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UNGGUL

ICGTD

THE 7TH INTERNATIONAL CONFERENCE ON GREEN TECHNOLOGY AND DESIGN

Greening the Future: Integrated Approaches for Environment and Energy Sustainability

BOOK OF ABSTRACTS

December 3rd – 4th

Bandung, Indonesia

2025

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SEGi UNIVERSITY

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ICGTD 2025 VENUE

GSG

SMART CLASS ROOM

OPENING REMARK

Assalamualaikum wr wb
Ladies and gentlemen, esteemed colleagues, distinguished guests and beloved students,

it is a profound honor to welcome you to the 7th International Conference on Green Technology and Design (ICGTD 2025), proudly hosted by Institut Teknologi Nasional Bandung (ITENAS), Indonesia. This year's theme, "Greening the Future: Integrated Approaches for Environment and Energy Sustainability," reflects our shared responsibility in addressing climate change, environmental degradation, and increasing global energy demands. ICGTD serves as an important platform for advancing integrated and systems-based solutions—such as life cycle assessment, modelling approaches, and design innovation—that support sustainable development and informed policy decisions.

We are pleased to note the growing scale and diversity of this year's conference, with 84 presentations distributed across 15 parallel sessions, three keynote lectures, and three invited speakers. Participants represent seven countries—Indonesia, Austria, the United Arab Emirates, Italy, Hungary, Malaysia, and Japan—and come from 17 universities, research institutions, and industry, including professionals. This international and multidisciplinary participation reflects a shared understanding that meaningful progress requires collaboration across sectors, disciplines, and borders.

Over the next few days, I encourage you to exchange ideas, challenge perspectives, and build connections that will shape future research and policy directions toward sustainability. We extend our deepest appreciation to all contributors and the organizing committee whose dedication made this gathering possible.

Thank you for joining us, and may ICGTD 2025 be a productive and inspiring experience for us all.

Wassalamualaikum wr wb,
Rector of Itenas
Prof. Meilinda Nurbanasari, PhD.

Assalamu'alaikum wa rahmatullaahi wa barakaatuh,

Dear participants,

Ladies and gentlemen, esteemed colleagues, distinguished guests, and beloved students,

It is my great honor and privilege to welcome you all to The 7th International Conference on Green Technology and Design (ICGTD 2025), hosted by Institut Teknologi Nasional Bandung (ITENAS), Bandung, Indonesia.

This year's theme, "Greening the Future: Integrated Approaches for Environment and Energy Sustainability,"challenges us to not only reflect on global issues but also to take meaningful actions at the local level—a mission deeply aligned with our commitment to research and community service.

This conference serves as a vital platform, addressing the global imperatives of climate change and environmental degradation by promoting integrated approaches across all scales: internationally, we seek innovative solutions; nationally, we support Indonesia's ambitious emission reduction and renewable energy goals; and locally, we recognize West Java's leadership in green innovation, emphasizing that lasting sustainability requires linking global research to local implementation.

With over 80 articles being presented and participants from more than five countries, I am confident that the discussions here will provide valuable insights and solutions to advance our shared goals in research and community service.

I would like to extend my deepest gratitude to the keynote speakers, invited speakers, and all participants for joining us. This conference is the culmination of the hard work and dedication of many individuals, and I thank everyone who contributed to making it possible.

Once again, welcome to ICGTD 2025. I hope you enjoy the conference, our campus, and the vibrant city of Bandung.

Wassalamu 'alaikum wa rahmatullaahi wa barakaatuh,

Head of LPPM ITENAS

Dr.Eng. Didin Agustian Permadi, S.T., M.Eng

Dear honorable speakers and participants,

It is my great pleasure and privilege, as the Chairperson of the 7th International Conference on Green Technology and Design (ICGTD 2025), to warmly welcome each of you. We are honored to host this meaningful gathering at Institut Teknologi Nasional Bandung, Indonesia, and we sincerely appreciate your presence and participation.

This year's conference embraces the theme "Greening the Future: Integrated Approaches for Environment and Energy Sustainability," reflecting our shared commitment to advancing research, innovation, and collaboration toward a resilient and sustainable future. We are pleased to present 84 papers covering nine diverse and exciting topics, ranging from optimization and artificial intelligence to institutional and cultural dimensions—illustrating that sustainability requires not only advanced technology but also interdisciplinary understanding and societal engagement.

