PBFs). Doing final revision of the Literature review prior to re-submission to a Journal
4. Yamarak, L. Mapping Local Rates of Poverty and/ Disadvantages to Mining Projects in Papua New Guinea using GIS Tools and Spatial Econometrics Techniques over both Time and Location.
5. Yamarak, L.: Inflation and Poverty\_ Its Relationship.

#### **Working Paper**

1. Yamarak, L. (Working Paper): The Effects of Rural-Urban Migration on Household Livelihoods in Rural Communities: A Case in Point of WAU: PNG University of Technology, LAE, Morobe Province, PNG.

2. Yamarak, L. & Yamarak, J. Y., (Working Paper): Effect of Socioeconomic Status on Teenage Pregnancy: A Case in Point of Lae City: PNG University of Technology, LAE, Morobe Province.

### **Publications in Journals**

1. Daniel, M. Reuben. (2015). A critical review of Sustainable Competitive Advantage as the ubiquitous dependent variable and Core Competency Theory as the critical internal driver of performance. *Asian Journal of Management Research, Vol. 5. (4)*. Pp. 536 – 541. ISSN 2229 -3795.
2. Daniel. M. Reuben. (2015). Revisiting Strategic Management through the process of Strategy Analysis. *Asian Journal of Management Research, Vol. 6. (1)*. Pp. 29 – 34. ISSN: 2229 – 3795
3. Ramasamy, A. (2015) Management Education and Training in Papua New Guinea: An Empirical Analysis. *Asian Academic Research Journal of Social Sciences & Humanities, Vol. 2, Issue 5*, ISSN: 2278-59X
4. Sun Z, Zou, H, &Strang K (2015) Big data analytics as a service for business intelligence, The 14th IFIP Conf on e-Business, e-Services and e-Society (I3E 2015), 13-15 Oct, Delft, The Netherlands. M.Janssen et al. (Eds), Open and Big Data Management and Innovation. I3E 2015, LNCS9373, pp. 200-2011, 2015, Springer, DOI:10.1007/978-3-319-25013-7\_16. Accessed at: [https://www.researchgate.net/profile/Zhaohao\\_Sun/info?endorsements=1457654400](https://www.researchgate.net/profile/Zhaohao_Sun/info?endorsements=1457654400)
5. Sun Z, Pambel F, Wang F (2015) Incorporating Big Data Analytics into Enterprise Information Systems. In I. Khalil et al. (Eds.): LNCS 9357, the 9th IFIP WG 8.9 Working Conference, CONFENIS 2015, as Part of WCC 2015, Daejeon, Korea, October 4–7, 2015, Proceedings, pp. 300-309, DOI: 10.1007/978-3-319-24315-3\_31. Accessed at: [https://www.researchgate.net/profile/Zhaohao\\_Sun/info?endorsements=1457654400](https://www.researchgate.net/profile/Zhaohao_Sun/info?endorsements=1457654400)

6. Vajjhala N, Strang K, & Sun Z (2015) Statistical modeling and visualizing of open big data using a terrorism case study. The International Conference on Open and Big Data (OBD 2015), 24-26 Aug, Rome, IEEE Press. pp. 489-496, DOI 10.1109/FiCloud.2015.15. Accessed at: [https://www.researchgate.net/profile/Zhaohao\\_Sun/info?endorsements=1457654400](https://www.researchgate.net/profile/Zhaohao_Sun/info?endorsements=1457654400)

### **Accepted and Forthcoming**

1. Strang, K. & Sun, Z. (2016) Analyzing relationships in terrorism big data using Hadoop and statistics. Journal of Computer Information Systems (JCIS), 56(3) 55-65 (<http://www.iacis.org/jcis/forthcoming.php>)
2. Sun, Z., Strang, K. & Firmin, S. (2016) Business Analytics-Based Enterprise Information Systems, Journal of Computer Information Systems (JCIS), 56(4) 74-84 (<http://www.iacis.org/jcis/forthcoming.php>).

### **Submitted to Journal**

1. Sun, Z. (2016) A Logical Approach to Experience-Based Reasoning, Submitted to Journal of New Mathematics and Natural Computation, under review
2. Sun, Z. & Strang, K. (2016) Big data analytics against global terrorism, revising for JAIS after first round review.
3. Sun, Z. (2016) A Framework for Developing Management Intelligent Systems, Submitted to International Journal of Systems and Service Oriented Engineering. under review

### **Conference Papers**

1. Mainga, W., Daniel, R. & Alamil, L. (2015). Employability Skills of Business Studies Degree Students in PNG: A Case Study. 2015 National Education Conference, University of Goroka/Unicef/Department of Education – PNG, Goroka, Papua New Guinea, 23-25<sup>th</sup> September 2015.

2. Yamarak, L. (2015). Development Challenges in Rural Areas of Papua New Guinea and Research Agenda. CPA Conference, Lae International Hotel, 20-21<sup>st</sup> August 2015. Available at: [www.epapng.org.pg/data/documents/CPA-Conference-20\\_08\\_2015.pdf](http://www.epapng.org.pg/data/documents/CPA-Conference-20_08_2015.pdf)
3. Yamarak, L. (2015). The Effects of Rural - Urban Migration on Household Livelihoods in Urban Communities: A Case in Point of Port Moresby, ANU/PNGUPDATE: <https://devpolicy.crawford.anu.edu.au/png-and-pacific-updates/png-update>.

### **Presentation at DBS Staff Seminar Series**

1. Assoc. Prof. Z. Sun: Publishing in Academic Journals
2. Dr. Luis Alamil: Integrated Financial Management System: Towards Strengthening Public Sector's Financial Management Practices in Papua New Guinea.
3. Mr. Ruben Maino: Organizational Justice and Organizational Citizen behaviour of faculties at PNG Universities.
4. Dr. W. Mainga: Project Success, Learning and Project Competencies in Project-Based Firms.
5. Mr. Londari Yamarak: Developmental Challenges of Rural Villages: A Case of Wau Bulolo
6. Dr. W. Mainga, Mr. Reuben Maino & Dr L. Alamil: Key aspects of Teaching and Learning in Business and Management Education, TLMU Series.

### **Presentation at Unitech Research Seminar**

Daniel, M. Reuben: A critical review of Sustainable Competitive Advantage as the ubiquitous dependent variable and Core Competency Theory as the critical internal driver of performance



**Editing Journal & Other Research Activities**

1. Assoc. Prof. Sun, Z. and Professor Paul Wang are editing a Special issue on big data analytics and intelligence in Journal of New Mathematics and Natural Computation (Scopus indexed journal)
2. Assoc. Prof. Sun, Z. founded the Research Centre of Big Data Analytics and Intelligent Systems (BAIS) here in 2015.

## **DEPARTMENT OF CIVIL ENGINEERING**

**Acting Head of Department: Mr Chris Kobal**

Research interests for the staff members from the Civil Engineering Department are as follows:

**Chris A Kobal**, *Principal Technical Instructor and Acting Head of Department.*

### **Research Interests:**

1. Coconut Timber – as a structural material. Coconut timber is currently not included in the Timber Structures Design Code list of timber species available for use as a structural material for structural designers. The aim is to carry out tests on timber specimens. Tests have been carried out on Bending/Flexural specimens and tension/Tensile specimens. The results are yet to be analysed and reported/presented.

2. Solid Waste Management – Domestic and Industrial Solid Waste. The aim is to properly dispose of these wastes. This involves determining the composition of these wastes, physical and chemical. Management includes collection, transportation, and disposing of these in properly designed, constructed and managed landfills. Work has started in the identification of these properties but more needs to be done in order to be able to propose alternative systems.

A project to categorize household waste has been started. A comparison with data previously obtained will describe the trend of house hold and domestic waste.

A two-year fulltime Master of Science (MSc) program has been approved by the Postgraduate committee and the Academic Board.

**Dr Graham P Atkins**, *Associate Professor*

### **Research Interests: Flood Predictions**

His PhD was based on data up to 1973. He intends to start from where it stopped. This is a possible Masters and/or PhD research topics.

Dr Mirzi Betasolo, Senior Lecturer

## Research Interest and Priorities

1. Material Engineering & Technology
  - a) Concrete Technology
    - **RVA (Rabaul Volcanic Ash) Cement and fine aggregate –on going (need fund to prototype project)**
  - b) Utilization of local resources –
    - **Utilization of Areca (Betelnut) Husk for FRC- on going (need fund)**
  - c) Energy resources –
    - **Energy Efficiency Design on Public Buildings (Unitech) – on going**
  - d) Timber technology –
    - **structural strength of local timber (on-going)**
  - e) Asphalt mix flexibility for the tropics (starts this year)
  - f) Recycling
2. Engineering Education
  - **Framework on Paradigm Shift Learning in Engineering Courses- ongoing**
  - **Virtual Research Environment- on going**
  - **LMS in Blended Learning for Engineering classes at Unitech- on going**
3. Water Engineering
  - a. **Groundwater resources- on Going**
  - b. **Rainwater Harvesting –on going**
  - c. Turbulent flow
4. Structural Engineering
  - **Structural Design and Performance of Reinforced RVA Structure (on going, need funds)**
  - **Axiomatic Design (on-going)**
5. Urban & City Management
  - a) Technicity – **GHG Monitoring in Lae City (Proposal made, need funding)**
  - b) Energy Efficiency in buildings – **on going (Energy Efficiency Design on Public Buildings (Unitech))**
  - c) Technology Management – *Capsulation*
  - d) Resource Management- *availability of shale resources in PNG*
  - e) Safe & Resilient City

- f) Urban Transport
- g) Sustainable Urban Land Use Planning
- h) Designing Water Utility Reform

### **List of Publications**

1. Betasolo, Mirzi L. Culture-Educational Paradigm Shift Framework Pedagogical Approach in Teaching Courses at DCE Unitech. 2015 Global Education Conference. 19 November 2015. <http://www.globaleducationconference.com/forum/topics/a-culture-educational-paradigm-shift-framework-pedagogical>
2. Betasolo, Mirzi L. Linking colleagues, researchers, industries and investment today. 2015 Global Education Conference. 19 November 2015. <http://www.globaleducationconference.com/forum/topics/linking-colleagues-researchers-industries-and-investments-today>
3. Rao S., **Mirzi Betasolo**, Svetlana Nilova. Motivational Factors in International Co-Creativity of University Teachers. Pushkin Leningrad University Conference 2015. St. Petersburg, Russia. 12 December 2015.
3. Nilova S.V., Rao S., **Betasolo M. Docena-Llego**. International co-creation as a path of modern development: the example of two networking University teaching information technology in Russia Federation: Proceedings of Thirteenth All Russian public conference. (Perm, 14-15 May 2015) Perr. State.nat.issled. Unive.Perm, 2015. C-63-65.
4. **Betasolo Mirzi L.**, Svetlana Nilova and Sandhya Rao. International Networking Co-creativity Experience and Possibilities. Tambov 2015. ISBN 978-5-4343-0576-01, pp. 280-285.
6. **Mirzi D. Llego-Betasolo**, Sandhya Rao, Smart-ism: Key to success for effective online collaboration, Proceedings GV (Proceedings in GV -Global Virtual Conference), GV 2015 ISBN: 978-80-554-1003-6, GV cd ISSN:1339-2778, GV e

ISSN: 1339-9373, vol. 3, issue 1, pp. 19--22, 2015. Online archive:  
<http://www.gv-conference.com/archive/?vid=1&aid=2&kid=30301-695>

## **Conference Attended**

1. Betasolo, Mirzi L. Culture-Educational Paradigm Shift Framework Pedagogical Approach in Teaching Courses at DCE Unitech. 2015 Global Education Conference. 19 November 2015. <http://www.globaleducationconference.com/forum/topics/a-culture-educational-paradigm-shift-framework-pedagogical> (virtual conference using Blackboard)
2. Betasolo, Mirzi L. Linking colleagues, researchers, industries and investment today. 2015 Global Education Conference. 19 November 2015. <http://www.globaleducationconference.com/forum/topics/linking-colleagues-researchers-industries-and-investments-today>(virtual conference using Blackboard)
3. **Mirzi L. Betasolo**, Plenary Speaker on “Integrating Emerging Technologies in Teaching & Learning of Engineering & Sciences Courses” in the 2nd (CISMCA 2015) Conference on Information Systems, Mobile and Computer Applications with the theme, “Computing Technology: Bringing 21st Century Skills and Geared Beyond All Limits”. Jose Rizal University, Mandaluyong Manila Philippines, January 2015.

**Mr. Jedge Kasadimi**, *Technical Instructor (I)*

## **Research Interest**

Urban/Region Development(Intercity) – with Lae City being planned for expansion in the coming years, there is a Master Plan currently done by JICA. There is a need to come up with smaller detail plans to fit into this master plan, not within the city alone but near by villages as well. I see there is much to do in terms of critical planning of how service providing systems/mechanisms can enhance the delivery of quality basic services and goods. Not only that but also to make these infrastructural developments sustainable and must sync with the entire province and or districts overall development plan.

1. Proposed Road Management System – A computer science graduate, Mr. Francis Kikile and I have come to agree to work on this research as it was his idea however the design and data collections would be collected for;
  - a. Case 1 – Lae’s road network
  - b. Case 2 – Kaiapit District Roads
  - c. Case 3 – Provincial road network

Preliminary research has already been done in terms of the programming part, only to make the research formal and to collect and feed data into the trial system.

2. Case study of designing a road built as a bridge with slabs on beams and on posts/abutments/columns for only a certain type of car. Below are few reasons considered;
  - a. Reduce the road and material cost
  - b. This suspended Road bridge is designed for 1 specific truck/car only and pedestrian to use
  - c. Reduce the traditional method machineries of road construction
  - d. Link areas so remote to the nearest road that will link to the main highway/intercity routes
  - e. Reduce the overall expence of labour and work of the actual construction works for standard gravel and or sealed roads.

**Murray M Konzang**, *Senior Technical Instructor*

**a. Research (Thesis) Interest and Priorities**

1. **CEME 501 & CEME 502:** Master of Engineering Research Thesis Year 1 and Year 2

Research Title: Impact On the Accessibility and Mobility of Traffic Caused by Development of Four Lane Highway and New Lae Port Development Project.

2. Scope, design and estimates of Ward 2, Lae Urban LLG road network and upgrading.
  - Pavement evaluation

- Traffic management
- Costing for upgrade and traffic management.

## **Conference Paper**

1. Konzang, Murray Matarab, *An Evaluation of Lae City Road network Improvement Project*, World Academy of Science Engineering and Technology, International Journal of Civil and Environmental Engineering, International Scholarly and Scientific Research & Innovation, Volume 1, No. 12, 2014-2015.

**Research Monographs:** Konzang, Murray Matarab, *Impact on the Accessibility and Mobility of Traffic caused by Development of Four Lane Highway and New Lae Port Development Project*, Research Monograph, PNGUT, Lae City, Morobe Province, Papua New Guinea.

## **b. Research (Thesis) Interest and Priorities**

1. Geotechnical Site Investigation and Design of Sea Wall of Pam Island, Manus Province. A community initiative project to mitigate the rise of sea level due to climate change.
3. Determination of Critical Acceptance Gap and Headway on Lae City Road Network.
  - Students who conduct this research will compile a new PNG or Lae City standard for critical acceptance gap, T and and follow-up headway, T<sub>o</sub>.
4. Scope and design of Milford Haven Road and Main Market Road Network.
  - Pavement evaluation
  - Traffic management
  - Costing for upgrade and traffic management
5. Goroka Airport Pavement Design. Evaluation of airport pavement and design methods.
6. Scope and Design of Butibam Road in Lae City.

- Semester 1: Pavement Design.
- Semester 2: Geometric Design and costing.

7. Scope and design of Milford Haven Road and Main Market Road Network.

- Pavement evaluation
- Traffic management
- Costing for upgrade and traffic management



## **DEPARTMENT OF COMMUNICATION AND DEVELOPMENT STUDIES**

**Head of Department: Dr Garry Sali**

The Department offers a 4-year professional program and has two sections: A Communication for Development (C4D) Studies and a service-course sequence in English for Academic Purposes (EAP) for students across all disciplines of the University; and, a professional program Communication for Development, which offers both Diploma and Degree Programs to train liaison and community development and public relations officers for resource development companies, government departments and non-government organizations.

In 2009, the Department began offering a Masters in Communication Studies (MCS) program. This program has both a course work and a dissertation component, where the students write a research paper on an appropriate topic in the final semester of their second year. In addition, a Masters of Arts in Organizational Leadership is offered in Cooperation with Development Associates International (DAI), The Christian Leadership Training College of Papua New Guinea (CLTC), and the Pioneers of Australia.

The Department has the following academic staff. Their positions and research areas of interest are noted below, along with their research activities undertaken for the year.

### **Name of the Faculty/Position/Research Interest**

<b>Name of the Faculty</b>	<b>Position</b>	<b>Research Interest</b>
<b>Dr Eric Gilder</b>	Professor	Higher education policy, scientific communication, technology and society, communication theory and practices across intercultural contexts, radio-TV history and legal aspects of broadcasting

		and the socio-psychological aspects of the communication process.
<b>Dr Golam S. Khan</b> (to May 2015)	Associate Professor	International migration, urbanization, health sociology, political economy, research methodology (qualitative) and family dynamics.
<b>Dr Garry Sali</b>	Associate Professor and Head of Department	Sociology of crime and deviance, prison systems, crime and development, and law and order problems in PNG.
<b>Dr Rachael Aisoli-Orake</b>	Senior Lecturer	English as a Second Language writing, Education/English curriculum and pedagogy, English for Academic Purposes, Cross-Cultural communication, development and responsibility and participatory research.
<b>Justin Kehatsin</b>	Senior Lecturer	Conflict resolution, negotiation and Higher Education.  (Enrolled in PhD Program, with the topic, “Unlocking Conflicts in the Public Universities in Papua New Guinea” (Gary Sali and Eric Gilder, Supervisors).
<b>Dr Apoi Yaraepa</b>	Senior Lecturer	Language documentation, discourse analysis, language education, production of learning materials for language at all levels (Elementary, Primary, Secondary and tertiary institutions), cross-cultural communication strategies, curriculum research, design, implementation and

		evaluation, English language development in PNG schools.
<b>Mary Kunenda Aisi</b>	Lecturer	Development communication, gender and leadership, and mass media.
<b>Imelda Ambelye</b> (on study leave 2015)	Lecturer	Enrolled in PhD Program at James Cook University(JCU-SASS), Australia. Research Topic: “Environmental education and natural resource management in Papua New Guinea” (Simon Foale, Supervisor).
<b>Francis Essacu</b>	Lecturer	Education for sustainable development and communicating sustainable development
<b>Joshua Frank Kuri</b>	Lecturer	Language development and practices via bilingual education; practices and effects of communication across developing societies.
<b>Sheryl S. Makara</b>	Lecturer	Emotional intelligence and leadership, critical thinking, communication in crime and sociology with relations to development, community development and participation.
<b>Wilma Molus</b>	Lecturer	Sociology of children, sociology of deviance and crime.
<b>Michael Winuan</b>	Lecturer	Enrolled in PhD Program. Research Topic: “Means by which agricultural messages are communicated to farmers: A case study of OPIC and small-holder oil palm out-growers at Buvussi and

		Sarakolok sub-divisions in West New Britain Province” (Eric Gilder and Garry Sali, Supervisors).
<b>Rhonda Lakele Eva-Gwale</b>	Principal Technical Instructor	Information management, traditional knowledge, changing societies and gender issues.  (Enrolled in Masters in Organizational Leadership (MAOL) Program)
<b>Ngawae Mitio</b>	Technical Instructor	Local community affairs/local governance.

## Journal Edited

*JCDS: Journal of Communication and Development Studies* II (1-2) (2015). Gilder, E., Orake, R., Sali, G., Yaraepa, A. (eds.). (In Press). ISSN: 1992-1322.

