FIJI NATIONAL UNIVERSITY

College of Engineering and Technical Vocational Education and Training

CETVET Research Newsletter

CETVET Awards

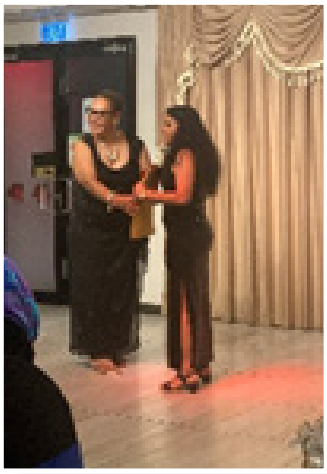
Researcher of the year - 2024 CETVET Annual Award for excellent research

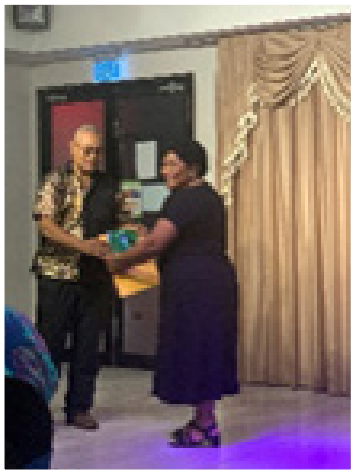
Dr Bimal Kumar was awarded as a researcher of the year award for excellent research. His research background is in the field of Human-Centered Computing, Software Engineering, and Applied Artificial Intelligence, with a particular focus on learning, health and ecommerce applications. His work explores the design, development, and evaluation of software applications. Dr Kumar has published papers, a few papers in high-impact journals. His research integrates systematic reviews, empirical studies, and computational techniques, bridging theory and practice to enhance software applications.

Excellent Teaching of the year - 2024 CETVET Annual Award for excellent teaching

Ms. Kite Lagicere was awarded an excellent teaching of the year. She is an academic at the Fiji National University, at the college of Engineering and Technology, Vocational Education and Training (CETVET) in Samabula. She is passionate about empowering young women in automotive electrical and electronic fault diagnosis and maintenance. This field, once male-dominated, now offers equal opportunities for women to engage economically, aligning with our fundamental human rights. Over the past 26 years, teaching at FIT and the Fiji National University (FNU) has been a privilege, allowing her to contribute to the development of Fiji's younger generation. She remains committed to fostering an environment where women can thrive in automotive engineering, honoring the legacy and paving the way for future generations.

Excellent Service - 2024 CETVET Annual Award for excellent service





Two recipients, Ms Ashmeen Sharma from the School of Mathematical and Computing Sciences and Ms Alisi Kasami from the School of Transport were awarded excellent service award of the year.

Best School of the year - 2024 CETVET Annual Award for Best School

The best performing school award was given to the School of Transport. The School of Transport is led by Mr Pravin Chand as Head of School and the Head of Departments Ms Kite Lagicere, Mr Amenatave Vuatalevu and Mr Vineet Dutt.

Workshops, Seminars and celebrations:

Regional Cold Chain Equipment (CCE) Management Training workshop

CETVET hosted 10 days' workshops on Regional Cold Chain Equipment (CCE) Management Training. UNICEF Pacific coordinated and managed the workshop logistics and supported participants from around the pacific. Facilitators were from the EAC Regional Centre of Excellence for Vaccines, Immunization, and Health Supply Chain Management. Participants were from Fiji, Kiribati, Samoa, Tonga, Tuvalu, Solomon Islands, Micronesia, Palau, Marshall Islands and Vanuatu. The workshop was held from 04/11/2024 to 15/11/2024 at ERDC Building, Teaching Lab, Derrick Campus, Samabula.

Enhancing the Climate Resilience of Fiji's Road Network

CETVET hosted a workshop, that was facilitated by Dr Ellen Robson from Durham University UK and Dr Gangadhara Reddy from FNU. Participants were from FNU, Water Authority of Fiji, Global Green Growth Institute (GGGI), FRA, USP, Jokhan Realtors, Ministry of Public Works, Institute of Technology India, Department of Roads Government of Nepal, Sustainable Future Consultancy, China Railway, ENTEC Pte Limited, Durham University, Erasito Consultants Ltd and Fiji Airways. The workshop was held on 10/12/2024 at ERDC Building, Teaching Lab, Derrick Campus, Samabula.