We are also proud to announce that ICGTD 2025 collaborates with more than seven journals, offering authors multiple pathways for dissemination and scholarly recognition. In addition, building on the success of previous conferences, we continue our partnership with AIP Conference Proceedings, indexed by Scopus, as one of our publication platforms. With participation representing more than seven countries, this conference continues to grow in diversity, transforming into an increasingly international and dynamic academic forum.

I extend my sincere gratitude to the Rector of Institut Teknologi Nasional Bandung, SEGi University as our Co-Host, Direktorat Riset, Teknologi, dan Pengabdian kepada Masyarakat (DRTPM), and the Head of LPPM ITENAS for their valuable support. My heartfelt appreciation also goes to the organizing committee and dedicated volunteers whose hard work made this event possible.

We hope this conference becomes an enriching platform for knowledge exchange, networking, and future collaboration. Thank you for being part of this journey towards a greener and more sustainable future.

Regards,

Chairperson of ICGTD 2024

Dr.nat.techn. Muhamad Rizki, S.T., M.T.

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CONFERENCE PROGRAM

ICGTD 2025

Time	Agenda
03rd December 2025, Wednesdey Place: Main Hall- GSG Bale Dayang Sumbi Itenas Topic: ICGTD 2025 Day 1 Join Zoom Meeting *ICGTD 2025* Meeting ID: 825 5420 1891 Passcode: 206590	
08:30 – 09:00	**Opening Ceremony** **Place: GSG Bale Dayang Sumbi Itenas** Welcoming remark by master of ceremony
09:00 – 10:00	Welcoming remark 1 Organizin committee chair **Dr.nat.techn. Muhamad Rizki, S.T., M.T.**
	Welcoming remark 2 Head of LP2M Itenas **Dr.Eng. Didin Agustian Permadi, S.T., M.Eng.**
	Welcoming speech and opening Rector of Institut Teknologi Nasional (Itenas) Bandung **Prof. Meilinda Nurbanasari**
10:00 – 10:45	Keynote Speaker 1 remark **Prof. Dr. Tezara Cionitta** (SEGi University, Malaysia) *Moderator: Dr. Eng. Didin Agustian Permadi*
10:45 – 11:00	**Coffee break** (GSG Bale Dayang Sumbi Itenas)
11:00 – 11:45	Keynote Speaker 2 remark **Prof. Makoto Chikaraishi** (Hiroshima University, Japan)

Time	Agenda	
	Moderator: Dr.nat.techn. Muhamad Rizki, S.T., M.T.	
11:45 – 13:00	Lunch break (GSG Bale Dayang Sumbi Itenas)	
13:00 – 13:45	Invited Speaker 1 remark **Taufik Suryo Nugroho, Ph.D.** (Institut Teknologi Bandung, Indonesia) *Moderator: Dr. Andrean Maulana, ST., M.T.*	
	Parallel session (Smart Classroom, ITENAS Library)	
13.50– 16.10	**Parallel session 1: Engineering, Energy Systems & Optimization 1** ***Room:*** *Smart Classroom (SCR) 1* Moderator: Dr. Diki Ismail Permana **Presenters:** 1. **(13.50-14.10)** *Evan M. Fathurrahman* | Indonesia's Power Sector Scenarios to 2060: Modeling Geothermal, Solar, and Wind Expansion Toward Sustainable Green Investment | 2. **(14.10-14.30)** *Krinso Cokro Dwi Margono* | Ten Years of Solar Tracker Research: From Mechanical Optimization to Intelligent Control Systems | 3. **(14.30-14.50)** *Meilinda Nurbanasari, Muhammad Ravli Sbastio, Abdurrachim, Burlian Prasetiyo, Hendra Hani, Alfan Ekajati Latief* | Thin-Lip Rupture Analysis of Primary Superheater Tube in a 600 MW Coal-Fired Power Plant || 4. **(14.50-15.10)** *Mohammad Hazairin Asyiddik Rahman, Sanggono Adisasmito* **|** Optimization of Fluid Collection and Reinjection System for Geothermal Power Plant in Indonesia |	**Parallel session 2: Engineering, Energy Systems & Optimization 2** ***Room:*** *Smart Classroom (SCR) 2* Moderator: Dr. Muhammad Aziz Mahardika **Presenters:** 1. **(13.50-14.10)** *Mohammad Azis Mahardika, Tri Sigit Purwanto* **|** Performance of Bulb Turbine as a Hydrokinetic Turbine for Harnessing Kinetic Energy of River/Irrigation Flow | 2. **(14.10-14.30)** *Yuono yuono, Ronny Kurniawan, , Vibianti Dwi Pratiwi, Muhammad Zidan, Ahmad Nurfauzi, M Nur Fakhri Al Mujadid, Bimo Wicaksono* **|** Comparative Study of Atmospheric, Vacuum, and Adiabatic Crystallization Methods in Palm Sap Granulated Sugar Production | 3. **(14.30-14.50)** *Diki Ismail Permana, Muhammad Pramuda Nugraha Sirodz, Mohammad Alexin Putra, Mannir Usman, Istvan Farkas, Federico Fagioli, Maurizio De Lucia* | Biomass Utilization in Combine Heat and Power: Bibliometric Analysis |