## Academic Publications

1. Gilder, E. 2015. Where have all the characters gone? Understanding the changing ethos of higher education and the reclaiming of “being” in higher education via an analytical matrix. *Dialogue and Universalism* 2: 256-68. Institute of Philosophy and Sociology of the Polish Academy of Sciences, Philosophy for Dialogue Foundation, and Polish SEC (Société Européenne de Culture).
2. Gilder, E. & Pal, D. K. 2015. Re-Thinking the SES aspects of ‘climate change’ as a process of pragmatic utopianism in action. *Melanesian Journal of Geomatics and Property Studies Department of Surveying and Land Studies (MJGPS)* 1: 87-97.

3. Gilder, E. & Pal, D. K. 2015. Climate change - probable Socio-Economic Systems (SES) implications and impacts in the anthropocene epoch. In Bârsan, G., Udeanu, G. and Căruțașu, V. (Coor.). *The Complex Physiognomy of the International Security Environment*. “Nicolae Bălcescu” Land Forces Academy in Sibiu (pp. 130-39).
4. Kehatsin, J. 2015. Communication is the recipe for establishing trust, goodwill, respect and success amongst stakeholders in rural based projects in Papua New Guinea. *JCDS: Journal of Communication and Development Studies II* (1-2) (In Press).
5. Khan, G. S. 2015. Forced migration and reconstitution of family history: an ethnographic focus. *Romanian Review of Political Sciences and International Relations* 12 (2): 63-84.
6. Kuri, J. F. 2015. Implementation of bilingual education policy: is it working in lower primary classrooms? A survey of rural schools in Southern Highlands and Hella provinces in Papua New Guinea (PNG). *JCDS: Journal of Communication and Development Studies II* (1-2). (In Press).
7. Molus, W. 2015. Factors affecting students’ academic performance in study skills subject in Papua New Guinea University of Technology. *Journal of Communication and Development Studies II* (1-2). (In Press).
8. Sali, G. 2015. *Raskols* and crime in Lae, Papua New Guinea thwarting sustainable development. *Korean Journal of Correctional Discourse* 8: 247-280.
9. Sali, G. 2015. Application of the death penalty in Papua New Guinea (PNG): Will it reduce the escalating law and order problems in the country or not? *JCDS: Journal of Communication and Development Studies II* (1-2). (In Press).
10. Yaraepa, A. 2015. Grammaticalization in Kewapi language. *Journal of Language and Linguistics in Oceania* 8:58-63, published by the Japanese Association of Linguistics in Oceania (In Press).

## **Conference/Seminar Presentations**

1. Essacu, F. 2015. Community-level leadership and development out in rural Papua New Guinea: Presented at the Waigani Seminar, UPNG, Abs-Ws-11 Category 1, Port Moresby. 19-21 August.
2. Essacu, F. 2015. Community-level leadership and development outcomes in rural Papua New Guinea: Evidence from three case study regions: Two seminars presented in the Departments of Communication and Development Studies and Forestry, at the Papua New Guinea University of Technology, Lae, 13 May.
3. Gilder, E. 2015. The rhetorical strategy of becoming an “American”: Jose Antonio Vargas as the intellectual face of an “illegal immigrant” in the context of USA immigration policy. Seminar presentation in rhetoric and oral communication, Faculty of Letters and Arts, Department of Anglo-German Studies, “Lucian Blaga” University of Sibiu, Sibiu, Romania, 27 November.
4. Gilder, E. 2015. European 2020 development strategy in the sky: O3b satellites pave access to the information highway for higher education development in PNG. Europe 2020 Strategy - Social and Economic Implications. SELTH 2015, 15<sup>th</sup> International Scientific Conference of the Romanian-German University of Sibiu, Sibiu, Romania, 20-21 November.
5. Gilder, E. & Kehatsin, J. 2015. Creating a productive community in a society under the strain of a values transition: the case of three of PNG’s higher educational institutions. Presented at the Waigani Seminar, UPNG, Abs-Ws-42 Category 1. Port Moresby, 19-21 August.
6. Gilder, E. & Pal, D.K. 2015. Climate change – probable socio-economic systems implications and policy responses in the anthropocene epoch. UNITECH Research Committee Seminar 09/2015, Lae, 14 April.

7. Gilder, E. & Pal, D. K. 2015. Climate change - probable Socio-Economic Systems (SES) implications and impacts in the anthropocene epoch. Presented at the 21<sup>st</sup> edition of The Knowledge-Based Organization (KBO) International Conference. “Nicolae Bălcescu” Land Forces Academy, Sibiu, Romania, 11-13 June.
8. Kehatsin, J. 2015. Leadership in the public universities in Papua New Guinea. Presented at the Waigani Seminar, UPNG, Abs-Ws-33 Category 1, Port Moresby, 19-21 August.
9. Molus, W. 2015. The role of communication motivating female children to practice commercial sex in Lae, Morobe Province. Presented at the Waigani Seminar, UPNG, Port Moresby, 19-21 August.
10. Orake, R. 2015. A contrastive analysis of the old and new LA 101 & LA 102 syllabuses at the Papua New Guinea University of Technology in 2015: Identifying the Gaps! UNITECH Research Seminar, Lae, 12 March.
11. Orake, R. 2015. Key concepts on teaching and learning languages. TLMU Training Workshop UNITECH, Lae, 7 May.
12. Sali, G. 2015. The application of death penalty in Papua New Guinea (PNG). A seminar presented in the Department of Communication and Development Studies at the Papua New Guinea University of Technology. Lae, 2 July.
13. Yarapea, A. 2015. Grammaticalization in Kewapi language of Papua New Guinea. Presented at the Department of Communication and Development Studies, PNG University of Technology, Lae, 23 April.
14. Wells, P. J., Florea, S. & Gilder, E. 2015. (Workshop) “Lifelong learning in action: the university, employers, trainers and the community working together,” “Lucian Blaga”

University of Sibiu and the Bucharest Professional Training College (BPTC), Sibiu, Romania, 19-20 November.

## **Ongoing International Partnership Research Project**

UNITECH Coordinator & Participant: Papua New Guinea languages documentation project – Partners: PNG University of Technology and USA Livingtongues Institute of Endangered Languages.

## **PhD Graduate Thesis Accepted**

Essacu, F. 2015. Community-level leadership and development outcomes in rural Papua New Guinea: Evidence from three case study regions: PhD Thesis submitted and accepted (December) at the Australian National University, Fenner School of Environment and Society, Canberra, Australia (as ACIAR John Allwright Fellow).

## **Masters in Communication Studies Graduates (Dissertation Titles)**

**Moka, R.C. 2015.** Assessing the influence of communication factors upon student academic performances in PNG secondary schools: A case study of Lae urban secondary schools in the Morobe Province. (Eric Gilder, Supervisor)

**Riwasino, J. 2015.** Development communication strategies for agriculture and forestry projects in Papua New Guinea: a case study of tree farming in Markham Valley, Morobe Province. (Apoi Yaraepa, Supervisor).

**Starza, P. 2015.** The intriguing challenges of tribal warfare in Enga: Communicating an integrated clan-based approach to restore peace and order. (Garry Sali, Supervisor).

**Wambu, E. 2015.** Resolving conflict of interest between Porgera landowners and Barrick Mining Company through interpersonal communication strategies and community engagement – case study at Porgera. (Eric Gilder, Supervisor).



## **DEPARTMENT OF ELECTRICAL AND COMMUNICATION ENGINEERING**

**Acting Head of Department: Dr Peter Kiss**

### **Preamble**

Electrical and Communications/Computer Engineering, arguably, is the most interdisciplinary of all technical subjects at a University. It is found in almost every single discipline whether it is word processing and **data mining**, computer technology based **surgery, detection** of hostile face in a crowd through image processing, monitoring the soil property and fauna of a **farmland/forest** through multisensory network or in **satellite monitoring** of ocean, land use and abuse. Electrical and communication technology is used in the advanced systems of deep space technology. It may be used in a remote village to assist the villagers, nurses and doctors **to identify disease** from symptoms reported or logged in (using English or Pidgin) and the medicines to be prescribed from an intelligent off-line computer that rapidly mines and plays the role of the medical doctor in diagnosis and prescription. Connect a blood pressure measuring electronic device and a temperature measuring sensor to the computer, it becomes an “on line” computer in a village which can sometimes even do better than a **medical doctor and a nurse** for certain diseases if at the basic research level, the partnership between the medical doctor and engineer has produced a **very intelligent diagnosing system**. Energy Systems Analysis where an electrical engineer works together with those in natural, applied and social sciences can enable **the government** not only to effectively deploy energy resources, including renewable energy, but also to effectively plan and make policies regarding energy generation and distribution and energy saving.

Since University of Technology is the premier University of Papua New Guinea in Technology, especially in the engineering disciplines, it is indeed pertinent that the research plan should aim at projecting and developing it as a leading institute in the Oceania, producing undergraduates that are competent to be top class engineers and leaders, able to position themselves as **advisors and wealth generators** for the community. Moreover, it is pertinent that that the University should generate **new knowledge and new technology**

**that is relevant to the local and national needs**, including that which will take away dependence on hiring expertise from abroad but make Papua New Guinean engineers and researchers as able to provide the needed technical and research expertise to attract foreign industries to invest in Papua New Guinea and **produce a local job market and economic benefit** to the nation.

To be **second class** or lower in undergraduate and postgraduate education and research is to be perpetually dependent on expatriate expertise in engineering and research, with the local graduates and researchers being dependents and a burden until the national wealth is exhausted. Hence as a leading department in engineering our vision is set on producing undergraduates and postgraduates trained **in state of the art technology and research techniques and findings** that will make us as a department able to compete with the best of Universities in the Oceania, and, we hope one day, globally.

**Teaching, Learning and Research and Innovation** of a fast advancing engineering science and technology are the tasks that face the Electrical and Communication engineering department. Moreover, with the rapid decrease in the price of computer technology and electronic, electromagnetic sensors there are now more problems open to solutions by electrical and communication engineers within reasonable costs, an ability to manage large amount of data (large computer memory available in small chips) and at rapid speeds (faster microprocessor and communication speeds through light speed wireless and optical fiber systems).

An **additional three priorities** could be added when the **Phase 2 (2017-2019)** of the research plan is ready at the end of the first three years. One of the priorities for Phase 2 will be **Sustainability** where we project that about 70% of the full academic carder will be filled with national members of staff, of which a minimum of 80 % will have PhDs) and the rest with competitive expatriate members of staff expert in one of the ten specializations and able to work together giving significant research leadership in the global scenario.

Our **basic commitments**, in keeping with these priorities are:

1. A department that is fully **integrated with Papua New Guinea industry and community**, changing society and creating wealth.
2. Depth of **quality and multidisciplinary in learning and applications** through class

room, laboratory and research programs which have measurable outcomes.

3. Research and Innovation work that is **beneficial to the local community** and contributes to **knowledge and experience to international challenges** in science and technology and their functions in society.

## **Vision**

Cutting edge teaching and research programs that are based on experimental based courses and high impact research

Amongst the top 20 electrical communication/computer engineering-discipline departments in the electrical and communication engineering discipline in the Oceania at the end of next three years.

Internationally recognized research and technical leader for Papua New Guinea, at the end of the three years, in two of the three major research clusters

## **Specializations in Electrical and Communication Engineering**

Considering the trends and needs in the local, national and international scenario, we envisage that at the end of the entire phases one and two of the research plan, the department would require electrical and communication engineering graduates with specializations in the following ten areas:

1. Power/Energy Systems 2 members of staff.
2. Telecommunications engineering. 2
3. Computer engineering 2
4. Sensors, Systems and Signals Engineering, 2
5. Renewable Energy Systems, 2.
6. Control and Systems, 2
7. Climate and Severe Weather Engineering, 2
8. Agriculture and Environmental Engineering, 2
9. Biomedical Engineering, 2
10. Music and Sound Signal Processing, 2

In the current situation of academic members of staff (see Appendix 2), only two (both expatriates) have earned doctorates and the others are with Master's degrees. Immense amount of will, vision, good cooperation between the **Administration and Academia**,

persevering work and moral commitment are needed to accomplish the position where we should be.

### **Academic Priorities and Basic Commitments**

The major **academic priorities** for **phase one (2014-2016)** of the research plan will be the following:

1. Integrate Research with Teaching and Learning
2. Local and national: connecting with the community
3. Recruitment of the best talents nationally and internationally – and retaining them.

### **Areas of Research**

“DESIGN OF SMART ENERGY CONTROL SYSTEM FOR PALM OIL PRODUCTION PLANT USING FUZZY-PID”, Mr. Joshua Yuanko (MPhil, Student, Department of Electrical & Communications Engineering), Supervisor: A/Prof. Dr. K. Pirapaharan

This research ventures into an investigation on the art of modern control engineering and its applications that can be suitably utilized to establishing Smart Energy Control System in **the Palm Oil Processing Industry in Papua New Guinea** to improve efficiency of energy utilization in the production plants. While basing this research in the application of Control System, the Fuzzy Logic Control System (FLC) and Proportional plus Integral plus Derivative Controllers are the classes of control system that will be used to determine the design of an Ideal Energy Controller.

Since **Fuzzy Logic Control System** covers the application of classical control system and can define parameters of control system properly in situations where the application of later methods become ambiguous and ill defined, FLCS introduces a new strength that can be harnessed in the designs of better controllers. Knowledge of Classical methods of Analyzing control system is very important in formulation of mathematical modeling in control systems and helps one to predict system behavior. By using fuzzy control system both closed loop system as well as other control subsystems that are ill defined by classical methods can be approximated with fuzzy logic reasoning methods

**based on expert experience and knowledge of the system.** Since this involves impartation of expert's knowledge from human to Intelligent Controller, the Fuzzy Controller is closer in spirit to a human expert. Fisher, J., P.R.P. Hoole, **K. Pirapaharan**, S. Thirukumaran and S.R.H. Hoole, "Three Dimensional Electric and flowcharts development, plant control system interaction design, plant data collection and mathematical (Qualitative and Quantitative) analysis, mathematical model formulation and Simulations. The mathematical model will be constructed in MatLab and in Simulink simulation environments to determine the stability and ideal design parameters of the Smart Energy Controller with respect to applications of FLCs and PID. (The work has made notable progress, and needs a new, full time candidate to continue it.)

**Renewable Energy Sources for Morobe Province and future National Smart Grid for PNG.** In this work a study of renewable energy (RE) sources available in PNG with a focus on the Morobe Province is carried out, while mapping for Wind energy and Solar energy potential in the whole of Papua New Guinea is done. Following the identification and calculations of significant RE resources in certain areas, the work will design and optimize the connection of the RE sources not only to local town/village residences, but also to the main Ramu power grid, which is largely driven by hydroelectric power and increasingly by diesel generators. One paper was presented at the Grand Renewable Energy conference (in Japan) to which the research candidate travelled supported by the University of Technology. Researcher Team: S Aiau (leader and PhD candidate, A/Prof Dr K Pirapaharan and Prof Paul Hoole. In 2015 the new member of staff Dr. Peter Kiss is expected to contribute to this program with the possibility of his taking over the supervision of Mr. Aiau, who is working towards his PhD at the University of Technology)

**Characterization and Measurement of and Protection against Sub microsecond travelling surges generated by high-voltage arcing across overhead line insulators.** The work is aimed at reducing the costly and significant amount of damage done by power transients generated at sub microsecond time scales, based on measurements done on the Low Voltage distribution systems, and mathematical, modeling and simulation of these transients to better understand and protect electronic, computer and telecommunication equipment and systems. One paper was presented at the Grand Renewable Energy Conference, and an additional paper at the International Lightning Protection Conference. It is expected that the work will be carried on (in 2015) at the Queensland University of

Technology by Mr. Moses Kavi, the research leader.

**Research Team:** M. Kavi, Prof. Paul Hoole and A/Prof Dr K. Pirapaharan

**Array antennas and signal processing for Underground Mine Telecommunication Systems.** It is recognized that wireless communications in the underground mines will have advantages over the wired (e.g. using leaky wave cables) telecommunication systems currently used in underground mines

– including for the location and communication with miners trapped by tunnel collapse or explosions.

However, the underground mine presents a formidably harsh environment for space waves radiated by antennas. In this work a new design for array antennas is sought, with appropriate measurements of underground signal propagation measurements done to design against interference due to multiple reflections from the cave surfaces as well tunnel bends and junctions. Initial work has made progress in the design of an array antenna that is simple in structure but will generate a single beam with significant reduction in additional beams which lead to waste of battery power as well as multipath signals emanating from the unwanted side lobes. This will also cut down on the need for reflectors which are commonly used in above ground wireless telecommunication systems. The main researcher, Mr. Herman Kunsei is expected to continue the research towards a PhD degree in Queensland. He is expected to leave in June 2015. Currently (2015) he is preparing a paper for an international conference based on the initial results.

**Research Team:** Mr. Herman Kunsei, A/Prof Dr. K Pirapaharan and Prof Paul Hoole

**Design and Protection of Aircraft against Severe Electric Storms: with special reference to increasing use of Carbon Composite Material in aircraft body**

To make aircraft lighter and faster, both commercial aircraft (reduction in fuel) and military aircraft (allowing for faster maneuvers when combating enemy aircraft) increasingly use carbon composite material. These have less withstand power to lightning strikes, less shielding effectiveness for internal electronic system and demand a different geometrical structure to reduce the effects of severe electric storms. Moreover, with climate change and increase of earth surface and atmospheric temperatures, the thunder storms are expected to increase in severity calling for different strategy to handle future threats to land, sea and air borne systems and devices. The research work has successfully modelled and simulated

realistic scenarios of aircraft-lightning electrodynamics to generate and analyze transient currents on aircraft surfaces which are almost impossible to measure when direct hits occur, as recent work on this at the Netherlands National Laboratory has shown (aircraft are deliberately flown into thunder storms). Three conference papers and two journal papers were published in 2014 in this area. The team leader Mr. Joe Fisher is working towards a PhD at the University of Technology.

**Research Team:** Mr. Joseph Fisher, Prof Paul Hoole and A/Prof Dr K. Pirapaharan.

**Additional Research and Innovation work** done at the Electrical and Communication Engineering department (with international collaboration) which have led to publications are:

**Multi-element array signal processing** for mobile station safety and communication systems,

**Signal pattern recognition** for signal localization as well as signal processing for source information extraction.

**Computer Based Electromagnetic Device Analysis and Education**

for reverse design.

**Eddy Current based Non-destructive Testing using Graphics Processing Unit**

GPU-based Laptops

**New Candidates Processing applications:** R. Rex, M. Lester, G. Kupale (PhD), L. Bonner (MPhil). There is now a need for special research room arrangements with proper facilities.

## **Publications**

1. Fisher, J., P.R. P. Hoole, K. Pirapaharan and S.R.H Hoole, "Applying a 3D Dipole Model for Lightning Electrodynamics of Low-Flying Aircraft," *IETE Journal of Research*, pp. 1-8. 2015.
2. Kunsei, H., K. Pirapaharan, P.R.P. Hoole, "A Single Beam Smart Antenna for Underground Mine Communications", *Proceedings of IEEE International Symposium of Antennas and Propagation (ISAP 2015)*, Tasmania, Australia, 9-11

November 2015.

3. Senthilkumar, K. S., K. Pirapaharan, and, P.R.P Hoole, Application of Perceptron Model for Adaptive Beamforming in Array Antennas, Proceedings of IEEE International Symposium of Antennas and Propagation (ISAP 2015), Tasmania, Australia, 9-11 November 2015.



## **DEPARTMENT OF FORESTRY**

**Head of Department: Dr Larry Orsak**

### **Introduction**

UNITECH's Forestry Department is the only academic institution in the South Pacific island region to confer undergraduate and postgraduate degrees in Forestry.

Education is the university's principal mission and the Forestry Department aims to provide high quality academic and administrative support services not only for undergraduates, but with increasing focus on the training of postgraduate students. Our postgraduate programme continues and further develops research skills they began learning through Year 3 courses (especially 'Experimental Design'), and culminating in Year 4 (final year research project).