Strategic Planning workshop

A two-day strategic planning workshop was organized at CETVET. Participants included Dean, ADs, Managers, EOs, HOSs, HODs, Administrators and OAs of the college. The discussion and presentation were based on annual reports, college progress, achievements and challenges. School action items for 2025 were planned and aligned to FNU Strategic Plan 2024–2026.

Open Day CETVET win

College of Engineering and Technical Vocational Education & Training (CETVET) won the Vice Chancellor's 2024 Open Day Award. CETVET defeated the two-time champion, the College of Agriculture, Fisheries and Forestry. The judges recognised breakthroughs, innovations, creativity, originality, and potential intellectual property ownership shown during the event. This award was because of a unique brick project led by Senior Lecturer Mr Viliame Sakiti. The winning brick was Mr. Sakiti's PhD research project exploring a unique blend of sand, clay soil, and cement. He aims to create affordable housing materials. This is the first of its kind in Fiji, focusing on a specific type of clay soil that integrates well with cement to achieve the required strength of 12.5 MPa (Mega Pascal). Mr Sakiti conducted extensive soil sampling across various regions, including Ba, Dreketi, and Savusavu.

News from CETVET projects:

1. Completed projects

A team of researchers from the School of Electrical & Electronics Engineering at CETVET, in collaboration with Telecom Fiji Limited, successfully completed an industry research project aimed at designing and building an innovative remote fuel level monitoring system. The goal of this project was to provide Telecom Fiji Limited with real-time insights into fuel storage and consumption patterns in tanks located at remote sites used to operate generators. The system was specifically designed to detect fuel leakage or theft, helping the company reduce downtime and better understand business risks and opportunities. Additionally, it enables the pursuit of tank capacity optimization strategies through consistent and reliable data.

The CETVET team undertook an investigation to model the fuel tank, select suitable transducers, design power supplies, install and program the embedded system, and set up the database and website for the monitoring system prototype at Derrick campus. Experiments were performed to validate the measurements from the level and flow sensors, ensure accurate fuel tank modelling, and enable remote updates of monitoring data with alarm configurations. The system was systematically designed and demonstrated to the management of Telecom Fiji Limited. It is anticipated that the system will be replicated by Telecom Fiji Limited for their various remote sites and is anticipated to also be a solution to other communication and utility service providers.

The CETVET research team included Dr. Satyanand Singh, Dr. Ronesh Sharma, Dr Shiu Kumar, Prof. Tibor Pasinszki, Dr Kajal Kothari, Dr Bhanu Pratap Soni, Mr Shivneel Chand, Mr Nauneet Menon, Mr Nischal Chandra, Mr Shamal Chand, Mr Pranid Reddy, Mr Vinay Maharaj, and Mr Ravendra Chand from Telecom Fiji Limited, who served as key industry partner for the project.

The Pro Vice Chancellor for Research & Innovation, Prof. Paul Ade Iji, emphasized the significance of the industry collaborative research project and congratulated the CETVET team for successfully achieving the project objectives. Mr. Mesake Tuinabua, the Chief Technical Officer, expressed his gratitude to the team and acknowledged the potential of the researchers at CETVET. He further highlighted the importance of this collaboration and expressed his eagerness for continued partnerships with CETVET in the future.

News from CETVET projects:

2 Ongoing projects

Title - Kavalactone Content of Fiji Kava and Its Relationship with Plant Type, Plant Age and Nutrient Content of the Soil.
Industry Partner: PHAMA plus
Principal Investigator - Prof. Tibor Pasinszki
Work in progress: The research team and the Fiji National Facilitator of the Australia and New Zealand funded Pacific Horticultural and Agricultural Market Access Plus (PHAMA Plus) Program travelled across Fiji, carefully selecting samples from classified kava varieties and brought them back to the lab for kavalactone analysis. The analysis is in progress and is expected to be completed soon.