Time	Agenda	
	5. **(15.10-15.30)** *Mohammad Hazairin Asyiddik Rahman, Sanggono Adisasmito* **|** Performance Evaluation of Additional Plate Heat Exchanger in CSCondensation Plant at PT.XX **|** 6. **(15.30-15.50)** *Miki Suharman, Johnner Sitompul* **|** Designing a Digital Transformation Strategy Through Enterprise Architecture Using the TOGAF ADM Framework in the Renewable Energy Sector **|**	4. **(14.50-15.10)** *Ade Triharyanto, Dina Ferdinasari, Ahmad Azhar, Virdi Chaerusani, Jenny Rizkiana* **|** Advanced Biofuel Production Pathways and Technological Perspectives in Indonesia **|** 5. **(14.50-15.10)** *Vibianti Dwi Pratiwi, Dyah Setyo Pertiwi, Choerudin Choerudin* **|** Microalgae-Based CCS Technology for CO_2 Mitigation Using Photobioreactor Systems **|** 6. **(15.30-15.50)** *Ahmad Azhar, Dina Ferdinasari,Ade Triharyanto, Virdi Chaerusani, Jenny Rizkiana* **|** Multi-Feedstock Assessment for Advanced Biofuel to Support Indonesia's Energy Transition **|**
13.50– 16.10	**Parallel session 3: Artificial Intelligence & Smart Systems 1** ***Room**: Smart Classroom (SCR) 3* Moderator: Marisa Premitasari, ST., MT. **Presenters:** 1. **(13.50-14.10)** *Yusuf Miftahuddin, Pratama Bevan Nurrohman, Chalifa Chazar, Kreusna Bayu Prangga W* **|** Activation Function's Influence on TabNet Performance for EEG-Based Mental Workload Classification **|** 2. **(14.10-14.30)** *Yusuf Miftahuddin, Anisa Putri Setyanigrum, Rizal Naufal Robbani* **|** Implementing Transfer Learning and Fine-Tuning on Convolutional Neural Networks for Art Style Classification **|** 3. **(14.30-14.50)** *Diash Firdaus, Galih Ashari Rakhmat, Afin Maulana Hidayat, Cikal Geminangtang Seya*	**Parallel session 4: Artificial Intelligence & Smart Systems 2** ***Room**: Smart Classroom (SCR) 4* Moderator: Corry Caromawati, S.S., M.A., Ph.D. **Presenters:** 1. **(13.50-14.10)** *Raden Budiraharjo, Mira Barmawi , Sofia Umaroh , Nazillah Wahidyah* **|** Extending the DeLone and McLean Model with Trust and Security: A Study of a Business Communication **|** 2. **(14.10-14.30)** *Nur Fitrianti Fahrudin, Corry Caromawati, Sofia Umaroh, Wahyudi* **|** AI-Based Automated Assessment for English Speaking Proficiency **|** 3. **(14.30-14.50)** *Sari Widya Sihwi*