Our overall educational challenge in forestry is to produce professionals, both men and women, with the necessary technical skills. Foremost amongst these is the ability to solve problems. It is to develop this problem-solving capacity that our department's research activities fundamentally fit into our education mission. To achieve this goal requires that the faculty themselves are not only well versed in research but apply that knowledge through active research projects and programmes. This five - year plan is our first departmental articulation of the strategies and mechanisms by which we hope to enhance our department's research activity component. The document also points out current, significant constraints in attaining our objectives that must be overcome at the university level.

### **Forest/Forestry Research Themes**

The Forestry Department has long recognized the multi-faceted value of Papua New Guinea's forests, and over the years has woven this into its academic and research program. Sustainable forestry in PNG requires a cross-disciplinary approach, which today means blending aspects of the economy, social features, environmental parameters and services, and climate change.

The Department structures its Research Development Plan and Post Graduate Study Program around a number of specific research themes:

- Ecosystem and Environmental Services
- Forest Biology, Ecology & Biodiversity
- Forest (health) Protection
- Wildlife Management, Community-Driven Forest Conservation.
- Role of Forests in Climate Change
- Silviculture, Including Reforestation and Plantation Management
- Agro-forestry/ Social and Community Forestry and Multiple land-use
- Wood Science and Technology; Timber Production/Utilisation
- Forest Engineering
- Forest Economics and Forest Product Marketing
- Appropriate Technology
- Remote Sensing and GIS
- Biomass Energy

Table 1 Summary: Academic Staff at UNITECH Forestry Department

<b>Faculty member</b>	<b>Position</b>	<b>Research Interest</b>
Dr. Larry Orsak	Associate Professor and HOD	Forest entomology and biodiversity assessments; Soil effects on tree stress and growth; tree crop horticulture.
Dr. M. Hossain (departed December 2015)	Professor	Timber engineering and wood technology
Dr. Osia Gideon (commenced January 2016)	Professor	Plant systematics; plant biology & ecology; forest policy
Dr Mex Peki	Senior Lecturer	Forest inventory including timber volume, biomass and carbon estimation and measurements.
Mr. Peter Edwin	Lecturer 2 and Deputy HOD	Wood science and technology; forest management
Mr. Rapo Pokon	Lecturer 2	Plant biology and pest and disease
Mr. Haron Jeremiah	Lecturer 1	Forest economics, marketing
Mr. Eko Maiguo	Lecturer 2 (study leave)	Silviculture and forest management
Mr. Louis Veisami <sup>1</sup>	Technical Instructor & A/Principal	Forest mensuration and inventory
Mr. Benson Gusamo <sup>1</sup>	Senior Technical Instructor	Wood science and technology
Mr. Bazakie Baput <sup>1</sup>	Lecturer 1	Community forestry; biodiversity
Mr. Olo Gebia <sup>1</sup>	Technical Instructor	Botany (plant morphology & tree physiology), Dendrology and forest plant biodiversity assessments; forest rehabilitation.
Mr. Diaiti Zure	Lecturer 1 (study leave)	Natural forest silviculture; forest genetics
Mr. Peter Amatus <sup>1</sup>	Lecturer 2	Community forestry; agroforestry; forestry advocacy.
Mr. Steven Sangau <sup>1</sup>	Senior Technical Instructor 2	Silviculture, forest policy

<sup>1</sup>Based at Bulolo University College campus.

## **On-Going Research Programs in the Department**

The Forestry Department has a number of on-going research activities, which are segregated according to general theme and briefly described below, noting the principal investigators involved:

- Ecosystem and Environmental Services
- Forest Biology, Ecology & Biodiversity
- Variation in the tropical rainforest soil seed bank communities along an altitudinal gradient in Papua New Guinea
- Variation in plant ecomorphic traits along an elevational gradient in the Bulolo-Watut Basin, Morobe Province, Papua New Guinea
- Forest biodiversity indicator assessments and technology
- Forest (health) Protection
  - Soil, plant stress and pest/disease vulnerability in plantation in *Araucaria* species
- Wildlife Management, Community-Driven Forest Conservation
- Role of Forests in Climate Change
- Silviculture, including Reforestation and Plantation Management
  - Clonal propagation techniques for selected species (including *Eucalyptus pelita*, *Acacia* spp.) and Forest Plantation Development
  - Clonal Propagation for Eaglewood
- Agro-forestry/ Social and Community Forestry and Multiple land-use
- Wood Science and Technology; Timber Production/Utilisation
  - Mechanical Strength Testing of 2<sup>nd</sup> Rotation *Araucaria cunninghamii* and *Pinus caribea* trees from Bulolo Plantation

- An Investigation of the Physical Properties (Basic Density & Volumetric Shrinkage) of *Pinus caribaea* and its Drying Behavior.
- Developing suitable (optimized) drying schedule for the timber species *Tremaorientalis*
- .
- Forest Engineering
- Operational analysis for various levels of partial cutting in small-diameter and old growth stands.
- Quality control in timber harvesting.
  - Forest harvesting productivity study in Bulolo Plantation forests
  - Impact of logging and road construction on soil and water at Bulolo Plantation Forest
  - Wood strength testing to use in the design of house and bridge
- Forest Economics and Forest Product Marketing
- Appropriate Technology
  - Mini-Pro Solar Kiln Timber Dryer – Drying of hardwood timbers using solar energy (low power consumption) technology
- Remote Sensing and GIS
  - Multi-temporal Analysis of Land Use and Land Cover Change Using Landsat TM Data in Morobe Province, Papua New Guinea
- Biomass Energy

### **Ongoing Research Collaboration with External Partners**

Apart from internally funded research programs, Forestry Department has been blessed with number of opportunities to conduct collaborative research with external partners over the last five years. The formal projects that contain research components include:

- Improving the Papua New Guinea balsa value chain to enhance smallholder livelihoods (FST 2009/16)
- Technical support to the Papua New Guinea Forest Authority to implement a multi-purpose National Forest Inventory (GCP/PNG/006/EC) (March 2013 to February 2016)
- Enhancing Value Added Wood Processing in Papua New Guinea (FST/2012/092) (July 2014 to January 2018) Partner organisation in PNG: PNG Unitech (Forestry Dept), PNG Forest Authority (FRI), Timber & Forestry Training College
  - Objective 1: To enhance the knowledge of wood properties and processing characteristics of PNG timbers. (Lead PPNGFRI)
  - Objective 2: To identify, pilot and evaluate interventions for enhanced value-added processing systems (Lead PNG Unitech, Forestry Dept)
  - Objective 3: To estimate the potential contribution and distribution of economic impacts to national and local economies from enhanced value added wood processing (Lead Melbourne University)
  - Objective 4: To enhance the capacity of Government, institutional support bodies, industry partners and landowners to implement value added wood processing policies, strategies and practices (PNG FA)

### **Seminar/Workshop and Conference Attendance**

1. Inception workshop for multipurpose forest inventory workshop 30<sup>th</sup> April 2015 at Holiday Inn. POM (see summary report attached and detailed report in the staff tea room)  
**Mex Peki**
2. Workshop on forest policy, promotion of community wood lot farming in PNG 04<sup>TH</sup> – 06<sup>th</sup> May 2015. ( see detailed report in staff tea room). **Mex Peki**

3. Workshop on assessment of forest management and REDD+ governance quality in PNG, 21-22 May 2015, at Lamana Hotel POM. ( see copy of the report at staff tea room) **Mex Peki**
4. Workshop on REDD+ Expert Training event from 9-10<sup>th</sup> November 2015 in Madang (see copy of the report at the staff tea room) **Mex Peki**

## **List of Publications**

- 1) **Moripi, L and Peki, M.**, (2015). Analyzing the distribution patterns of nutmeg (*Myristica* spp) in Busama forest area using quadrat size technique, *Universal Journal of Plant Science* 3(2), p13-20, <http://www.hrpub.org>. DOI: 10.13189/ujps.2015.030201
- 2) **Peter Edwin** and Barbara Ozarska (2015). Bending properties of hardwoods timbers from secondary forest in Papua New Guinea *Journal of Tropical Forest Science* 27(4): 456–461 (2015)
- 3) Nathan J. Kotlarewski, Benoit Belleville, **Benson K. Gusamo** & Barbara Ozarska (2015) Mechanical properties of Papua New Guinea balsa wood, *European Journal of Wood and Wood Products*, Holz als Roh- und Werkstoff, ISSN 0018-3768, Eur. J. Wood Prod. DOI 10.1007/s00107-015-0983, Published online November 2015, Springer

## **Final Year Students Research Reports**

1. Amo, Aquina – Influence of external temperature, relative humidity and cloud cover for optimal timber drying using solar kiln technology in Morobe Province (**Haron Jeremiah**, supervisor)
2. Batau, Vincent – Assessing onsite factors affecting sawn timber output for local mobile saw operators in Morobe Province, Papua New Guinea (**Haron Jeremiah**, supervisor)
3. Frank, Nimrod – Determining strength properties (using static bending and compression test) of secondary and lesser known timber species for building and construction purposes (**Peter Edwin**, supervisor)

4. Jimbudo, Mavis – Estimation of biomass and carbon stock in Oomsis and Ngalakumbung forest are of Morobe Province (**Mex Peki**, supervisor)
5. Kunkun, Pauline – Processing and utilization of secondary timber species in Morobe Province. (**Mex Peki**, supervisor)
6. Mondo, Rose – The effects of fertilizer application on the trial of *Eucalyptus pellita* at forestry plantation, PNG University of Technology (Kulala Mulung, **Mex Peki**, supervisors)
7. Muno, Joycen – Developing drying schedules of various lesser known timber species using pro-mini solar kiln technology (**Peter Edwin**, supervisor)
8. Penu, Israel – Impact of logging operations on soil at Bulolo plantation forest. (**Mozaffar Hossain**, supervisor)
9. Songi, John – Investigating cutting effect of lesser known timber species and secondary timber species in Morobe Province, Papua New Guinea (**Peter Edwin**, supervisor)

#### **Postgraduates (studies completed)**

1. Simon Arnold (2015) “The Interrelationship of Nutritional Deficiency, Root Zone Development and Pest Vulnerability in *Araucaria cunninghamii* in the Bulolo Plantations of Morobe Province, Papua New Guinea.” Post Graduate diploma in Forestry. Supervised by **Dr. Larry Orsak**
2. Russell Tarutia (20015) “Land Use and Land Cover Classification Applying Expert Classification Techniques with Land sat TM and Rapid Eye Data in the Markham Area of Morobe Province, Papua New Guinea.” M.Phil Forestry degree. Supervised by **Mr Lewi Kari** (Lands & Surveying Dept.)



3. John Beko (2015) “Propagation of Eaglewood Tree (*Gyrinops ledermannii*): Investigating Seed Storage and Rooting Success in Stem Cuttings”. M.Phil Forestry degree. Supervised by **Kulala Mulung** (formerly Forestry Dept) and **Tom Okul** (Agriculture Dept.).
4. Diaiti Zure (2015). Testing a hypothetical hybrid, *Alpinia x ilanensis*, and its putative parents, *A. japonica* and *A. pricei* using Inter-Simple Sequence Repeats (ISSR) markers. *National Chung Hsing University, College of Agriculture & Natural Resources*, International Master Program of Agriculture. Supervised by Assistant Prof. Dr. Ying-Hsuan Sun

## **Constraints**

World-competitive research today occurs only when certain, mandatory infrastructure is present. Because forestry relies so much on field work, **reliable personal transport (4-wheel drive vehicle)** is our foremost constraint. While **lab space** and overall **research funding** are general issues at UNITECH, high quality research is often possible in forestry at surprisingly low cost and our lab space is good compared to other departments.

Less mentioned but probably most fundamental to achieving world-competitive research, however, is **access to relevant primary literature**. This is woefully inadequate at UNITECH: we rely on antiquated interlibrary loan hardcopies which themselves are limited, plus a few free access journal networks provided by non-profit institutions that do not access many forestry journals. In contrast, researchers overseas enjoy electronic access via an appropriate level of subscription to the Web of Science that would include a spectrum of high calibre Forestry and related journals.

Expatriate faculty, and certain *senior* national faculty suffer less from this deficiency if they have library connections (via overseas schools they attended, overseas advisors they studied under, etc.), or can pull in literature during overseas annual leaves (i.e. expatriates). Faculty lacking such connections are at a disadvantage within the Forestry Department and more generally in the university. Currently it is the national faculty who have not recently gone on overseas study leave

who suffer disproportionately; it is essential that this inequality be recognized and addressed through much-improved university-wide access to primary literature.

## **DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE**

**Acting Head of Department: Mr Benson Mirou**

The department has embarked on a long term goal of developing a postgraduate program to embrace the changes taking place in the university with regard to scientific research and ensure that from this program qualified national academics are produced.

Our short-term goal (2015 – 2019), however, is to ensure that qualified international academics with years of experience in teaching, industry and research in either Mathematics & Computer Science or both are recruited and are actively involved in supporting the program.

To that end, the department has embarked on accomplishing the following in 2016;

1. Identify potential postgraduate students from among national members of staff who are serving as academics and technical instructors. So far eight have been identified for this training. Training to be sourced locally (Unitech and/or training partners) or overseas.
2. Identify potential postgraduate students from our recent and current graduates to enrol in the postgraduate program as future academics. So far two have been identified. We hope in the future to attract a quality GAP student from our graduating students,
3. A new inclusion in the department, Dr. Smolin, a Computer Science engineer will enable the department to implements some of its goals (points 1 and 2 above) in terms of postgraduate training and give us some more depth in research. We are hopeful that more inclusions in the middle of year will boost our stocks of qualified international counterparts who will lead in research and provide skilled manpower in developing our postgraduate programs in both Mathematics & CS.

### **Research Based Departmental Seminars**

To ensure that a healthy culture of research is established in the department, a series of seminars on a weekly or fortnightly basis has been scheduled where opportunity is given to a member

of staff to address his academic colleagues on an area of research or area of interest. Staff, who are also identified as postgraduate students involved in Mathematics and CS are encouraged to participate. So far early in the semester the results have been encouraging.

## **Department Research Project**

The department has proposed and agreed to isolate and focus on an area of research that is common to both Mathematics and CS as a starting point. The aim of the project is to teach skills that are necessary for research and writing papers, something that the department clearly lacks in its national academics. The area of research chosen is Cryptography.

Apart from this suggested area of research, staff are encouraged to continue working in their areas of expertise and to seek direction from senior members of staff with experience in research and writing papers.

This year we continue on the work done last year and hope the level of research increases each year. Below is the proposal that was put forward last year and we will continue to support the program add to it meaning fully this year.

Movement of staff has been a contributing factor in the process and ultimately determines whether our postgraduate programs are well supported or not. The departments goal to recruit well qualified lecturers and researchers is ongoing and ultimately we are confident more areas of research can be added to the ones we already have.

## **Common Research Area Proposed for Mathematics and CS (2015 – 2016)**

Much of what has been initiated in 2014 is continuing with much better results. Our weekly/fortnightly departmental seminars are now well supported with more input from senior and junior staff. Topics of research are based not only on a research area of Mathematics, Computer Science/ICT but also on topics of interest relating to the latest trends on ICT and its impact and/or applications in different fields including Mathematics and Computer Science.

We proposed to organize a seminar with the title “Algebraic structures, coding theory and statistics” in 2014. We will continue with the program and study algebraic structures which

have applications in computer science: lattices, semi-lattices, semigroups, ordered sets. We also will discuss at this seminar papers on statistics and applications in areas of CS.

A tentative program of the seminar series,

1. The department continues research in “Algebraic structures, coding theory and statistics”:

The source material used in the research is the book by **Ricahrd E. Blahut**, “**Algebraic Codes for Data Transmission**”, **Cambridge University Press, 2003**, 482 pages” (the book is readable and contains chapters about applications).

2. To try to find directions of research in statistics and Computer Science. Focus has now opened for wider discussion on “matters on interest” regarding ICT and its impact on education and relevance to Unitech and PNG.
3. To report new results obtained by the members of the Department.

## **Publications**

1. **Bovdi, Victor; Grishkov, Alexander; Ursul, Mihail**. On the endomorphism rings of abelian groups and their Jacobson radical. *Period. Math. Hungar.* **71**(2015), no. 2, 155 --165. [MR3421690](#)

## **Student Research Projects**

The research activity is also extended to the undergraduate program, where the final year students in CS are required to participate in a year-long (two-semester) research project supervised by a member of staff. The topics chosen are normally an indication of the department’s area of strengths in terms of research and teaching.

# **DEPARTMENT OF MECHANICAL ENGINEERING**

**Head of Department: Professor John Pumwa**

## **Introduction**

The Department of Mechanical Engineering considers engineering research to be very important as it leads to an expansion of knowledge and discoveries of new products and services. It is through research that leads to breakthroughs in engineering and technology. Research and experimental development comprises creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications.

Engineering research is the systematic investigation and study of materials and sources to establish facts and reach new conclusions, so it shapes people's understanding of the world around them. Research involves testing hypotheses and predictions using testable data and a full battery of scientific and engineering tools and methods.

## **Focused Research Areas**

The department has decided to concentrate and focus on the following areas of research in mechanical engineering:

- i. Design and Manufacturing*
- ii. Energy and Environment*
- iii. Materials Characterization*
- iv. Engineering Education and Management*

The department encourages faculty to conduct their research concentrating and focusing in the above areas.

## Research Seminars

Fundamentals of Program Assessment”” by M A Satter, Presented at the Department of Mechanical Engineering, August 6, 2015.

## Faculty Research Topics

The following Table 1 provides research topics that current faculty members are being involved in:

**Table 1**

<b>Staff Member</b>	<b>Topics of Research</b>
Professor John Pumwa, Ph.D.	Tribology (Friction, Wear and Lubrication), Failure Analysis, Energy, Biodiesel, Engineering Education.
Professor M. A. Satter, Ph.D.	Machine Design, Systems and Control, Vibrations, Engineering Education and Management, Curriculum Design
Professor Nicholas Lambrache, Ph.D	<ul style="list-style-type: none"><li>a) 3-D modeling of weak parts and subsystems.</li><li>b) Finite Element simulation on stresses – including dynamic stresses and fatigue</li><li>c) Fatigue experiments on computer controlled devices.</li><li>d) Statistical interpretation based on accumulated data from the mine site.</li><li>e) Material Science interactive research on minerals affecting strength of metal alloys in mining equipment.</li></ul>
Dr S. Wahid	Energy and Environment: <ul style="list-style-type: none"><li>1. Heat Transfer,</li><li>2. Renewable energy,</li><li>3. Conservation of energy</li></ul>
Dr. Asherd	Computational Fluid Dynamics (CFD)

Dr Albert Ude	Composite materials
Mr M.R. Satter	<ul style="list-style-type: none"> <li>a) Creative problem solving in engineering design</li> <li>b) Integrating the use of technology to enhance creativity engineering education</li> <li>c) Engineering curriculum optimization using Quality Function Deployment (QFD) house of Quality.</li> <li>d) Renewable energy technologies – power generation systems</li> </ul>
Mr E. Sirisena	Automotive Engineering
Mr Samuel Dunstan	<ul style="list-style-type: none"> <li>a) Effect of corrosion (rust) on structures</li> <li>b) <i>A Mathematical Approach to Dipstick Calibration</i></li> </ul>
Mr Steve Ales Korokan	Friction welding
Mr Brian N'Drean	<ul style="list-style-type: none"> <li>a) Renewable energy – use of solar to provide power, efficiency management of renewable energy.</li> <li>b) Statistical analysis of Failure of mining equipment – study of the properties of the mineral being mined and the effects on life expectancy of equipment components.</li> <li>c) Safety Analysis of Causes of Accidents leading to analysis of design and even management of existing practices – looking at ethical implications.</li> </ul>
Mr. Jack Khallahle	Two Phase Flow in Horizontal gas/liquid pipeline flow for on shore application and the revalidation of flow parameters for stratified flow in horizontal pipeline

### **Undergraduate Research Projects**

The following projects were done by final year Mechanical Engineering Students in 2015 as part of departmental research efforts:

<b>Project Title</b>	<b>Name of Students</b>	<b>Supervisor</b>
Design and fabricate an engine exhaust silencer for the Sandover standby generator set	Apolos, Hillary	Mr. B. N'Drean
Design and recommend solar energy supply for Mechanical	Pikip, Merolyn	Mr. B.