Investigators and research assistants during data collection.

Title - Analysing potential mangrove blue carbon in an equatorial archipelago (Indonesia-Fiji) as a means of sequestering atmospheric carbon pollution from maritime vessels.
Industry Partner: Udayana University
Principal Investigator – Dr. Ravita D. Prasad and Dr. Shipra Shah
Work in progress: Primary data collection has been completed through small boat surveys and mangrove sampling in villages across Bua and Macuata provinces. Local stakeholders, including the conservation officers from both provinces, actively participated in the project. The data collected is currently being analysed by the principal investigators.

Meeting at the Itaukei provincial office in Macuata

Title: Enhancement of the efficiency and stability of low-cost paintable carbon-based planar perovskite solar cells with engineered perovskite/carbon interface using multi-walled carbon nanotubes (MWCNTs) and carbon quantum dots (CQDs)
Principal Investigator: Dr Kiran Kumar Kondamareddy,

Title: Quantifying Bio Methane Production & Co-generation Potential at Natabua wastewater treatment plant in Fiji
Principal Investigator: Mr Ashmit Kumar

Title: Comprehensive Analysis of Fijian Honey Composition and Antimicrobial Activity - A multi-parameter approach
Principal Investigator: Dr Visheshni Chandra

Master and PhD students' achievements and milestones:

1. Candidature Confirmation

Ms Anshiu Kumar is a Masters by Research student at Fiji National University. She presented her proposal title "Assessment of the Ecological and Socio-Economic Impacts of Co-Occurring Invasive Tree Species on Native Forests and Communities in Fiji". Her principal supervisor is Dr Shipra Shah, and her co-supervisor is Dr Rupantri Raju.

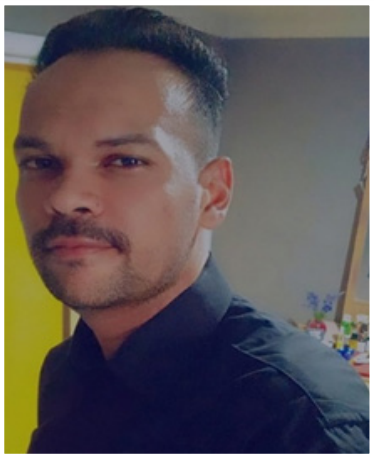
Abstract: Invasion by multiple non-native plants is common in forest ecosystems. However, a single Invasive Plant Species (IPS) is often prioritised in management and research due to its expected greater impact. The impact of the multiple plant invasive species can be greater, neutral, or less than the single IPS, depending on the type of interaction between the co-occurring invaders. Assessment and management of only a single IPS can be biased leading to inadequate IPS management. Effective management of IPS requires adequate knowledge of their impacts as both individual invaders and co-occurring invaders to target resources towards the management of sites with the highest impact. Limited research is on the impacts of co-occurring IPS in forest ecosystems and local communities, however, remains a key challenge in invasion science. This study will investigate the combined and single impacts of Spathodea campanulata (African tulip) and Acacia spp. on the structure and composition, regeneration, soil physicochemical properties, and litter mass of native forests in Bua, and Macuata province, Vanua Levu, Fiji. It will also examine local communities' perceptions, attitudes, and understanding of Acacia spp. and African tulip and identify policy interventions for IPS management. A systematic sampling method using nested plots will be used to collect data on trees, saplings, seedlings, and soil and litter mass. A semi-structured questionnaire will be used to collect socioeconomic data via household surveys from affected farmers and landowners, and key informant surveys with the affected communities and staff of Fiji Pine Limited. The findings from this study would have implications for the management and control of multiple species invasions on other island ecosystems across the Pacific and worldwide.

Mr Nischal Chandra is a Doctor of Philosophy student at Fiji National University. He presented his proposal title "Design and Analysis of Control Strategies for Power Quality Improvement in Grid-Connected Systems". His principal supervisor is Dr Ronesh Sharma, and co-supervisors are Prof. Alok Sharma and Dr Rahul Ranjeev Kumar.