Engineering Department		N'Dreelan
Analyse sustainable energy sources applicable to PNG	Tarabi, Anzeerlyn	Dr. S. Wahid
	Buison, Elihud	
Dynamo Optimization for Mechanical-Electrical Energy Conversion	Onartoo, Solomon	Prof. N. Lambrache
	Malaibe, Charles	
Design and development of battery operated bi-cycle	Ireeuw, Nunway Fernando	Prof. M. A. Satter
	Ekai, Abraham	
Airborne particles generated during braking & their effect on health	Pep, Kerry	Dr. S. Wahid
	Takune, Belinda	
Do hot dip galvanizing of steel samples, test effectiveness against corrosion control and discuss advantages or limitations as compared to galvanizing by electrolysis	Kili, Goshen	Mr. S. Dunstan
	Kamane, Douglas	
Design of high-speed gas jet cutter - team2	Kala, Harvey	Dr. G. M. Arshed
	Embia, Granville	
Design, construct, test and analysis output parameters for a screw conveyer and trough for industrial use	Ngaungau, Tonny	Mr. S. Dunstan
	Warap, Mathias	
Design and Fabrication of Setup(s) for Testing Properties of Natural Materials for Thermal Insulation	Vuti, Salle	Mr. M. R. Satter
	Wiriasong, Tarashiape	
Design of a settling basin and hydrocarbon (oil/water) separator at Unitech vehicle workshop & fuel pump station	Poleam, Gomeda	Mr. J. Khallahle
	Benson, Clayton	
Design of a manually operated 5-colour T-Shirt screen printing machine	Umbu, Stanley	Prof. M. A. Satter
	Paiakan, Freddrick	
Optimization of Cooling Systems for Microprocessors	Niba, Sandra	Prof. N. Lambrache
	Dangi, Mirriam	
Designing and fabricating of a waste paper recycling pulp molding egg tray carton machine	Kitum, Chris	Mr. E. Sirisena

	Jacob, Steven	
Design of high-speed gas jet cutter - team1	Bahu, Billy	Dr. G. M. Arshed
	Hangat, Stanis	
Torsional Behavior of Corroded Aluminium Alloy	Yahamani, Edmond	Mr. A. Korokan
Design of a pneumatic paper cup forming machine	Mone, George	Mr. H. S. Srivastava
	Rumi, Mathew	
Mechanical properties of Coconut Fibers/Epoxy composite for automotive interior applications	Duambe, Webster	Dr. A. Udeh
	Sape, Robert	
A study of the mechanical properties of Banana Fibres/Epoxy Composite for automotive interior application	Ivosa, Ian Charles	Dr. A. Udeh
	Duri, Gini	
Design an air-conditioning system for a proposed building at Unitech incorporating office, computer room and restaurant	Jimmy, Niguel	Mr. J. Khallahle
	Mesa, Paul	

### Postgraduate Students Research

The following projects are being conducted by our M. Tech Students:

Item	Research Projects	Status	PG student
1	Corrosion Rates in Atmospheric and Seawater Environment of Lae Port on Selected Metallic Alloys	Continuing	Stephanie Konts
2	Evaluation of current livestock and aquaculture small-scale feed mill equipment used in PNG and development of strategies for best practice under various operating requirements	Continuing	Jimaimah Nathaniel

### List of Publications

1. Ales, S. K. “Corrosion Rate of AA2024-T4 Friction Stir Weld Aluminum Alloy” PNG University of Technology Research Seminar#25, Tuesday September 8, 2015
2. Eshkooor, R. A., A.U. Ude, A.B. Sulong, R. Zulkifli and C.H. Azhari, “ Energy absorption and load carrying capability of woven natural silk epoxy triggered composite tubes” Composites Part B 77 (2015) 10-18; 2015

3. Satter, M. A. *“The History of the Mechanical Engineering Department-PNG University of Technology”*, to be published in the proceedings of 8<sup>th</sup> Huon Seminar, PNG University of Technology, Lae, Papua New Guinea, July 2015
4. Satter, M. A. *“Trends in Primary and Secondary Education”*, Paper published in the Magazine commemorating 100<sup>th</sup> Anniversary of Chandshi Iswarchandra Secondary High School, Chandshi, Barisal, Bangladesh, 9<sup>th</sup> January 2016.
5. Ude, A.U., R. A. Eshkoo, R. Zulkifli, J. Mariyam, C.H. Azhari. The Energy Absorption and Load Carrying Capability of Woven Bombyx Mori Natural Silk fibre-Epoxy Composite Cylindrical Tubes. (**Oral Presentation**) 13th ASIAN Textile Conference, Australia: 3-6 Nov. **2015**

## **DEPARTMENT OF MINING ENGINEERING**

**Head of Department: Dr. Gabriel Arpa**

The Mining Engineering Department offer two degrees- bachelor of Engineering in Mining Engineering and Mineral Processing Engineering. There are 15 academic staff, 5 Technical staff, 3 Administrative staff and two auxiliary staff. One of the 15 academic staff are currently on study leave pursuing PhD studies in Australia and 3 academic staff are currently pursuing Masters in Philosophy studies in the Department. The current staffs of the department are pursuing research activities in their areas of expertise as outlined below.

### **DR. GABRIEL ARPA, SENIOR LECTURER**

#### **Research Priority Areas**

- Feasibility study of Kassam Pass Underground Tunnel Construction., Lae Papua New Guinea.
- Site Blasting specification for Hidden Valley open pit mine using blast vibration monitoring. Morobe Mining. Lae Papua New Guinea.
- A comparative study on ventilation efficiency in dead space in both laboratory model and underground mine condition. Lae, Papua New Guinea.
- Modelling of the Deep Sea Tailing Placement System and Practice in Papua New Guinea.
- Sedimentation Studies of the Watut and Markahm River system and their effect on the environment and Lae Wharf system. Lae Papua New Guinea.
- Mineral Economic studies of mines in PNG after Extension of Mine Life
- Geomechanics Studies of Wafi-Golpu Underground Mining (Block Caving)
- Mechanics of Phytoremediation – Environmental Engineering

## **Papers submitted and currently under peer review**

1.) International Journal of Phytoremediation. (*Elsevier Science*) 2015

**Statistical Comparison and Analysis of Selecting Optimal Native Phytoremediation Plant Species for Heavy Metal Removal on Mining Environment of Papua New Guinea. A Case Study at Closed Namie Mine of Wau, Morobe Province.**

**Stanley Rungwa, Gabriel Arpa, Harry Sakulas, Anthony Harakuwe and David Timi**

Papua New Guinea University of Technology, Mining Engineering Department Private Mail Bag, Lae, Morobe Province, Papua New Guinea | Phone: (675) 473 4682/4671 | Email: [srungwa2015@gmail.com](mailto:srungwa2015@gmail.com) or [garpa@mining.unitech.ac.pg](mailto:garpa@mining.unitech.ac.pg)

### **Abstract**

This paper is focusing on statistical comparison and analysis of data which were generated and obtained through Inductive Coupling Plasma (ICP) and Atomic Absorption Spectrophotometer (AAS) technique during the field research study at closed Namie mine as to select optimal native plant species for Phytoremediation study in Papua New Guinea (PNG) mining environment. Phytoremediation technology is also known as ‘*Green Technology*’ and is a bioremedial solution with cost effective measures where plants are used to remove metal contaminants that are being released into the environment by large mining operations in PNG. Currently, PNG is experiencing environmental problems relating to mining activities despite receiving valuable earnings from mining projects in PNG. These mining environmental problems have been increasing rapidly causing lots of instability on surrounding environment and ecosystems. Moreover, the natural presence of heavy metals in the mining environment has increased to more concentrated level as a result of mine tailing disposals causing riverine, dieback, dumping of waste rock materials on nearby mine land, etc. This paper alludes in providing statistical data comparison and analysis of native plant species that were obtained from ICP and AAS technique to critically identify optimal native plant species between *Phragmite karka* and *Piper anduncum* as phytoremediation species in removing toxic heavy metals from mining environment. However, according to the statistical data compared and analyzed, it was proven that *Phragmite karka* has a potential absorption rate despite having average hyperaccumulator ability.

**Key words:** Phytoremediation, hyperaccumulators, toxicity, heavy metals, environment, adopt, statistical.

- 2.) International Journal of Mining Reclamation and Environment (*Taylor and Francis*). 2016  
– *Paper Under review*

### **Ventilation Exchanges in Dead Spaces Along Main Airways Based on Mine Measurement and Laboratory Models**

Gabriel ARPA<sup>1</sup>, Kyuro SASAKI<sup>2</sup>, Arif Widiatmojo<sup>2</sup> and Yuichi SUGAI<sup>2</sup>

<sup>1</sup> Mining Engineering Department, Papua New Guinea University of Technology.

<sup>2</sup> Department of Earth Resources Engineering, Faculty of Engineering, Kyushu University, Fukuoka 819-0395, Japan

#### **Abstract**

Studies on airflow through a mine ventilation network, using tracer gas has revealed that quality of air is greatly affected by the presence of dead spaces along the mine airways. In order to further study the effect of dead spaces on quality of air and the ventilation exchange rate in the dead space of the mine, studies were conducted in both laboratory model and measurements in an open stope at the Porgera underground mine in Papua New Guinea. Laboratory models of dead entry space by varying aspect ratio, L/W, with constant width, W, and increasing length, L, were constructed. Tracer gas was released inside the end of dead space and the gas concentration against elapsed time was measured at the entrance of the dead space for various L/W ratio. Air exchange rate N, decreases as the length of the dead space increase under a constant cross sectional area, and ventilation flow was measured as almost constant against the L/W ratio over one.

### **3.) Investigating the physical mechanisms of heavy metals uptake in plants**

- **A case study of lead (Pb) uptake in *Leucaena leucocephala*.**” 2016

**Francis Kiap, Stanley Rungwa, Gabriel Arpa, Harry Sakulas, Anthony Harakuwe and David Timi**

Papua New Guinea University of Technology, Mining Engineering Department Private Mail Bag, Lae, Morobe Province, Papua New Guinea | Phone: (675) 473 4682/4671 | Email: [srungwa2015@gmail.com](mailto:srungwa2015@gmail.com) or [garpa@mining.unitech.ac.pg](mailto:garpa@mining.unitech.ac.pg)

#### **Abstract**

Phytoremediation, a green technology that uses plants to clean up contaminated sites, has high potential for remediation of mine contaminated sites and mine rehabilitation. However, the effectiveness of this technology is limited by plant type and the nature of contaminant. The pre-

requisite to improving the effectiveness of this technology is to understand the mechanisms involved in moving these heavy metals from the rhizosphere into the roots and up the plant to the above-ground parts.

The main objective of this study was to find out the physical mechanisms that are responsible for the uptake of heavy metal lead (Pb) from the roots of *Leucaena leucocephala* plant species to its above-ground parts. The research aimed to answer the questions of how Pb is being taken up the plant against gravity, although the metal is denser, and through which vessel it is taken up.

The research has found the simple explanation of the mechanisms accountable and the answers to the questions proposed. The physical mechanisms that are heavily involved in the intake and uptake of Pb are transpiration, osmosis and capillary. These mechanisms are driven by temperature, pressure and the two important properties of water called cohesion and adhesion. Moreover, the possibility of the movement of water and emerged Pb particles as bulk flow or mass flow into the root and through the xylem up the plant is also dependent on the density of metal.

### **MS. MARY KAMA, SENIOR TECHNICAL INSTRUCTOR**

#### **Research Priority Areas**

- Calcination and Quality tests on Elimbari lime stone from Chuave in Simbu Province.
- Isothermal carbothermic reduction of iron oxide and production of sponge iron from 4 different materials from Ok Tedi magnetite Skarn Ore (MPhil Research Project).
- Further research activities to extract iron from tails from other existing Mines in PNG.
- Further research to increase grade of sponge iron produced from pyrite concentrates- mini steel industries.
- Calcination & quality testing for Manus & Finschafen lime stone deposits

## **Abstracts of Publications**

### **1.) Reaction kinetics of iron oxides in the Ok Tedi pyrite concentrates** (*Paper Accepted for Publication at Minerals Engineering Institute 2016*)

<sup>1</sup>M. Kama, <sup>2</sup>N. Kama, <sup>3</sup>P. Leki,

#### **Abstract**

Large quantities of iron in the form of pyrite were discarded as tailings from the Ok Tedi copper mine in Papua New Guinea, thus causing environmental problems through acid drainage around the Ok Menga riverine area. A pyrite plant was built to concentrate the pyrites and stored under water table at Bige dam. This investigation was conducted to establish the reaction kinetics of extracting the iron in the pyrite concentrates to produce sponge iron for commercial purposes.

Roasting processes were carried out in a muffle furnace at varying temperatures and times. Particle sizes of the samples ranges between 106 µm and 150 µm. Coconut charcoal was used as the reducing agent and calcium oxide as the fluxing agent.

The reaction kinetics was marginally higher at temperatures above 800 °C. Although, oxygen was not completely removed, the iron content was upgraded to 72 % due to the removal of sulfur.

**Key words:** pyrite, concentrates, sponge iron, kinetics, tailings.

<sup>1</sup>Lecturer in Mineral Processing, Mining Engineering Department, PNG University of Technology, Papua New Guinea. Corresponding Author Email: [mkama@mining.unitech.ac.pg](mailto:mkama@mining.unitech.ac.pg)

<sup>2</sup>Graduate Metallurgist, Ok Tedi Mining Ltd, Western Province, PNG.

<sup>3</sup>Plant Metallurgist, Barrick Pogera, Enga Province, PNG.



**2) Reaction Kinetics of iron oxides in Ok Tedi Magnetite Skarn Ore**  
(*Paper published in the International Mineral Processing Congress IMPC 2016*)

Mary Kama and Kaul Gena

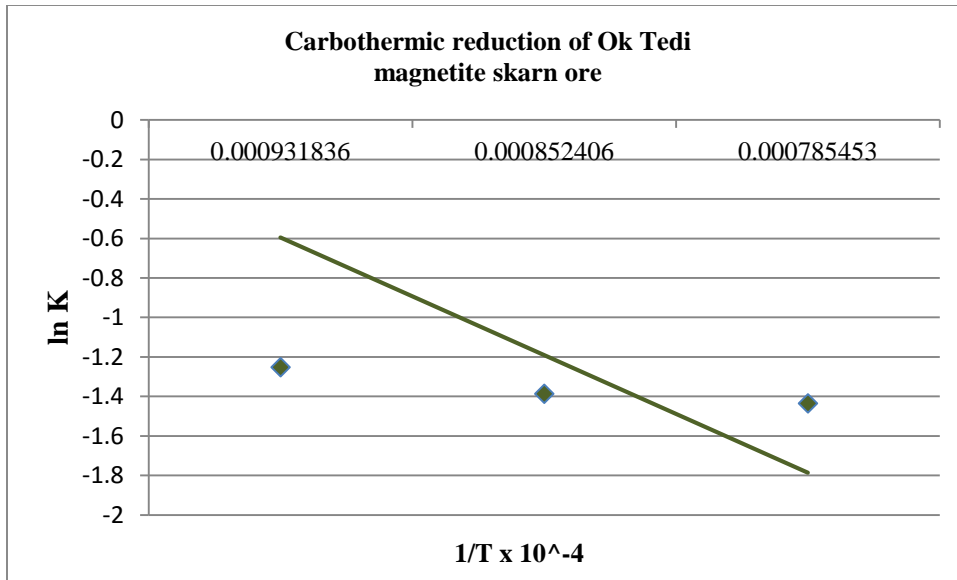
Department of Mining Engineering, Papua New Guinea University of Technology, PMB Lae, Morobe Province, Papua New Guinea.

**Abstract**

The objective of the paper is to investigate the iron ore reaction kinetics (IORK) of a naturally occurring Ok Tedi magnetite skarn ore (MSO) by isothermal carbothermic reduction using coconut charcoal, lime flux and sugar cane juice as a binder.

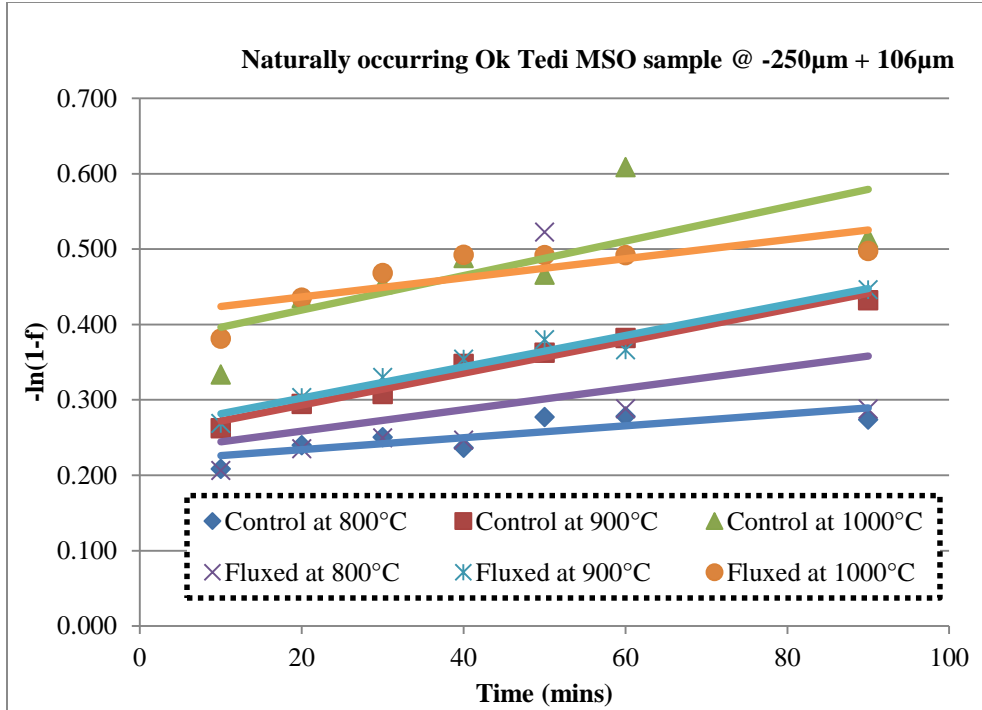
Magnetite skarn ore is one of the copper bearing ore types mined from the Ok Tedi Copper Mine. The copper minerals are floated to concentrate the copper while the iron oxides and iron sulphides are discarded as tailings. Content of iron in the tailings are of substantial quantity and grade that it can be extracted and use as a source for sponge iron for mini steel plants in Papua New Guinea. The SEM-EDAX analyses of the Ok Tedi magnetite skarn ore indicated 10.1 % C, 30% O, 0.6% Mg, 1.1% Si, 21.1% S, 0.8 % Ca and 36.2 % Fe. Most of the iron in the Ok Tedi MSO occurs as pyrites and in oxide form.

Ok Tedi MSO samples of various size fractions,  $-106+53 \mu\text{m}$ ,  $-250+106 \mu\text{m}$  and  $-425+250 \mu\text{m}$  were reduced by coconut charcoal carbon at temperatures 800 °C, 900 °C and 1000 °C for reduction times of 10 to 90 minutes. The SEM-EDAX analyses of the reduced products of  $-250+106 \mu\text{m}$  particle size indicated 30-40 % Fe at 800 °C, 40-50% Fe at 900 °C and 50-60 % Fe at 1000 °C. An increase in oxygen and decrease in sulphur compositions was observed. The XRD results indicated high iron in the form of hematite, magnetite, wustite and metallic iron in the reduced products at reducing temperatures of 900 °C and 1000 °C.



**Figure 1** Arrhenius plot for Ok Tedi MSO pellets (-425 + 53  $\mu\text{m}$ ) reduced by coconut charcoal carbon for reaction:  $\text{FeO} + \text{CO} = \text{Fe} + \text{CO}_2$

Results of isothermal carbothermic reduction of Ok Tedi MSO showed that the reaction kinetics increases with increasing temperature and time. Figure 1 show that the reduction energy required to reduce the wustite to produce sponge iron is higher since the transfer of heat and reduction rates depend on the carbon gasification. Fluxing did not affect the reduction of the iron oxides significantly. Only a slight increase in kinetics was observed with reduced particle size. Besides, the reaction rate constant (k) did not vary much within the temperatures investigated, according to the kinetic model in Figure 2.



**Figure 2 - Kinetic model plots of  $-\ln(1-f)$  versus reduction times for reduced naturally occurring Ok Tedi MSO of particle size  $-250+106 \mu\text{m}$ .**

Reduction of iron oxides in the Ok Tedi MSO increases with increasing reduction time. Thus, prolonged time of reduction at  $900^\circ\text{C}$  would most likely produce high grade iron. However, close monitoring of temperature and reduction time are essential. Reduction rate increases with increase in both temperature and time of reduction but limited to re-oxidation. Hence, the overall rate of reduction appears to be controlled by  $\text{C}/\text{CO}_2$  reaction or carbon gasification reaction. Therefore, the IORK of Ok Tedi MSO is limited to further investigations within reducing temperature of  $900^\circ\text{C}$ . In conclusion, this study has found that it is possible to produce high grade iron from the Ok Tedi MSO.

**Keywords:** oxidation, magnetite, flux, skarn, ore, carbon, pyrite, reduction, sponge iron, reaction kinetics and roasting.

[https://www.google.com.pg/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEwjDhOrGg7\\_LAhUJopQKHevEBpcQFggmMAI&url=https%3A%2F%2Fsecurity.gibsongroup.ca%2Fimpc%2Fabstracts%2Fimpcabs664.docx&usq=AFQjCNHTR-5XBGVTkeLUJzYuZ9wPOO\\_p0g](https://www.google.com.pg/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=8&ved=0ahUKEwjDhOrGg7_LAhUJopQKHevEBpcQFggmMAI&url=https%3A%2F%2Fsecurity.gibsongroup.ca%2Fimpc%2Fabstracts%2Fimpcabs664.docx&usq=AFQjCNHTR-5XBGVTkeLUJzYuZ9wPOO_p0g)

**DR JIM LEM. SENIOR LECTURER, MINERAL PROCESS ENGINEERING**

**Research Priority Areas**

- Process mineralogy
- Increasing flotation recovery in the -10  $\mu\text{m}$  slime region by investigating approaches that can improve particle-bubble collision efficiency
- Use of DETA to reduce the effect of base metals particularly Cu on gold cyanidation
- Investigating an environmentally benign depression in the selective flotation of molybdenite and chalcopyrite.
- Increase recovery of gold in porphyry copper ores.
- Effect of density on cycloning of high density minerals.
- Investigation of stable metal complexing agents in mill tailings.

**MR. STANLEY RUNGWA, TECHNICAL INSTRUCTOR**

**Research Priority Areas**

- Assessment and Evaluation of Tailing Disposals and Contaminants (Heavy Metals) into Bulolo and Markham River Stream, Morobe Province, Papua New Guinea.
- Hyper-accumulator Plant Species Identification along Bulolo and Markham River, Morobe Province, Papua New Guinea.
- Biotechnology/Genetic Study of Hyperaccumulators to increase their Heavy Metals Absorption Activities, Morobe Province, Papua New Guinea.
- Assessment of *Leucaena* plant as Phytoremediation plant species for PNG Mining Environment.
- Assessment of Arsenopyrite Stability using Phytoremediation Technique on Lihir Mining Environment.

**MR. FRANCIS KISAI BURE, SENIOR TECHNICAL INSTRUCTOR**

**Research Priority Areas**

- The Qualitative Assessment of Aggregates (Industrial Minerals) used for Horizontal and Vertical Construction
- Characterization of River Gravel Aggregates (Industrial Minerals) used in the construction Industry.
- Characterisation of Quarry Aggregates (Industrial Minerals) used in the construction Industry.

**On going Research as Masters of Philosophy Student. (Expected date of completion – 2016)**

***The Qualitative Assessment of Aggregates (Industrial Minerals) used for Horizontal and Vertical Construction***

Industrial minerals (River sediments or Gravel & Quarried Limestone or Sandstone) have been used for the construction of roads and buildings in Papua New Guinea (PNG), for decades. River gravel has been the major source of construction material except for a few places where river sediments are inaccessible, then quarry materials are used for road construction.

PNG is a mountainous country and has high drainage systems. Hence, river gravel or sediments are transported long distances from its source and deposited along river banks where the river currents gradually plateaus out. The sediments deposited or gravel consists of various minerals of varying quality and hardness. Some are soft minerals and others are hard minerals with varying reactivity, from very reactive to the more stable rocks like granite.

River gravels are common sources of aggregates used in roads and building constructions in most parts of PNG at present. These materials are composed of minerals of varying physical and chemical properties. It is known that some minerals have properties that are reactive and when exposed to the atmosphere over prolonged periods, tend to disintegrate thus contributing to collapse of aggregate-based products. In this process the reactive, minerals slowly disintegrate and cause the aggregates to loose their structure and strength, thus result in propagations of cracks and collapse of the mineral particles of the aggregates. The fast deterioration of sealed roads and

collapse of footpaths and concrete-based structures are partly testaments to failure due in part to the disintegration of the reactive mineral species.

The aim of this investigation is to firstly characterize all the mineral compositions of the materials used to produce aggregates for roads and general constructions. After the characterization of the minerals the reactive components will then be selectively separated and removed to improve the homogeneity of the aggregates. A comparative study will be undertaken where the homogeneous aggregates and the river gravel as it is will be subjected to hardness test to determine the hardness of each type of minerals deposits (river sediments). The investigation will also look at alternative rock breakage methods with the intention to select the best crusher or processing method to produce compatible aggregates.

The success of this work will translate to huge savings to the PNG Government's annual road maintenance expenditures and the building and construction industries by enhancing the longevity of aggregate-based products. This project provides for us an opportunity to produce original data and invaluable knowledge and information which will form part of PNG standards in the production of aggregates for the construction industry. The work will help to improve the quality of knowledge and information in the production procedures and selection, flow sheet design and production of competent aggregates to ultimately enhance the longevity of finished aggregate products including sealed roads and concrete based products in PNG.

**MR. YAWAS DEKBA, SENIOR TECHNICAL INSTRUCTOR, GEOLOGY**

**Research Priority Areas**

- Assessment of quality of aggregates sources from river gravel versus hard rock quarry for construction and industrial uses
- Study of geology and structural geology of Lae city for geohazard potential (including earth quakes, liquefaction and floods.
- Study of the distribution of layered gabbro of the Ramu- Markham fault system as a corridor petroleum formation and mineralization.

## **DEPARTMENT OF SURVEYING & LAND STUDIES**

**Head of Department: Professor Dilip K. Pal**

### **Priority Research Areas**

The department's research activities revolve around the pivot 'Land and allied resources' optimum utilization, management, valuation. Impact of Climate Change being a hot topic worldwide is also featuring the department's research interest of late. The department is primarily involved in the process of developing human resources adept in the holistic management of land resources and to eke out best value out of them in a sustainable manner through coordinated research activities. The human resources developed in the department have a wide exposure to the state of the art technology e.g. recent developments in the field of Remote Sensing, Geographic Information Systems, Global Positioning System / GNSS, use of latest Total Stations and allied implements of the digital era.

The department is also involved in a number of research programs including densification of Benchmark points for PNG using latest GPS / GNSS technology, GIS, remote sensing, and cartographic communication through development of thematic maps for PNG, property valuation and land management research programs as well as student projects.

Some specific areas are given below:

- 1) Climate change studies
- 2) Land suitability for Rice cultivation in PNG using Remote Sensing and GIS
- 3) Forest Biomass monitoring using Remote Sensing and GIS
- 4) Forests and Societal management
- 5) Inventorying Environmental Resources
- 6) Disaster Risk Reduction / Disaster Risk Management (DRR & DRM)
- 7) Urban sprawl detection

- 8) Groundwater mapping
- 9) Land use planning and management
- 10) Land Administration studies
- 11) Migration studies
- 12) Asset valuation studies
- 13) Cadastral Data Modeling
- 14) Management of incorporated land groups (ILG)
- 15) GNSS Survey and Vertical Adjustment of Madang Network
- 16) GIS in Customary Land Tenure Investigation
- 17) RS & GIS in Urban and Regional Planning
- 18) Mining and Its Impacts on Property Market
- 19) Residential Property Management
- 20) Public Educational Facility Management
- 21) Property Development Process in Papua New Guinea
- 22) Low Income Housing in PNG: Challenges and Opportunities
- 23) AHI land mobilization policy
- 24) Impacts on customary land owners under Plantation Redistribution Scheme
- 25) Impacts & effects of special agriculture and business lease (SABL) on customary land owners
- 26) Causes and effects of urban land values
- 27) Road Alignment (Horizontal/Vertical)
- 28) Drainage Design
- 29) Subdivision Design
- 30) Control Surveys using GPS/GNSS
- 31) Local Geoid study using GPS heighting on heightened MSL Benchmarks
- 32) GPS/GNSS to Cadastral Surveying in PNG
- 33) Infrastructure Development Surveys
- 34) Geodetic Control Surveying using GPS/GNSS
- 35) ILG (Integrated Land Groups) Customary Land Registration  
etc.



## **Scientific(National/International) Paper Publication in Peer Reviewed Journals**

### **JOURNAL**

1. Babarinde, J. A. (2015), "Asset Valuation and the Role of News in sub-Saharan Africa: Valuers' Rationality and The Hype Dilemma." Paper published in Pacific Rim Property Research Journal, Vol. 21, Number 2, pp. 139-159 (Available online).
2. Babarinde, J. A. (2015 - Forthcoming), "Hotel Project Viability and Fear of Terror Attack in Abuja: Investors' Rationality and the Risk Dilemma," Paper Under Peer Review for Publication in Journal of Sustainable Real Estate, San Diego, California, USA.
3. Das, R. K. (forthcoming): Efficacy of GPS Levelling an experience in PNG
4. Ginton, N., Holis, S. S. and Babarinde, J. A. (2015), "Impact of Corporate Real Estate Strategy on Corporate Sustainability: A Case Study of the Papua New Guinea University of Technology," Paper Published in Melanesian Journal of Geomatics and Property Studies, Vol. 1, pp. 1-21 (Available online).
5. Jana, S.K., Sekac, T. and Pal D. K., 2015: Landslide Hazard Investigation in Papua New Guinea-A Remote Sensing & GIS Approach, International Journal of Scientific & Engineering Research, ISSN (Online): 2347-3878 Volume 3 Issue 3, March 2015. <http://www.ijser.in/archives/v3i3/IJSER1539.pdf>
6. Jana, S.K., Sekac, T. and Pal D. K., (Forthcoming): Integrating Remote Sensing and GIS for Investigating Malaria Risk areas in Morobe Province-Papua New Guinea, International Journal of Remote Sensing and GIS, ISSN 2277- 9051.
7. Karigawa, L., Babarinde, J. A. and Holis, S. (2015), "A Comparative Analysis of Customary Land Associations and Sustainability Issues in Papua New Guinea," Paper submitted to Land Tenure Journal (FAO), Under Peer Review.

8. Karigawa, L., Babarinde, J. A. and Holis, S. (2015), “Sustainability Assessment of Incorporated Land Groups in Papua New Guinea,” Paper restructured for re-submission to Land Journal.
9. Koloa, C., and Samanta, S., 2015, Spatio-temporal Soil Loss Pattern Analysis of Markham River Basin Through Remote Sensing and GIS Techniques, *Melanesian Journal of Geomatics and Property Studies*, 1, 56-68.
10. Mille, J. and Babarinde, J. A. (2015), “Land Dispute Settlement and Compensation Assessment in Papua New Guinea,” Paper submitted to *Land Use Policy Journal - Elsevier* (Under Peer Review).
11. Mille, J. and Babarinde, J. A. (2015), “Identification and Analysis of Customary Land Disputes in Simbu Province, Papua New Guinea,” Paper submitted to *World Development Journal – Elsevier* (Under Peer Review).
12. Samanta, S., 2015, Geospatial Data for Surface Runoff and Transport Capacity Modeling, *International Journal of Remote Sensing & Geoscience (IJRSG)*, 4 (1) 91-100.
13. Samanta, S., and Aiau, S.S., 2015, Spatial Analysis of Renewable Energy in Papua New Guinea through Remote Sensing and GIS, *International Journal of Geosciences*, 6, 853-862.
14. Samanta, S., (2015): Development pressure in transforming of land use/land cover using Geo-information Technologies, *International Journal of Advances in Science, Engineering and Technology (IJASEAT)*, 3 (3, spl. 3), 53-57.
15. Sekac, T., Jana, S.K. and Pal D. K., 2015: A Remote Sensing and GIS Approach to assessing Multiple Environmental Factors Leading to Delineation of Flood Hazard Risk Zone in the Busu River Catchment, Morobe Province, Papua New Guinea, *Melanesian Journal of Geomatics and Property Studies(MJGPS)*, Department of Surveying and Land

Studies Issue 1, Volume 1, November, 2015, pp 40 – 55 <http://mjgps.org/wp-content/uploads/2015/11/1503.pdf>

16. Sekac, T., Jana, S.K and Pal D.K., 2015. Application of Space Technology to Identifying Suitable Areas of Solid Waste Disposal in and Around Lae City, Papua New Guinea, International Journal of Scientific & Engineering Research, Volume 6, Issue 10, November-2015, ISSN 2229-5518
17. Tumare, J., Babarinde, J. A. and Tagicakibau, M. (2015), “A Conceptual Framework for Multipurpose Land Information System (MPLIS) Application for Land Management in Papua New Guinea,” Paper Published in *Melanesian Journal of Geomatics and Property Studies*, Vol. 1, pp. 69-80 (Available online).
18. Yali, R. G., Samanta, S., and Yosi, C. K., 2015, Improved estimation of forest carbon (biomass) using bi-temporal RapidEye data in a low-altitude tropical landscape, *Melanesian Journal of Geomatics and Property Studies*, 1, 22-39.

### **Conference Proceedings Publication**

1. Eric Gilder and Dilip K Pal, 2015. Climate Change – Probable Socio-economic Systems (ses) Implications and Impacts in the Anthropocene Epoch. International Conference on The Complex Physiognomy of the International Security Environment: Sibiu, Romania. ISBN 978-973-153-215-8.
2. Jana, S.K., Sekac, T. and Pal D. K., (2015): Landslide Hazard Investigation in Papua New Guinea-A Remote Sensing & GIS Approach, *International conference on Arts and Science*, University Foundation, Rue d'Egmont 11, Brussels, 30 June to 3 July 2015
3. Jana, S.K., Sekac, T. and Pal D. K., (2015): Study of changing river courses and estimation of reduction of available land reserved for development in Lae city of Papua New Guinea using GIS and Remote Sensing Technology, International Conference in Geospatial Media & Communication 2014, 25-29th May 2015, Lisbon, Portugal.

4. Samanta, S., (2015): Development pressure in transforming of land use/land cover using Geo-information Technologies, 4th International Conference on Recent Trends in Engineering and Technology (ICRTET-2015), August 16, Bangkok, Thailand.
5. Samanta, S., (2015): Modeling of Coastal Vulnerability for Future Sustainable Development using Geo-information Technology, 3rd International Conference on Creative Technology, 19 - 21 August 2015, Thailand.

### **List of Seminar Presentations**

1. Dilip Kumar Pal (2015). Science of Climate Change. Seminar hosted by Centre for Climate Change and Adaptation Research, Anna University, Chennai, India. December, 24.
2. Sailesh Samanta (2015). Modelling of Climate Attributes using GIS. Seminar hosted by Centre for Climate Change and Adaptation Research, Anna University, Chennai, India. December, 24.
3. Dilip Kumar Pal (2015). Climate Change – Short Term Triggers. UNITECH Research Committee Seminar – 07/2015. Presentation made at the weekly Unitech Staff/Students Academic Seminar, Rose Kekedo Foyer, Unitech Campus, Lae, Tuesday, March, 31.
4. Dilip Kumar Pal (2015). Climate Change – Long Term Triggers. UNITECH Research Committee Seminar – 08/2015. Presentation made at the weekly Unitech Staff/Students Academic Seminar, Rose Kekedo Seminar Hall, Unitech Campus, Lae, Tuesday, April, 04.
5. Eric Gilder and Dilip Kumar Pal (2015). Climate Change – Probable Socio-Economic Systems Implications and Policy Responses in the Anthropocene Epoch. UNITECH Research Committee Seminar – 09/2015. Presentation made at the weekly Unitech

Staff/Students Academic Seminar, Rose Kekedo Foyer, Unitech Campus, Lae, Tuesday, April, 14.

6. S. K. Jana, (2015): Landslide Hazard Investigation in Papua New Guinea – A Remote Sensing & GIS Approach, UNITECH Research Committee Seminar 26/2015, Presentation made at the weekly Unitech Staff/Students Academic Seminar, Rose Kekedo Seminar Hall, Unitech Campus, Lae, Tuesday, 15<sup>th</sup> September 2015

### **Research Leading to Ph.D Degree**

<b>Name of the Scholar</b>	<b>Program</b>	<b>Topic</b>	<b>Supervisors</b>
Ms Cathy Koloa	Ph.D in Geomatics Registered in 2015	Hydro-Morphometric Analysis and Hazard Assessment of Major River Basins in Papua New Guinea using Remote Sensing and GIS Technology	Dr. S. Samanta Prof. D. K. Pal

### **Research Leading to M. Phil Degree - 2015**

<b>Name of the scholar</b>	<b>Program</b>	<b>Research Topic</b>	<b>Supervisors</b>
Jerry Mille	M.Phil/2	Identification and Analysis of Land Dispute factors: A Study of Boundary, ownership, Types of Disputes and Assessment (BODA) factors in Simbu Province	A/ Prof. J. Babarinde Mr. A. Pai Dr. Jana
Glen Yali	M.Phil/2	Assessment of Above Ground Carbon Stocks Using Temporal Remote Sensing data and GIS on a Low-altitude Tropical Forest Landscape	Dr. Samanta Mr. J. Suat
Robert Rosa	M.Phil/2	Evaluation of Orthometric Heights from GPS Survey Using a Geoid Model– a case study for Madang, Papua New Guinea	Dr. Jana Mr. R. Stanaway (Australia)

***PNG University of Technology***

Lepani Karigawa	M.Phil/2	Issues Affecting Incorporated Land Groups (LLGs) and their Sustainability in Papua New Guinea: A Case Study of Morobe Province	A/ Prof. J. Babarinde Mr. A. Pai
Fataimoemanu 'O'Malolo	M.Phil/1	A Comparative Analysis of Corporate Real Estate Strategies of Selected Public & Private Corporations in Papua New Guinea	A/ Prof. J. Babarinde Mr. S. Holis
James Seniel	M.Phil/1	An Evaluation of the Affordable Housing Initiatives of the PNG Government in Resolving the Housing Crisis in the Country: A Case study in Lae and Port Moresby	A/ Prof. J. Babarinde Mr. S. Holis
Paulus Mоторо	M.Phil/1	A Comparative Analysis of Residential Property Markets in informal Settlements and Formal Residential Areas of Lae and Port Moresby	A/ Prof. J. Babarinde Mr. S. Holis
Tapulu Wesley	M.Phil/1	Using Integrated RS & GIS Technology to Identify Potential Site for Establishing Small - Scale Hydro Power Plant for Rural Electrification in Bulolo - Wau Districts in Morobe Province, Papua New Guinea.	Dr. Jana Mr. Kari
Tingneyuc Sekac	M.Phil/1	GIS and Remote Sensing Approach in Earthquake hazard Assessment and Monitoring in Papua New Guinea	Dr. Jana Dr. I. Pal (Thailand)
Catharine Rupa	M. Phil new	Using GIS and Remote Sensing to find out Change Detection of Port Moresby coastline due to land reclamation	Dr. Jana Mr. Kari