Abstract: The energy demand is directly linked to development and modernisation, as we adapt to modern infrastructure and technology. Thus, there is a demand for clean renewable energy. The most accessible form of energy is solar; however, it is inconsistent due to varying sunlight intensity during the day. Integrating a battery energy storage system extends the reliability of solar energy by storing excess energy generated during peak sunny periods. The power grid has been the primary source of energy due to its ability to provide a consistent power supply. However, relying solely on the grid to power nonlinear load is not ideal. The unpredictable nature of the load feeds harmonic current into the grid. Over time, this degrades the grid's performance. Therefore, integrating renewable energy sources alongside advanced power management systems is essential, to prevent further deterioration of power quality. While there are multiple solutions for managing power flow between Solar PV, batteries, and grid, these systems face several challenges due to nonlinear loads causing harmonic currents and voltage distortion. The unexpected behavior of solar irradiance and load profile often cause grid instability, offering rapid changes that the state-of-the-art control system struggles to handle, affecting the quality of electricity. The traditional

resolution of passive filters results in increased losses, harmonics, and resonance issues, while modern control techniques based on active power filters still struggle with inadequate performance under unbalanced grid conditions. This highlights the need for more advanced control strategies.

This research will investigate the development of advanced adaptive control algorithms that can operate in real-time, managing energy flow between solar PV, batteries, and the grid. Novel control algorithms will be designed to adapt to the changes in solar power generation and energy demand, ensuring stability and efficiency in the grid. Advanced tools including RT-LAB, MATLAB, and hardware-in-the-loop (HIL) systems will be used to simulate, test, and experiment control algorithm's performance under various scenarios, such as power fluctuations or grid disturbances. The design, development, and testing of the advanced control strategies in this research will offer a more reliable and efficient system for distributed generation grid-connected systems. The proposed system will ensure stable voltage, reduce power fluctuations, and enhance the overall quality of electricity delivered to homes and industries. The investigation and analysis in this study will strengthen the integration of renewable energy sources into the power grid, thus, contributing to a more sustainable and cleaner energy.



Mr Roneel Prasad is a Masters by Research student at Fiji National University. He presented his proposal title "Nutraceutical Profiling and Perception of Climate Change Impact on Rice Production: A Case Study of Brown Rice Varieties in Fiji" His principal supervisor is Dr Sumantla Varman and co-supervisors are Dr Asif Iqubal and Dr Ravi Dutt Sharma.

Abstract: Fiji is a Pacific Island country where brown rice (Oryza sativa) is a major cereal crop and a common food for all ethnic groups, typically consumed as white rice. Over 30,000 tons of white rice, valued at about $40 million, are imported annually. On the other hand, several local rice landraces are being cultivated in different regions of Fiji; however, their production is greatly reduced due to a lack of demand stemming from their physical and nutritional quality. Several studies confirm that brown rice is likely to form the basis of nutraceuticals. Therefore, this study aims to collect four common samples of local brown rice varieties from Dreketi, Province of Macuata in Vanua Levu, analyzing the morphological and biochemical characteristics of the local varieties, and conduct nutritional comprising of vitamin (B6) and mineral (iron, calcium, and magnesium) profiling of brown rice.

Four common locally grown brown rice varieties, comprising traditional and improved varieties, will be analysed for their physical characteristics, cooking, physicochemical, and nutritional properties. Standard procedures will be used to evaluate the physical (grain dimensions, 1000-gram weight), cooking (optimal cooking time, cooked rice volume, cooked rice dimension, elongation ratio and index, aroma taste, and texture), and physicochemical (gelatinisation temperature, gel consistency, water uptake ratio, and amylose content) aspects of these varieties.

The results of this study will indicate that local varieties of brown rice are ideal for consumption and reduce the risk of chronic diseases. This study also supports the Fijian government's efforts to revive rice cultivation in the country to reduce the massive rice import bill. In addition, it will provide an overview of climate change's impact on the production and nutritional quality of brown rice, along with adaptation strategies to farmers and people.