## Research Leading to Part-Fulfillment of M. Sc Degree in RS and GIS

Name	Program	Research Title	Supervisor
AKIKE Slady	M.Sc RS/GIS	LULC Mapping and Estimation of Forest Canopy Density of the Wafi Goplu Project Area Pre-Deforestation	Dr S. Samanta
JOHN Gregory	M.Sc RS/GIS	Use of geographical information system (GIS) to assess road surface condition and create road maintenance program _Case study – Hiritano highway, Central province.	Mr. Gupta
KENDAURA Andrew	M.Sc RS/GIS	Optimal Route Selection Using The Aid of RS and GIS-“Case Study of Usino to Yal Pilot Track in the Madang Province	Mr. Gupta
MAIS Jennifer	M.Sc RS/GIS	Rabaul Volcano Ash Fall Hazard Risk Assessment on Critical Infrastructure utilizing Remote Sensing and Geographic Information System	Mr. W. Antonio Mr. L. Kari
MICHAEL Elizabeth	M.Sc RS/GIS	Identification of Landslide Vulnerability Zones using Geospatial Datasets through Remote Sensing and GIS: Case study along economic corridors, Simbu Province, Papua New Guinea	Dr S. Samanta
SIGA Jonathan	M.Sc RS/GIS	Mapping of micro watershed identification and planning for Land Use of Ramu Agri Industries through the Application of RS & GIS	Dr. S. Jana
TINAH Mark	M.Sc RS/GIS	Using Remote Sensing and Geographic Information Systems to determine Oil Palm Production Potential Areas – Case Study of South Milne Bay to Orangerie Bay of Papua New Guinea	Dr S. Jana
VUE Chris	M.Sc RS/GIS	Enhanced CCTV Monitoring System in Design using Remote Sensing & GIS Application - Case Study: Monitoring and Control of Illegal Mining at Porgera Gold Mine	Mr L. Kari
WANA Leonard	M.Sc RS/GIS	An Investigation into The Forest Vegetative Cover Changes in Morobe Province of Papua New Guinea Post-Independence from 2004 – 2013	Dr S. Samanta
AELLEN Len	MSc RS/GIS	Monitoring of Tuna Movements from Tuna breeding grounds to waters around New Ireland	Mr. S. Gupta
BAK Paulus	MSc RS/GIS	Use of RS in Route Planning at Lower Nebilyer Sub-District (WHP)	Professor R.K Das
JACOB W Wesley	MSc RS/GIS	Mapping Hydrothermal Alteration Minerals Using Satellite Remote Sensing Techniques for Gold Exploration in Tabar Island, Kavieng, New Island Province PNG.	Dr S. Samanta
JOSEPH Josiah	MSc RS/GIS	Integrating Census Mapping, Geographic Information System, and Remote Sensing techniques to develop a Dwelling level geographic database and to create Census Unit (Enumeration Area) boundary for planning and management of census operations.	Mr. S. Gupta
KUA Joel	MSc RS/GIS	A Geospatial Web-Based application for Educational Management	Mr. Lewi Kari

OALA Iuda	MSc RS/GIS	Measuring Terrestrial Carbon Change Using Remote Sensing & GIS from 2000-2014	Dr Hitofumi Abe/Dr S. Samanta
POI Nebare	MSc RS/GIS	Remote Sensing & GIS Base Spatial Data Infrastructure for Rural Development Planning at District and LLG Level - Case Study: Gumine District of Simbu Province, PNG	Mr. Lewi Kari/ Mr. Job Suat
PUMUYE Pedro	MSc RS/GIS	Planning & Monitoring of Ialibu District Township using Remote Sensing & GIS Technology	Professor R.K Das
REUPANA Alban F.	MSc RS/GIS	Spectral Signatures of the Kaindi Metamorphic and the Morobe Granodiorite – Hidden Valley Gold Mine Lae Morobe Province	Dr Samanta
ROBBY Moses	MSc RS/GIS	Managing Effective and Reliable Bus Stations and Traffic Network using Remote Sensing and GIS Application. The Lae Metropolitan Main Rapid Bus Stations - an ideal case study	Mr. S. Gupta
WANI John	MSc RS/GIS	Use of Remote Sensing & GIS for Mapping Crime and Criminal Hotspots in Port Moresby from 2010 - 2015	Mr. Lewi Kari

## Bachelor's Degree Final Year Research Project -2015

### List of the GISci Section: 2015

COURSE: **BGIS/4**

#### Final Year Research topic (SL424) for Year 2015

Student	Topic
AQUILA Nicole	Using GIS/RS to detect LULC changes over time in Kokopo Town.
AURI Thompson	Use of GIS to Map and Evaluate HIV/Aids in ENB.
BUKI Erwin	Impact Assessment of Sea Level Rise at Ahi Rural LLG, Morobe Province using RS/GIS, Morobe Province
DAMA Cathy	Multi-Purpose DCDB of West Taraka in Lae, Morobe Province
FRANCIS Charles	Development of Hidden Valley Mine and its impact to surrounding area using RS/GIS
KAIRUKU Evangeline	Using RS/GIS techniques to Identify and Monitor Mangrove Ecosystems in the Kairuku Area – Central Province
LOSEA Herro	Utilizing GIS/RS to Establish an Interactive Web-Map Site for Lae City Roads for the DOW, Morobe
OKOA Allen	Development of a Detailed Road Network Map of Waigani Area in Port Moresby to Minimise Traffic Jam.
PETER Priscilla	Population flow in-out of Morobe Province
RUPA Catherine	Using GIS and RS for Change detection of wetland reclamation in Port Moresby.
SOLOMON Donald	Developing a User Front-End Supporting PNG Water Distribution



SUI Anthony	Application of RS/GIS in LULC for change detection in Basamuk Area
TAI Martin	Change Detection of Road Side LULC between Lae City and Nadzab
TAMAI Nathaniel	Scenario of sediment –build up during 1992 to present at Lae Port Tidal Basin
URALIU Medlyne	Application of RS/GIS in Identifying Cocoa Pod Borer affected areas in Gazelle district, ENB Province
WILLIS Godfrey	Change detection of Vegetation in Bulolo Area using RS/GIS
WORU James Kurup	Land Suitability Analysis for Oil Palm cultivation using RS & GIS techniques in Morobe Province
DEBORAH Tuaki	Using ArcGIS to do Water Utility Modelling for Eda Ranu – Rainbow Estate – Port Moresby

**List of the Property Studies Section: 2015**  
**COURSE: BPVP-BPLP/3**  
**PS 306 PROPERTY RESEARCH PROPOSAL**  
**By YEAR 3 STUDENTS (BPLP/3 & BPVP/3), SEMESTER 2, 2016**

Name	Topic	Supervisor
Carlos Palatcham	The use of computer assisted mass appraisal in PNG “An investigation of the applicability of the system in PNG”	J. Babarinde
Mariestella Yambu	An investigation into the causes and effects of land grabbing in PNG: A case study of lae, Morobe Province	S. Holis
Jeremiah Korke	Property Management: A case study on the Physical and Functional factors that influence the rate of depreciation on male lodges at PNG University of Technology, Lae	J. Babarinde
Joel David	Investigation into causes and effects of Shortage of State land in PNG: A case study in Lae City	S. Holis
Jonah Vitika	Electronic records and user friendly database for titles or ownership in land registry	J. Babarinde
Leonard Kaile	Implacing timeshare industries in untouched tourist attraction sites in Gazelle LLG, Kokopo, East New Britain Province to boost and stabilize Property Market	J. Babarinde
Regina Kiele	The effects of introducing Capital Gains Tax on Commercial Property Values in PNG	J. Babarinde
Vanessa Peregua	Population increase and its effects on supply of housing: A case study of Lae City	S. Holis
Alfred Jambiakwe	An evaluation of the participation of woman in land mobilization in a patrimonial society in PNG: A case study of Ahi land mobilization in Lae, Morobe Province	S. Holis
Deborah So'onwai	Implementing an effective and efficient land	J. Babarinde

	information system (LIS) for legal cadastre at Port Moresby	
Martin Wau	Rezoning of residential properties in Lae City: Opportunities and challenges	J. Babarinde
Bobby Mondo	An investigation into the applicability of Quasi – Formal settlement in upgrading informal settlement to formal settlement	S. Holis
Nelu Lukas	The decentralization of property taxation power to Provincial and Local Level Government and its effect on the Provincial economy: A case study in Lae, Morobe Province	S. Holis
Joyce Kia	An investigation into the issue of changes in recreational zoning to other land uses in Lae City	J. Babarinde
Erica Madu	Inadequate supply of public housing by National Housing Corporation within urban areas: Case study of Port Moresby	S. Holis
Molu Kapia	Function of Land Policy and land Policy Reform processes in Land Tenure System in Lae City	S. Holis

**COURSE: BPLP/4 – LAND ADMINISTRATION & PROPERTY MANAGEMENT  
PS404 PROPERTY RESEARCH DISSERTATION**

<b>Name</b>	<b>Proposed Research Topic</b>	<b>Supervisor</b>
AIGERE Percy	An investigation into the feasibility of a property rent control policy for Papua New Guinea: A Case Study of Lae City	Holis
ATZIER Wilfred	Mining and the Impacts on the Property Market: A Case Study of Lihir Gold Mine (Newcrest)	Holis
BEROM Jerry	Fire Safety Management for Shopping Centres: A Case Study of Brian Bell Shopping Centre in Lae.	Babarinde
ELECOR Sedester	Impacts of High Rentals on the Residential Property Market in Lae	Karigawa
JESSY Lalapu	Registration of Valuers in PNG: Challenges and the Way Forward	Mille
JOSEPH Yatu		Holis
MALISO Allen	Decentralisation of Land Title Registration in PNG from the National Level to the Provincial Level	Karigawa
MARU Albert	Challenges Facing Residential Property Management: The Way Forward.	Babarinde
MASO Solomon	Customary Landowners' Benefits Sharing in PNG: A Critical Appraisal.	Karigawa
MIAMBA Danny	An Appraisal of Public Educational Facilities Management in PNG: A Case Study of PNG Unitech Main Campus.	Mille
MU-HU Stanis-laous	Urbanisation and trends in residential property rentals and values in Lae (2010-2014)	Holis
PAUL Steven	An Assessment of the 99-year State Lease and Its Impact	Holis

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	on Commercial Property Investments in PNG	
PETER Michael	Impediments to the supply of affordable housing accommodation for low-income earners in Lae	Babarinde
PURINDA Nosa	Analysis of Informal Customary Land Sales and the Outcomes in Lae	Karigawa
SAKIUSA Vanessa	Leisure Property Management and Tenants' Satisfaction: A Case Study of ...Hotel.	Mille
GAWI Enos	An Assessment of the Property Development Process in PNG	Holis
GUNINIEI Socrates	Mixed-use developments as a strategy for city sustainability in PNG: An exploratory study.	Babarinde
KANDAO Nisi	Loopholes in Rural Property Valuation Practice and Impacts on Sustainable Development in the Highlands	Babarinde
KOLTES John	An Exploratory Study of Student Housing in PNG Using Shipping Containers.	Karigawa
MADI Richard	A Study of Vacant Land for Highest and Best Use: A Case Study in Lae	Mille
MANGO Francis	Urbanisation and Its Impact on the Property Market in Lae	Holis
MANIWAVIE Sillon	Sustainable Resettlement Policy for Manam Islanders Sequel to Volcanic Eruption	Mille
NICKSON Mora	Residential Market Segmentation to Meet Customer Needs in Port Moresby	Karigawa
PAUL KODANG Sebastian	An analysis and assessment of development-induced displacement and resettlement in Madang.	Mille
TAVIP Cathy	Compulsory Purchase and Resettlement Policies in PNG: An Assessment.	Holis
WAPELE Joel	Residential Property Investment: Issues and Challenges Affecting First Time Investors in PNG	Mille
WAUGA Atha	Private Sector Provision of low income housing in PNG: Challenges and Opportunities	Babarinde

**List of the Surveying Section: 2015**

COURSE: **BTSR/4**

<b>Name</b>	<b>Topic of Project</b>
Willie Altomo	Residential Subdivision Design for Unitech Staff at Housing Area# 2
Abraham Gasowo	Computation and Comparison of ITRF '92 Coordinates to PNG94 Coordinates to obtain Site Velocity on PSMs in Lae Area using GPS
Lesley Nanai	GNSS/ GPS Application to Cadastral Surveying: A case study of GPS Application to Subdivision Points established using Total Station
Scott Hezure	Upgrading Drainage System Design for storm water Management – From International students' Village through Agriculture Dept. to Students' Mess
Frazer Asimole	Rehabilitation of Unitech Sewerage treatment pond
Sihon Yamkumbu	Investigating the Surveying methods and Technology of acquiring an ILG Plan for Customary Land Registration
Nimrod Onga	Subdivision Design & Planning of Unitech Male Residential area for construction of further Male student Dormitory
Wilson Tepend	Standardization of Total Station electromagnetic distance measurement calibration at Unitech under different time intervals and temperature using an established Baseline (Unitech Baseline)
Helmut Billie	Drainage Design and Improving of existing surface drainage
Richard Sambep	Underground development survey of Barrick Pogera Mine 3D solid modeling and control using Total Station (Leica TS15R400)
Ken Peter	A new open drainage design to connect Unitech Oil Palm low lying area to existing open drainage of Independence Drive
Tau Lucas	Road Alignment Design
Isaac Paul	Subdivisional design on the Vacant land at Area 5 along Unitech Farm for the Development and Construction of new staff residential house
Roddie Koniel	Upgrading of the Geodetic Control Network using GPS and GNSS, Taraka Campus, Unitech
Otte James	Realignment of road curve on part of Sarawaged road from the International Village to the Junction that leads to Sogeri Marke
Helen Zankum	Proposed new road network (Horizontal and Vertical Alignment) linking existing drive from security office to Union Hall and transport pool
Alex Mosese	Drainage design of a proposed residential subdivision over the existing Unitech playing field
Dominic Voese	Road Design for a proposed residential subdivision at Unitech field

Melissa Toridon	Digital Terrain Modeling for Subdivision Design – the vacant land next to the Unitech Farm
Job Moses	Proposed Residential Subdivision at Unitech Field
Joel Dagnosisok	Designing road drainage network of Buka town as part of general upgrading

## Research Conducted by the Postgraduate Students during 2015

The following 29 PG students completed their research/studies in 2015 and will graduate on 1<sup>st</sup> April 2015.

Name of the Student	Program	Department	Thesis Title
Gwendolyn BAN	PhD	Agriculture	Study the effect of <i>Trichoderma</i> species on selected soil borne fungi in Papua New Guinea
Lydia TASI	Mphil	Agriculture	Prevalence of <i>Salmonella</i> and <i>Campylobacter</i> spp. in poultry as a source of food borne disease in PNG
Henry MAINO	Mphil	Agriculture	Yield stability analysis of 37 promising rice varieties for advanced multi-location testing in Papua New Guinea
Redly OPASA	Mphil	Agriculture	Evaluation of physicochemical and organoleptic characteristics of introduced promising rice varieties in Lae, Morobe Province, Papua New Guinea
Theresa SAKI	MSc	Agriculture	Development of Nitrogen dilution curve for sweet potato ( <i>Ipomoea batatas</i> (L.) Lam) crop
Ruth BAIGA	MSc	Agriculture	Influence of biochar material on Nitrogen (N) mineralization and Nitrogen use efficiency (NUE)
Christian BUGAJIM	MSc	Agriculture	Genetic variations among selected <i>Oryza</i> (L.) species of Papua New Guinea: morphology and seed shattering
Peter BUYOYU	MSc	Agriculture	Characterization of <i>Colletotrichum gloeosporioides</i> causing foliar anthracnose on cutnut ( <i>Barringtonia edulis</i> )
Ero WAMBU	MCS	Communication & Development Studies	Resolving Conflict of Interest between Porgera Landowners and Barrick (Niugini) Ltd Mining Company Through Effective Communication Strategies and Community Engagement.
Paul STARZA	MCS	Communication & Development Studies	The Intriguing Challenges of Tribal Warfare in Enga: Communicating and Integrated

			Clan-Based Approach to Maintain, Peace, Law and Order.
Ruth CLIFF MOKA	MCS	Communication & Development Studies	Assessing the Influence of Communication Factors upon Student Academic Performance in PNG Secondary Schools: A Case study of Lae Urban Secondary Schools in Morobe Province
John RIWASINO	MCS	Communication & Development Studies	Development Communication Strategies for Agriculture and Forestry projects in Papua New Guinea: A case study of Tree farming in Markham Valley, Morobe Province.
John BEKO	Mphil	Forestry	Propagation of Eaglewood Tree ( <i>Gyrinopsle dermannii</i> ): Investigating Seed Storage and Rooting Success in Stem Cuttings
Russel TARUTIA	Mphil	Forestry	Land Use and Land Cover Change Detection Using Expert Classification Techniques with RapidEye and Landsat TM in the Markham Valley of Morobe Province, Papua New Guinea
Simon ARNOLD	PGD	Forestry	The Interrelationship of Nutritional Deficiency, Root Zone Development and Pest Vulnerability in <i>Araucaria cunninghamii</i> the Bulolo Plantations of Morobe Province, Papua New Guinea.
Christopher RUSSELL	M. Tech	Mechanical Engineering	Transient & Steady-State Responses on Automatic Process Controllers
Robert ROSA	Mphil	Surveying & Land Studies	Evaluation of Orthometric Heights from GPS Survey using a Geoid Model - A Case study for Madang, Papua New Guinea
Glen YALI	Mphil	Surveying & Land Studies	Assessment of Above-Ground Carbon Stocks using Temporal Remote Sensing Data and GIS in a Low-altitude Tropical Forest Landscape
Lepani KARIGAWA	Mphil	Surveying & Land Studies	Issues Affecting Incorporated Land Groups and Their Sustainability in Papua New Guinea (Case study of Morobe Province)

Jerry Kamane MILLE	Mphil	Surveying & Land Studies	Identification and Analyses of Land Dispute Factors: A Study of Boundary, Ownership, Types of Disputes and Assessment (BODA) Factors in Simbu Province, Papua New Guinea.
Mark TINAH	MSc in RS & GIS	Surveying & Land Studies	Using Remote Sensing and Geographic Information Systems to determine Oil Palm Production Potential Areas – Case Study of South Milne Bay to Orangerie and Amazon Bay of Papua New Guinea
Elizabeth Aipe MICHAEL	MSc in RS & GIS	Surveying & Land Studies	Identification of Potential Landslide Vulnerability Zones using Geospatial Datasets Through Remote Sensing and Geographical Information System, Simbu Province, Papua New Guinea
Slady AKIKE	MSc in RS & GIS	Surveying & Land Studies	Land Use Land cover (LULC) Mapping and Estimation of Forest Canopy Density of the Wafi Golapu Project Area Pre-Deforestation
Jennifer MAIS	MSc in RS & GIS	Surveying & Land Studies	Rabaul Volcano Ash fall Hazard Risk Assessment on Critical Infrastructure utilizing Remote Sensing and Geographic Information System
Leonardo WANA	MSc in RS & GIS	Surveying & Land Studies	Forest Cover Land Use Changes in a sampled area of the Morobe Province using Remote Sensing and GIS Data
Jonathan SIGA	MSc in RS & GIS	Surveying & Land Studies	Mapping and Developing a Data Base Management System for the Sugarcane Plantation Drainage System of Ramu Agri Industries - Papua New Guinea
John GREGORY	MSc in RS & GIS	Surveying & Land Studies	Use of geographical information system (GIS) to assess road surface condition and create road maintenance program _Case study – Hiritano highway, Central province.
Chris VUE	MSc in RS & GIS	Surveying & Land Studies	Enhanced CCTV Monitoring Using Remote Sensing and GIS Applications- A Case Study to Monitoring and Control of Illegal Mining at Porgera Gold Mine



Bapa BOMOTENG	EMBA	Business Studies	(Full Coursework)
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**Summary:**

<b>Degree</b>	<b>Number</b>	<b>Department</b>	<b>Number</b>
PhD	01	Agriculture	08
Mphil	09	Business Studies	01
MSc	12	Communication and Development Studies	04
MCS	04		
M Tech	01	Forestry	03
MBA (E)	01	Mechanical Engineering	01
PGD	01	Surveying and Land Studies	12

PNG UNIVERSITY OF TECHNOLOGY  
ALLOCATION OF RESEARCH FUND- 2015

Item	Applicant	Department	Research Title	Amount (K)
1	Dr. R. Rao Theresa Saki, MSc/2	Agriculture	Development of N dilution curve for sweet potato.	5, 000
2	Dr. R. Rao Ruth Baiga, MSc/2	Agriculture	Influence of biochar material on N mineralization and N use efficiency	5, 000
3	Dr. Tom Okpul Christian Bugajim, MSc/2	Agriculture	Investigating genetic variation in the seed shattering genes, <i>Sh4</i> and <i>qSh1</i> , in selected wild rice ( <i>Oryza (L)</i> species of prevalent in Papua New Guinea.	7, 933.20
4	Dr. Tom Okpul Malcolm Kabiwaga, MSc/1	Agriculture	Investigating the occurrence of mobile genetic elements in the taro ( <i>Colocasia esculenta (L) Schott</i> ) genome.	6,791
5	Dr Peter Manus Jeromi Kavi, MPhil/1	Agriculture	Economics of Sweet Potatoe Production, distribution and Consumption in Papua New Guinea	10,000
6	Dr Macquin Maino Aloma Motamota (MSc/1)	Agriculture	Morphological and Molecular Characterization of <i>Colletotrichum</i> spp. Causing anthracnose of <i>Dioscorea alata</i> (Greater Yam) in Papua New Guinea	5,000
7	Dr Macquin Maino Melanie Pitiki (MSc/1)	Agriculture	Isolation and Identification of endemic fungal pathogen of eaglewood ( <i>Gyrinops ledermannii</i> )	5,000

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8	Dr R. Rao Rokotamana Vitinaqailevu (MPhil/1)	Agriculture	Cocoa Pod Husk Composting (CPH)– Quantification of Nitrogen Loss and Effect of Amendments	5,000
9	Dr S. Gopalakrishnan	Applied Science	Bio-Synthesis and Efficacy of Silver Nanoparticles on plant parasitic nematodes, <i>Rotylenchulus reniformis</i> under laboratory conditions using <i>Euodia anisodora</i> plant green extract	11, 500
10	Dr J. Gopalakrishnan Philip Kaupa (MPhil/1)	Applied Science	Removal of heavy metals from water using tuber and roo products as safe and cost-effective purification method.	7, 452
11	Mr Londari Yamarak	Business Studies	The Effects of Rural – Urban Migration on Household Livelihoods in Rural Communities: A Case of Wau – Bulolo Rural Communities, Morobe Province.	9, 000
12	Dr M. Betasolo Carl Smith (MPhil/1)	Civil Engineering	Sustainable Rainwater Harvesting System (SRHS) in Lae City: A Model for Papua New Guinea.	5, 000
13	Dr Gary Sali Willie Pilailo (MCS/1)	Communication & Development Studies	The Challenge of preventing violence against in Lae City: Communicating and Integrated approached of engaging men as partners in prevention of domestic violence.	2, 200
14	Dr Eric Gilder Andrew C Wiavi (MCS/1)	Communication & Development Studies	Development Communication for Participatory Community Development in Mine Impacted Communities in PNG: A case of Ok Tedi Development Foundation	4, 900
15	Prof. M.M Hossain	Forestry	Strength Dynamics of <i>Araucaria Cunninghamii</i> (Hoop Pine) of Bulolo Forest Plantation (BFP).	5, 000

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	Steven K. Anakime, MSc/2			
16	Dr. L. Orsak Heveakore Maraia, MSc/2	Forestry	Review of the Genus <i>Ixora</i> (Rubiaceae) in the Papuaia region, with an exploration of sources of species richness, including flower dependent niche partitioning.	7,151
17	Dr. L. Orsak Cassidy Kausik, MSc/1	Forestry	Biology and conservation of the endangered Madang Paradise Birdwing butterfly <i>Ornithoptera paradise parasidea</i> .	7,025
18	Prof. N. Lambrache Stephanie Konts, M.Tech/2	Mechanical Engineering	Corrosion Rates in Atmospheric and Seawater Environment of Lae Port on Selected Metallic Alloys.	10,000
19	Dr Jacob Babarinde Paulus Motoro (Phil/1)	Surveying & Land Studies	A Comparative analysis of rental housing market in informal settlements and formal residential areas of Lae and Port Moresby.	4,430
20	Dr Jacob Babarinde James Seniela (MPhil/1)	Surveying & Land Studies	An evaluation of Affordable Housing Initiative in Resolving Housing Crises in PNG.	4,550
21	Dr Veronica Bue Ms Zina Bird (MSc/1-BULA)	Agriculture	Household dietary patterns of fish farmers in Potsy village, Morobe Province	1600
22	Professor M. Hossain Lawrence Lewis (PhD/2-CARPIMS)	Agriculture	The use of <i>Acacia magnum</i> in the rehabilitation of mined out sites in Hidden Valley	21486
<b>Total</b>				<b>151,018.20</b>

**ALLOCATION OF CONFERENCE FUND- 2015**

<b>Item</b>	<b>Name</b>	<b>Department</b>	<b>Conference Venue</b>	<b>Amount (K)</b>
1	Dr. Sujoy Kumar Jana	Surveying & Land Studies	Club de la Fondation Universitaire (a.k.a University Foundation), Rue d'Egmont 11, Brussels, <b>Belgium</b>	9, 285
2	Dr J. Gopalarkrisnan	Applied Sciences	BeitZaman Hotel & Resort, <b>Jordan.</b>	10, 216.79
3	Reuben Daniel Maino	Business Studies	The University of Goroka, <b>PNG.</b> 23 – 25 <sup>th</sup> September 2015	1, 225.00
4	Jerry Walliah	Building & Architecture	The University of Goroka, <b>PNG.</b> 23 – 25 <sup>th</sup> September 2015	1, 225.00
5	Dr Dapsy Olotona	Applied Physics	PNG Clean and Renewable Energy Conference 2015, UPNG, <b>PNG.</b> 11 – 12 <sup>th</sup> November 2015	1, 422
6	Wilma Molus	Communication & Dev. Studies	University of Papua New Guinea, Port Moresby, <b>PNG</b> 19 -21 <sup>st</sup> August 2015	K1, 816
<b>TOTAL</b>				<b>25189.79</b>

## **UNITECH RESEARCH COMMITTEE SEMINAR SERIES - 2015**

The weekly Unitech Research Committee Seminar Series started in 2013. We achieved another milestone in Research Committee Seminar series by successfully completing the 2015 Academic year. This weekly seminar is a hallmark of the PNG University of Technology that brings the academics, staff and students together in a common forum to share and disseminate research findings to wider university community. This seminar series is the best forum not only to disseminate the research outcomes to wider community but also to train the young academics and postgraduate students for their presentation skills. There are lots of enthusiasm in the Unitech community as expressed through the participation of academics, staff and students. The continued success of the seminar series also demonstrates the commitments of Unitech to develop scholarship and research culture of high standard.

A total of 27 seminars including two from overseas academics and one from the University of Goroka were presented in 2015 on diverse subject matters. As a University, we have to carry this forward to strengthen and build the research culture at Unitech which in turn will enhance our standing as a university and help our bid for program accreditation.

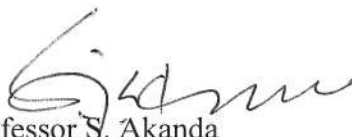
To make the Unitech Research Committee Seminar series sustainable and more attractive, everyone one of us has a role to play.

- Recently, Unitech recruited a large number of academic staff with wealth of experiences. It is the best forum for sharing their unique experiences.
- Masters and PhD students are also encouraged to make presentation on their research findings

Unitech Research Committee takes this opportunity to thank all the presenters and participants involved with the seminar series. It is hoped that the seminar series will enhance the research culture and reputation of Unitech. With posting of the seminar abstracts on the website, the Unitech Research Committee renews its commitment to make the seminar series sustainable and more attractive in the future.

I am quite confident that together we can make this Research Committee Seminar a success story for Unitech. Dr S. Gopalakrishnan, Associate Professor from the Department of Applied Sciences is Coordinating the Seminar Series in 2016, and I wish him the very best.

I also take this opportunity to thank all the Research Committee members, Executive Officer and the Heads of the Academic Departments for their continued support and contributions.



Professor S. Akanda

Coordinator, Unitech Research Committee Seminar Series

**ABSTRACTS**  
**UNITECH SEMINAR SERIES**  
**2015**

## **A Mathematical Approach to Dipstick Calibration**

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### **Abstract**

A dipstick calibration chart is a table that gives fairly accurate, corresponding liquid volumes for each 10mm or so of vertical height from the bottom horizontal surface of a horizontal fuel or liquefied gas tank. In a non-pressurized refined petroleum fuel tank these volumes are usually inscribed on a vertical “dipstick” so the user is able to ascertain the volume of product contained in the horizontal tank at any time by viewing the “wet” level on a dipstick immersed in the tank and withdrawn for viewing of the liquid level. By various mechanical devices such as floater actuated gauges, similar methods are used to ascertain liquid volumes in cryogenic and liquefied gas tanks (which are at high pressure). At present it is very difficult to produce calibration charts for dipsticks for “level” cylindrical horizontal fuel tanks with curved end surfaces. As yet it remains to be discovered as to how this problem can be solved for “slightly inclined” horizontal tanks with curved end surfaces. It is a problem that has only been able to be solved by either slow physical measurement or by paying large sums of money to offshore companies to supply tank calibration charts using suspected 3-D computer models of the tank, such as Solid Works, after size and configuration details were supplied by me and other local users to these suppliers. It has been propositioned that a purely mathematical method of solving is possible. This remains a challenge for engineers and applied mathematicians hence this research.

Keywords: dipstick, calibration chart, horizontal-inclined-tank, analytical-methods.



## **Traditional Medicine in PNG and Evaluation of Radical Scavenging, Cytotoxic Effect and Antimicrobial Activity of AgNPs from Medicinal Plant *Pittosporum f. Dryand***

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### **Abstract**

In a developing country like PNG, the benefits of modern medicine and health care reach only a small percentage of the population living in the rural areas. More so, in villages and communities where per capita income is low, it is difficult for many to afford the cost of modern medicine. Infectious dermatological environment is a common in rural areas and among the tribal population. Application of herbal remedies with traditional medicines are usual practices and providing health care to large populations. The information presented here is to support and incorporate the knowledge of traditional medicine practitioners. Medicinal plants are the main ingredients of local medicines and this innovative work covers only a small proportion of the immense knowledge on traditional medicine, the plant species from which they are derived, the diseases they can treat and the parts of the plants to be used. In this study, biosynthesis of silver nanoparticles was carried out using aqueous leaf extract of *Pittosporum f. Dryand* and characterized using UV-visible spectra, SEM, TEM and XRD techniques. The antimicrobial activity, nanotoxicity properties on MCF7 liver cell lines and anticancer activity using DPPH assay [1] have been investigated in order to prove traditional medicines are efficient.

**Key words:** Biosynthesis, Radical scavenger, cytotoxicity, *Pittosporum Dryand*

## **Hydro-Morphometric Analysis and Hazard Assessment of Markham River Basin and Lae Coast Using Remote Sensing and GIS Technology**

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### **Abstract**

The technological advancement in the application of Remote Sensing (RS) and Geographic Information System (GIS) techniques enables us to estimate river basin characteristics, surface runoff and soil loss based on different parameters in any watershed of Papua New Guinea. The objectives of this study include land use and land cover mapping, hydro-morphometric analysis of the basin, estimation of surface runoff, transport capacity and soil loss of the Markham River, furthermore coastal processes including hazard assessment. Global DEM data along with Landsat satellite image were used for morphometric analysis and Land use/land cover mapping through the ArcGIS v-10.1 software. An integrated approach of SCS, RUSLE and transport capacity modelling of different hydrological parameters, resulted in an estimated average of 53.22% of total storm rainfall flowing out as surface runoff, average soil loss of the study area of 8.4 tons/acre/year, while modelling predicted a transport capacity of 12321.81 tons in 3-days storm rainfall of 229 mm respectively. High resolution LiDAR satellite image (20cm resolution) and DEM (1 m resolution), historic tidal gauge data of sea levels, future projections of global mean sea level rise, infrastructure elements and demographic information along the Lae coastal tract, facilitated the modeling and development of the coastal flood hazard data base. Results shows an area of 38.19 sq km area being under the risk of inundation in the end of this century. A majority of urban populations in the region live in coastal areas inundation is also likely to cause large tolls for infrastructure relocation. These hazard maps can be developed for any other coastal areas of Papua New Guinea to manage coastal hazards in the context of regional and local knowledge, using data gathered by site-specific tide-gauges and other relevant technology.

**Key words:** Remote Sensing, Geographical Information System, hydro-morphometry, DEM (Digital Elevation Model), LiDAR

## **Climate Change – Short Term Triggers**

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### **Abstract**

The earth-atmosphere system as an open system has been considered with energy input engendering weather and how the long term pattern of the latter keep changing with the passing of time has been discussed. Considering the state of the art, often dynamism of these climatic attributes turns virtually inexplicable. Although rationalization is often sought from the consequence of complex phenomena in ocean-land-atmosphere system. Primarily climate is the result of the broad interaction between ocean and atmosphere engineered by solar irradiance. Also climate is conditioned by the differential interplay of spinning continents and oceans with the incoming solar radiation. In this paper the short term factors are deliberated. ‘Short term’ is here attributed to the events that cast impact over a small period of time, or the event has been ascribed to a short turn-around-time. Earth’s climate depends on the net solar energy retained on the globe. Retention is a function of the albedo of the earth atmosphere system; plus, absorbents both in earth surface mostly by 71% waters and in atmospheric constituents through Green House Gases (GHGs) and aerosols. The dual role of aerosols as absorbents and at the same time reflectors is discussed. Effect of warming of earth-atmosphere interface by an ever-increasing supply of GHGs has been dealt with. Apart from photosynthesis and respiration, the significance of geochemical processes in maintaining the CO<sub>2</sub> concentration of earth atmosphere is deliberated. Also the heating by GHGs in the neighbouring planets Mars and Venus is discussed as the evolutionary path in sustenance of life in planet earth vis-à-vis its neighbours. The warming by GHG gets countered to a considerable extent by increased planetary albedo by dint of enhanced quantum of water droplet / crystal cloud as well as volcanic ash / aerosol cloud. Moreover, the gray snow from ash deposit has certain effect on reducing albedo. Recent Icelandic volcanic eruption is a case in point while the sulphurous aerosols belched out through the major volcanic events in the past resulted in certain cooling effect by hiking planetary albedo for a certain period of time. All in all there is no simplified answer as to why climate changes – science is not yet clear and

possibly cannot pinpoint causes for a particular climatic change. The experiments that tend to prove an increase of planetary albedo in recent years go against the precept of global warming. Thus attributing one or two causes for the global warming may be a sort of over-simplification of the subject.

**Keywords:** Solar irradiance, Planetary albedo, GHGs, Aerosols, Sensible heating, Latent heating, Volcanicity, Geochemical processes

## **Climate Change – Long Term Triggers**

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### **Abstract**

Global climate has never been a static entity over a period of time. The extent of dynamism of energy input /output, the jerky tectonism evincing continent /ocean shifting relative positions, the ever- changing atmospheric chemistry throughout the passage of time since the birth of the planet earth warrant a closer look. The progressive climate change leading to development of oceanic biosphere and then to continental biosphere has been discussed. Genial climate change responsible for development of terrestrial life, and at the same time the next change to adverse climate responsible for extinction of major biota have been explained. Average temperature in the geologic past was greater compared to the recent earth. Number of ‘ice age’ in-between that only helped causing ‘anomalies’ in the otherwise continuous warm phase. Each Ice Age commenced following a specific orogenic movement – the mountain building episode. Liquid waters have been responsible for evolving the differentiation between continental and oceanic crusts. The hydrous minerals formed at the mid ocean ridges when subducted carry water deep into the mantle lowering melting point of rocks, thus facilitating the evolution of nonsubducting granite rocks. Also it gives rise to the development of greasy asthenosphere on which the crustal plates glide, a phenomenon called tectonism gifted to this beautiful blue planet earth. Whereas, the nearby terrestrial heavenly bodies like the Moon, Mars and Venus lack abundant liquid water, thus bereft of tectonism, granite formation and eventually culminating in monotonous ‘no ocean - no continent -no life’ bodies. The role of liquid water has been discussed for bestowing a 20 km relief for the planet earth starting from the Pacific abyss to the apex of Everest, apart from supporting a salubrious climate for the evolution and development of biosphere. The sunspot 11 year cycle as well as 22 year cycle are deliberated for changing energy input from external sources leading to possible climate change. Fluctuation of solar constant has its own contribution to altering thermal equilibrium. Long term implications of 3-prong Milankovitch cycle have been elaborated. The cycle in which the sun-earth geometric orientations swing, has substantial impact on the climatic veering in a long turnaround time. Moreover, the heat stored in oceans and the continental positions vis-à-vis oceans do have

significant bearing on the thermal regime. It can be inferred rather safely that the changes in solar activity, earth-sun geometry, tectonic activism leading to ocean-continent relativity provide the long term shifts of climate while short term variations might be linked to the present day economic activities of the human society.

**Keywords:** Glacial-interglacial cycle, Orogeny, Liquid water, Sunspot cycle, Milankovitch cycle, tecton

## **Climate Change – Probable Socio-Economic Systems: Implications and Policy Responses in the Anthropocene Epoch**

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and

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### **Abstract**

In the last two sessions, Professor D. K. Pal has indicated both the short- and long-term triggers to climate change upon the planet. It is therefore vital for us to learn from the historical records of global climate change as to how the human society has been impacted by its consequences in the “new” Anthropocene Epoch. Some of these consequences of global climate change include the perishing of several human settlements in different parts of the globe at different times, e.g., in 1700 B.C., prolonged drought contributed to the demise of Harappan civilization in northwest India. In 1200 B.C., under similar climatic extremity the Mycenaean civilization in present-day Greece as well as the Mill. Creek culture of the Northwestern part of present-day US state of Iowa perished. Why did some societies under such climatic events perish while others survived? Lack of preparedness of one society and its failure to anticipate and adapt to the extreme climatic events might have attributed to their extinction. Professor Pal will analyze the extinction of one European Norse society in Greenland during the little Ice Age (about 600 years ago) as compared to the still-surviving Inuit society in the northern segment of Greenland, which faced even harsher climatic conditions during the little Ice Age than the extinct Norsemen. This is how the adaptability and “expectation of the worst” matter for the survival of a particular community against climatic “black swan” events (Taleb, 2007). Similar impacts in terms of sea-level rise expected by the year 2100 whereby major human populations of many parts of the world are expected to lose their environmental evolutionary “niche” will be discussed. Rising temperature will not only complicate human health issues, but also will take its toll on the staple food producing agricultural belts in some latitudinal expanse. It will also worsen the living condition of the populace living in areas where climate is marginal.

Professor Gilder, through the Socio-Economic Systems Model provided by Vadineanu (2001) will detail his approach to balancing both NC (Natural Capital) and Human Capital as reflected in the SES (Social-Economic System), and then end with a short film by Steve Cutts, showing in a dramatic way the “worst case” scenario of a poorly conceived Anthropocene Era. In sum, both professors agree that it has to be understood that climate change will happen and effective policies must be enacted to mitigate its extant and effects. If we are not wise in our responses, we too may follow, as Boulding suggests (1971), the Dodo into extinction.