Master and PhD students' achievements and milestones:

2. Completion Seminar

Mr Malakai Tuinasau Tadualala presented his research topic "Groundwater Exploration Using an Integrated Approach of Remote Sensing, GIS - Artificial Intelligence (Machine Learning), And Geophysics Survey - Demarcation of Potential Groundwater Zones: Case Study of Nadi, Viti Levu Island, Fiji". His principal supervisor was Dr. Satyanarayan Shastri; co-supervisors were Dr. Joeli Varo, Dr. Ulukalesi Tamata, Prof. Todd E. Dennis and Dr. Nicholas Rollings was his adviser.

Abstract: The study focuses on tailored solutions to counter water crises in marginalised communities (MC) that live within proximity of the Nadi, Momi, and Sabeto rivers watershed. For now, MC, is unable to access water availability in the non-metered water reticulation coverage region, which is typically supplied by the main Water Authority of Fiji (WAF) in Nadi City, Western Viti Levu Island, Fiji. Delineating a newly mapped groundwater potential and ground truthing the area are therefore the study's primary partial objectives. This process entails several steps, to develop groundwater potential area (GWPA), including the selection of new, low-cost technologies and techniques, the collection and collation of remote-sensored datasets, and the analysis of geospatial, geostatistical, and geophysics methods were also utilised. The newly mapped GWPA study also enables future groundwater strategic response on effective leadership for policymakers, relevant tailored information and adaptable methods for effective and efficient decision-making tools for adaptive water-related stakeholders. By safeguarding water resources security for sustainable Small Island Developing States in the Pacific.

Master and PhD students' achievements and milestones:

Ms Deepti Darshani Devi presented her research topic "Analysis of Kavalactone Content of Roots and Rhizomes of Fiji Kava". Her principal supervisor is Prof. Tibor Pasinszki, and co-supervisor is Dr Visheshni Chandra.

Abstract: Kava is the traditional intoxicating beverage of the Pacific with mild sedative and muscle relaxant effects, which are attributed to a group of compounds known as kavalactones. This PhD work aims to evaluate the quality of kava cultivated in Fiji by determining the kavalactone content and profile of the six major kavalactones in roots and rhizomes of kava plants collected in Bua, Kadavu, Ovalau, Taveuni, Qamea, Rabi, Rotuma, Saqani, and Savusavu. In addition, the work also aims to measure kavalactone contents in kava sold in the local markets of Fiji through the quantification of the six major kavalactones in kava root bundles and powdered kava packages. The quantification of kavalactones is performed using ethanolic extracts of kava products and High-Performance Liquid Chromatography (HPLC) as instrumental technique.

The PhD project involves farm visits in targeted areas, uprooting kava plants, drying and grinding plants, extracting kavalactones, and quantifying lactone content using reversed-phase HPLC. The aim of the project is to explore the idea of being able to establish a kava 'fingerprint' – which would link a particular variety and area with certain a combination of kavalactone levels and associated strength, effect, or other distinguishing qualities. The project aims to assist farmers in selecting plant variants with the highest lactone content and most favorable lactone profile to increase income, as well as consumers select the healthiest kava products.

Center news

The Centre for Water and Energy Engineering (CWEE) has been in discussion with Water Authority of Fiji to collaborate for the building of engineering capacity in the Pacific Region countries. Two collaboration strategies have been identified as viable pathways to achieve this goal:

- Development of problem-based learning courses specially designed to build the engineering capacity on common water engineering problems in the water industry.
- Research projects that allow in-depth investigations of fundamental theories and build the knowledge base that can be applied to a class of problems.Both strategies require an R&D laboratory that allows students and researchers to test their and refine theories and hypotheses without the risk of damaging live water systems (both fresh water and wastewater systems). In 2024, the soft starter control was installed, and the previous installed pump system was rectified and tested.

Publications:

1. Journal

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12. Singh, S., Singh, P., Rosak-Szyrocka, J., & Vasa, L. (2024). 5G Opportunities in the South Pacific: Leveraging Low-Band Spectrum for Socio-Economic Development. HighTech and Innovation Journal, 5(2), 508–533. https://doi.org/10.28991/HIJ-2024-05-02-020

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