**Keywords:**

Climate Change, Anthropocene Era, “Black Swan” events, Human survival versus extinction (inputs/decisions/outcomes), , Socio-Economic Systems Analysis (Vadineanu), probable outcomes vis-à-vis globalization processes

**Selected References:**

Boulding., K. E. (1971, May). The Dodo Didn’t Make it: Survival and Betterment. *Bulletin of the Atomic Scientists*. 19-22.

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## **Ethno-Mycological Leads to Useful Myco-Chemicals: From an Academic Research to a Community Based Project**

**Dr Stewart W Wossa**

Centre for Natural Resources Research and Development  
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University of Goroka

### **Abstract**

The species within the kingdom Fungi are quite diverse and constitute a major component of the biodiversity on the island of New Guinea. A conservative estimate of the number of fungi had been projected to be within the range from 90,000 to 120,000 on the basis of a ratio proposed by leading mycologists that on average, six fungal species colonize one vascular plant species.

Unfortunately, there has been minimal attention given to this group of biotic entity that had colonized every available ecological niche. Traditional knowledge systems relating to the use and appreciation of macro fungi (mushrooms) as food, medicine and others have not been documented. Our study to record such knowledge systems and to understand the epistemological insights led us into the depths of traditional knowledge systems on mushrooms and generally the biological environments of the local peoples we have been working with.

Our work to correlate the traditional knowledge systems to modern sciences as in mycology, taxonomy, pharmacology and chemistry led to the identification of known as well as novel classes of chemical compounds with interesting biological activities. These findings provided the scientific basis to prove the medicinal and nutritional uses of mushrooms by the traditional communities. On the basis of the scientific data generated, a community based mushroom cultivation project was initiated as part of the University of Goroka's community engagement initiative. This presentation will highlight the story behind the achievements of what was initially a basic scientific research that has now been translated into a successful community based project.

## **Short Biography**

Stewart Wossa recently completed his PhD studies at the Australian National University and now teaches organic chemistry at the University of Goroka. He did his undergraduate degree at the University of PNG and went on to complete an MPhil qualification prior to joining the University of Goroka in 2006. As part of the MPhil work under the mentorship of Professor Topul Rali, the chemical profiles in the diversity of aromatic plants around PNG were determined and a number of publications made in both local and international journals. His PhD work was under the mentorship of Professor Russell Barrow and focused on ethnomycology as lead to identifying useful myco-chemicals. The study included work towards bioassay guided isolation and structure elucidation of useful compounds, laboratory based synthesis of bioactive compounds and further screening of the isolates for their medicinal (antibiotic and anticancer) properties.

## **Economic Efficiency of Smallholder Peanut Farming in the Markham Valley of Papua New Guinea**

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### **Abstract**

The study, which was conducted using primary data of the smallholder peanut farming in the Kaiapit District of Markham Valley, was to examine the economic efficiency of these farmers in their farm production. The input-oriented Data Envelopment Analysis (DEA) model was used to estimate technical and allocative efficiencies, the components of economic efficiency. The results establish that while about 18 percent of the farmers were both technically and allocatively efficient and therefore were economically efficient in their farming operations, the majority of the farmers were found to be economically inefficient. Decomposing technical efficiency into pure technical and scale efficiencies suggests the presence of scale inefficiency by 17 percent. This implies that the farmers were not using their inputs at optimum scale. Of the 76 percent (13 farmers) of the farmers who were found to be scale inefficient, about 92 percent of them (12 farmers) were operating in the region of increasing returns to scale while the balance was operating in the region of decreasing returns to scale. Since the majority of the farmers were both found to be technically and allocatively inefficient, it is useful for these farmers to shift their resources to more profitable alternatives. This would be done at no extra cost to society.

**Key words:** smallholder, peanut, economic efficiency, scale efficiency

## **Empowering Subsistence Rural Farmers with Innovative Approaches in Value Added Product of Traditional Root and Tuber Crops for Commercialization and Mini Rural Agri-Business in Papua New Guinea**

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### **Abstract**

Root and tuber crops play a significant role in the nation's food security, import replacement, providing raw materials for industrial uses, provides self-employment opportunities and household income generation for rural people in Papua New Guinea (PNG). Among the diversity of food crops in PNG, root and tuber crops including sweet potato (*Ipomoea batatas*), taro true (*Colocasia esculenta*), taro kongkong (*Xanthosoma sagitifolium*), yam (*Dioscorea esculenta* and *Dioscorea alata*), cassava (*Manihot esculenta*) have emerged to be very important staple food crops in PNG for well over centuries despite introduction of modern crops including rice, wheat, leafy vegetable crops, potato and other perennial crops. These crops adaptation to marginal environments, their contribution to household food security, and their great flexibility in mixed farming systems make the crops important component of a targeted strategy that seeks to improve the welfare of the rural poor and to link small holder farmers with these emerging growth markets. The economic and nutritional importance of the said root crops prompted substantial research work by former Research Division of the Department of Agriculture and Livestock and the National Agriculture Research Institute (NARI) in the past forty years. Much of this work had concentrated on varieties selection, crop improvement, pest and diseases, soil and fertilizers and agronomy, however very little research work done on the downstream processing involving livestock feed formulations, industrial starch and ethanol and various value added products of these important root crops. Future prospects for these important root and tuber crops will continue to increase as population increases. There are diverse of food products that can be developed from sweet potato and cassava include; cassava rava (a semolina type product), health drinks, nutritionally enriched fried food products from composite flours, improved fried chips and strips, starch based ice cream mixes and sweet desert. Technologies for production of sweet potato based food products like jam, pickles and squash have been perfected in other

developing countries. Value addition technologies for the feed sector include cassava based silage as cattle feed and by-product utilization of cassava starch factory waste as broiler feed. Due to short storage life resulting to high postharvest losses experienced in such root crops, downstream processing and possible value added products from these important root and tuber crops create window of opportunities for both domestic and international market.

**Keywords:** root-crops, tuber crops, Value added products, food security

## **Naturally Fibre plastic Based House Development**

### **Professor Xiong Xueping**

Adjunct Professor Nanjing Forestry University  
China & CEO Kunlun Scientific, Ltd, Hainan, China

#### **Abstract**

In this presentation, Prof Xiong will first briefly introduce his company with new materials development, Henan development as a tourism province, then he will look at the naturally fibre plastic based building materials manufacturing, and for house development in particular for Lae and PNG. He will also describe the cooperation with our Development and Consultancy, Ltd. Finally, he will provide a perspective to the future cooperation with Lae and PNG in house development based on the fibre plastic building materials.

Short Bio. Prof Xiong, Xueping is an adjunct professor of Nanjing Forestry University and the CEO of Kunlun Scientific, Ltd, Hainan, China. Kunlun Scientific is a national high tech company of China, and manufactures new building materials based on naturally fibre plastic. This company have been extending its business in house development internationally, using the mentioned new building materials. Prof Xiong is visiting our campus and observes a cooperation with our Development and Consultancy, Ltd. This cooperation is building a few dozens of houses based on the mentioned new building materials for our university, near to the gate 2 of our campus.

## **Approaches for Rural Development: Experiences of the South Pacific Institute for Sustainable Agriculture & Rural Development (SPISARD)**

**Mr Willian Nano, Dr Veronica Bue and Ms Betty Tiko**

Department of Agriculture

### **Abstract**

The Agriculture Department of PNG University of Technology through its extension arm has been developing the women, men and youth entrepreneurship in remote villages in PNG. The extension arm named as South Pacific Institute for Sustainable Agriculture and Rural Development (SPISARD) has developed a package to train and engage women, men and youths of small and marginal farm families in remote locations. Training package on "Personal Viability and Sustainable Development of Rural Poor" includes local resource use for income generation and livelihood improvement. All sorts of farm and non-farm activities for income generation, value addition of local products and other skills trainings are included in the package. SPISARD is working with the rural population in selected model villages with the following objectives:

- ✓ To increased farmers' household income,
- ✓ To increased food security.
- ✓ To improve farmers' knowledge on health and nutrition,
- ✓ To improve and maintain sustainable agriculture production, and
- ✓ To be equipped with life-long skills to improve their lives.

SPISARD has trained more than 1000 farmers including, men, women, youth entrepreneurs, and marginalized farmers in the last 6 years. Most of the participants trained were able to utilized the knowledge and skills gained from the trainings.

## **Smart-ism: Key to Success in Online Collaboration**

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### **Abstract**

This paper is a product of engagement on the coined word “smart-ism” defined as a theory, practice and process to get along with the fast changes on life activities relative to technologies used in this generation and the uncertainties of the evolution of these technologies in the future. A person who is a novice in today’s technology can be smart to adapt the global technological pace. SMART is sub define with the following terms: S – Simple to accept change), M-method employed (innovative and balanced), A-actual (hands-on), R-response (appropriate to the need), T- Time (time is same to all). This concept was practiced and adopted by novice technologist (authors) and was found successful as they accomplished their daily routine at work with the newly adapted technology.



## **Transient and Steady-state Responses on Automatic Process Controllers**

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### **Abstract**

The Process Control raises major theoretical and experimental challenges in the industrial processes. In order to meet and maintain a good correlation between a set of input parameters and the desired output requirement, there is a need for effective and efficient control of operations required to carry out industrial processes. In order to achieve optimum process control, the control itself must be designed with focus on its stability as a key attribute and it also must be tuned properly.

Controller tuning can be achieved in several ways and it is function of the dynamics and desired strengths of the system. Many tuning methods have been developed and refined in recent years and the PID controllers became the most widely used controllers in industrial processes. The main reason is their simple structure, which can be easily understood and implemented using digital electronics. Therefore, finding design methods that lead to the optimal operation of PID controllers is of significant interest. The tuning method commonly used because of its ease of implementation and low cost to benefits ratio, is the Ziegler and Nichols method because its optimal cost/performance ratio and regardless of its drawbacks.

One major drawback of the Ziegler-Nichols method is its high overshoot in the transient response region to step inputs. This overshoot may be too excessive for some high precision processes. Even for processes not required high levels of precision a high overshooting may result in longer times for achieving the process steady-state. This research embarks on designing industrial control systems with a reduction in the said undesirable responses to step inputs by using compensators designed under the root locus design method and employing several basic industrial control schemes. The thesis and its associated research focused on the design and

optimization of control systems adhering to the root locus design process and the main stages involved are:

- Tuning of Proportional-Integral-Derivative PID Controller using the Ziegler-Nichols method.
- PID response is compared with optimized Ziegler-Nichols values using the root loci method.
- Analysis of loop interactions involving the process parameters temperature, flow and level and the design of appropriate controller.
- Comparison between the performance compensator optimized on multi-variable loop approach versus Ziegler-Nichols optimized PID Controller.

The research was performed on computer simulated environments. It guarantees effective controller tuning parameters confirmed by extensive experimental effort.

## **A Single Beam Smart Antenna with Electronically Rotatable Beams**

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### **Abstract**

The underground mines in Papua New Guinea, as in mines in other countries, provide one of the most challenging environments for communications between miners in different tunnels and between miners and the control centre of the mine normally found outside the mine. Multipath reflections, rugged surfaces of the tunnels, and communication through multiple tunnels with irregular surfaces are amongst the critical challenges to using wireless underground communications systems. One major need is to cut down on the beams, except the main lobe, while steering the beam towards the desired transceiver so as to avoid generating multipath rays and to be effective in minimizing battery power. We present an array antenna that forms a single beam without the need for reflectors or complex arrangement of the array elements.

Most of the smart antennas in the literature have focused on array elements along a stripe with varying current elements. However, it can be analytically proved that rotatable single beam could not be achieved by placing array elements in a single stripe with varying current elements. Thus we have proposed a smart array structure where the dipole elements are not placed in a single stripe. Hence we need at least 3 elements in our array structure.

Single beam smart antenna designs with 3, 4 and 6 elements are achieved by optimizing weights of current. This paper will discuss the minimum number of dipole elements required in a linear array to produce a highly directed beam. In addition, antenna with different structures having 3, 4 and 6 elements will be analysed to verify their performance and effectiveness in directing a beam to justify its applicability in underground communications systems.

## **Using the Smallholder Version of the ADOPT Tool to Predict the Adoption and Diffusion of Agricultural Innovations**

**Dr Geoff Kuehne**

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### **Abstract**

The Adoption and Diffusion Outcome Prediction Tool (ADOPT) was developed to assist those involved with agricultural research, development and extension to apply and understand factors that are likely to affect innovation adoptability. It predicts adoption levels based on a structured application of well-established understanding of the socio-economic factors influencing adoption of agricultural innovations.

The first version of the tool, while applying well-established and widely applicable principles of adoption and diffusion of innovations, was developed and validated using Australian cropping and crop-livestock farming systems as its basis.

The beta version of the smallholder ADOPT tool was developed to satisfy the needs of those working in international agricultural development for a tool that could provide prediction of likely level and rate of adoption, while also engaging practitioners in considering factors influencing adoption.

## **Renewable Energy Resource Mapping in Morobe Province: Solar and Wind**

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### **Abstract**

Papua New Guinea (PNG) has numerous energy resources, including renewable energy resources. Renewable energy resources have taken center stage in PNG with the international push for 32% of national power demand to be met by renewable energy sources by the year 2030. In this paper we present the initial Geographic Information System (GIS) based study to consider the development of renewable energy power generation at the new Umi Township in the Markham valley of the Morobe Province. The paper will present the preliminary GIS based evaluation and will draw some general conclusions from the analysis carried out for the Markham valley of the Morobe Province that could be adopted for all of the entirety of PNG.

**Keywords:** renewable energy, solar energy, wind power, geographic information system.

## **A Review of Understanding the Competitive Advantage Models to Cultivate Sustainable Competitive Advantage**

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### **Abstract**

The academia and practitioner world of business and management continue to wrestle with some unresolved phenomena in the face of rapidly changing market demographics. One of these issues is the ever changing definitional constructs of management concepts and principles. This review is aimed at critically reviewing the concept of Sustainable Competitive Advantage as the ubiquitous dependent variable and Core Competency theory as the critical internal driver of performance. The review begins by explaining Porter's Industrial model of competitive advantage, and then focuses on Barney's Resource Based View of competitive advantage. The author then reviews the Core Competency model of competitive advantage coined by Pahalad and Hamel, and then explains how Sustainable Competitive Advantage can be determined by corporations in the face of current rapidly changing market environments based on understanding the three models of competitive advantage.

**Key words:** Competitive advantage, Industrial model, Resource-based model, Core Competency model, Sustainable Competitive Advantage

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## **Inorganic Polymers: From Discrete Molecules to Ceramic Materials**

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### **Abstract**

Organic polymers have widely been used for most of our day-to-day activities and they are, no doubt, enjoying a good reputation amongst the people community. In spite of all these, most of them lose their performance and some of their essential properties in harsh environmental conditions: they are attacked by common chemical and oxidizing agents, and their thermal stability is very poor. All these could be attributed to the polymers being constructed of carbon-carbon bonds in the backbone which is susceptible for disruption. However, when inorganic elements, other than carbon in *p*-block series of the periodic table, make up the polymer backbone, huge modification in some properties is expected and is also observed. Noteworthy applications include their use as charge transport materials, elastomeric materials, nanomaterials, fire resistant composite materials, electroluminescent materials, biomaterials, etc. This presentation will address general characteristics, classification, synthetic methods and particular examples of inorganic polymers along with some interesting applications.

## **The Role of Organic Matter in Amelioration of Acid Sulfate Soils**

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### **Abstract**

This study has shown that addition of Organic matter (OM) to sulfuric soils can have a strongly ameliorative effect on the soil acidity. Organic matter was found to be highly effective if incorporated into the profile, under both anaerobic and aerobic conditions. When applied as a surface mulch, large increases in pH were also recorded under anaerobic conditions but less so under aerobic conditions. For sulfuric soils, changes in pH were closely correlated with changes in Eh and sulfate content, implicating sulfur educing bacteria as the main source of the alkalinity. The findings of this study have important implications for broad-scale management of acid sulfate soil. As a replacement for lime, OM has a number of advantages. Firstly, it is likely to be much less expensive and more readily available, and secondly, it can be applied to environmentally sensitive areas such as Ramsar wetlands where lime application is not permitted.



## **Corrosion Rate of AA2024-T4 Friction Stir Weld Aluminium Alloy**

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### **Abstract**

Corrosion is one of the environmental hazards that degrade mainly metallic materials. This paper is about the rate at which Friction Stir Welded AA2024-T4 Aluminium Alloy has been experimentally investigated to find out its corrosion rate. The mechanical properties were also determined. It was observed that different weld zones had difference hardness compared to the parent material. In an excellent corrosive chamber, the material was submerged for a number of hours in a 3.5% NaCl solution and cleaned using ultrasonic cleaning method. The results showed a significant increase in corrosion rate when subjected to different specimen time intervals in the solution. The longer the number of specimen left in the solution, the higher the corrosion rate observed.

**Key words:** FSW, Corrosion Mechanisms, Microhardness, Microstructure, Surface morphologies

## **Landslide Hazard Investigation in Papua New Guinea – A Remote Sensing & GIS Approach**

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### **Abstract**

Inhabitants of the mountainous regions of Papua New Guinea (PNG) experience copious rains as a result of the specific geographic location's experiencing convergence of trade winds from northern and southern hemisphere. Thus the rainforests on the mountains of Inter Tropical Convergence Zone (ITCZ) enjoy near-perpetual cloudiness and frequent torrential downpour. The heavy downpour often brings about frequent landslides in the area. Lack of administrative control to maintain and to safeguard the sanctity of the pristine forests in steep slopes exacerbate the mass wasting process along the gravity line. The Eastern Highlands Province (EHP) is one such landslide prone province in the mountainous regions of PNG. Landslide is known as a natural hazard that has the potential to wreak an immense harm to built-up structures and other valuable assets of the resident populace. The research was contrived to gauge landslide hazards by satellite remote sensing data processing and also using GIS platform. The episode of landslide is attributed to a number of morphological, geological and human factors. However, according to the availability of data, some selected factors of prime significance are treated in the present study. The investigation concentrates on certain contributing factors of mass wasting in their relative order of potentials in generating landslide. Besides tectonic instability of the terrain, certain geo-morphological and geological factors like lithology, slope, rainfall, land use / land cover, soil type etc. are considered by assigning proper weightage in the GIS platform to produce the desired output. We used 'ranking', 'classification' followed by 'weighted overlay analysis' technique to generate landslide hazard map.

**Keywords:** ITCZ, Mass Wasting, Landslide prone locations, Weighted overlay analysis, Remote Sensing data, GIS platform

## **Social Media Enhances Teaching Interdisciplinary Sciences, Education & Technologies in Papua New Guinea**

### **Sustainability: The 21ST Century Educators' New Assignment**

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#### **Abstract**

In an age where young people seem to have a natural affinity with smartphones, computer games and social media, teachers and lecturers face a big challenge for a golden opportunity. How can new technology promote learning, engage students and motivate them to sustain a lifelong career in learning? For educators everywhere, our challenge is to take readily available devices that have the potential for great distraction and boldly appropriate them as tools that can inspire and engage. On the back of Steve's hugely popular blog, also named Learning with e s, he shows how the world of learning is changing, and how new technology and you and I can make a difference. This study hopes to find out that E-learning using mobile phones social media tools enhance learning experiences at secondary level and universities in PNG. The proliferation of digital technologies and cultures is having a profound impact on learning, prompting questions which need answers. How will technology change our conceptions of learning at PNG University of Technology? How will new ways of learning impact upon our uses of technology to manage our classroom and lecture attendance? How will teachers and lecturers roles change; what will they need to know; and what will we see learners doing in the future? Grounded in his research and in pedagogical theory, Steve explores the practical ways in which technology is influencing how we learn, and looks toward emerging trends to examine what the future of learning may look like A 22nd century Pedagogical Approach. For teachers, lecturers, learning and development professionals and anybody who wants to be inspired by the new ways learning is being revolutionised through the use of new and emerging technologies in the University lecture corridors.