Time	Agenda	
	| Real-Time Detection of Online Gambling Comments on YouTube Using Long Short Therm Memory (LSTM) | 4. **(14.50-15.10)** *Kirana Octa* **|** Multimodal Information Credibility Detection on X Using Hybrid Deep Learning with FastText Feature Expansion and Firefly Algorithm Optimization | 5. **(15.10-15.30)** *Tunggul Arief Nugroho* **|** Physics-Informed Neural Network-Based Modeling of IoT-Sensed Greenhouse Microclimates for Resilient, Energy-Efficient Climate Control |	**|** Hierarchical Attention-Based Fusion with Multi-Loss Optimization for Multimodal Human Communication | 4. **(14.50-15.10)** *Ryansyah Fathin, Dede Rohidin, Jondri Jondri* | Customer Churn Risk Analysis Using a TabNet and SHAP Model in Banking Sector | 5. **(15.10-15.30)** *Nor Anis Asma Sulaiman, Fazidah Wahit , Muhammad Zahiruddin Ibrahim, Hamizah Hariri, Xu Feng, Siti Nazirah* | Natural Language Processing for Automated Environmental Impact Assessment in Green Product Design |
13.50– 16.10	**Parallel session 5: Environmental and Infrastructure Monitoring & Sustainability 1** ***Room**: Smart Classroom (SCR) 5* Moderator: Dr. Eng. Didin Agustian Permadi **Presenters:** 1. **(13.50-14.10)** *Mila Dirgawati* | Prediction of Exposure to PM10 by Integrating AERMOD and Land Use Regression Models in the City of Bandung| 2. **(14.10-14.30)** *Aulya Adisti Febriyanti, Didin Agustian Permadi* | Evaluating Environmental Impact of NCG Emissions from Geothermal Power Plants Through Air Dispersion Modeling | 3. **(14.30-14.50)** *Aristian Nurfauzi, Taufik Rizki Ramadhan, Ramadhan and Didin Agustian Permadi*	**Parallel session 6: Material Science** ***Room:** GSG 1* Moderator: Dr. Vibianti Dwi Pratiwi **Presenters:** 1. **(13.50-14.10)** *Jono Suhartono* | Influence of CNT Functionalization on the Structural and Surface Properties of Polyethersulfone Membranes | 2. **(14.10-14.30)** *Joni Agustian, Lilis Hermida, Darmansyah* | A Green Process to a Mesoporous Cellular Foam Silica Product: An Alternative from Palm Oil Boiler Ash | 3. **(14.30-14.50)** *Nabila Azzahro* | A Review on the Application of Chemical Absorption Using MEA as a Solvent in Biogas Upgrading for Higher Renewable Energy Value | 4. **(14.50-15.10)** *Kanageswary Sockalingam, Muaamar Mohammed , Lim*

Time	Agenda	
	| Assessment of Open Biomass Burning Contributions to Surface Ozone Formation in the Southeast Asian Region Using the WRF-CAMx Modeling System | 4. **(14.50-15.10)** *Firman Apriana Prawira* | Analysis of the Sectoral Contribution of Transportation and Industry Emissions to PM2.Concentration in DKI Jakarta Using the WRF-CAMx Model |	*Tiong Seng, Mathan Sambu, Noor Farhana Halil Abdul Razak , Erum Pathan* | Preliminary Physicochemical and Mechanical Evaluation of Recycled Face Masks Composites | 5. **(15.10-15.30)** *Fadzilah Adnan, Sharifah Fathin Adlina Syed Abdullah , Najmi Haziq Badrulhisam , Teh Sabariah Abd Manan, Affiani Machmudah* | Fabrication and Mechanical Characterization of Jute Fiber-Reinforced Polypropylene Sheet Composites Processed via Hot Press Method | 6. **(15.30-15.50)** *Riny Yolandha Parapat, Ayunita Yuniar and Muthi Hannindyah, Milda Husada, Jasman Pardede* | Engineering a Natural Microemulsion via Mixture Design as a Novel Template for Eco-Friendly Nanoparticle Synthesis | 7. **(15.50-16.10)** *Dicky Dermawan, Dyah Setyo Pertiwi* | Evolutionary Design of Melamine-Urea-Formaldehyde Resin for Medium Density Fiberboard Application |
13.50– 16.10	**Parallel session 7: Human-centered Evaluation, Urban Planning, & Housing** ***Room:*** *GSG 2* Moderator: Dr.nat.techn. Muhamad Rizki **Presenters:** 1. **(13.50-14.10)** *Muhamad Rizki, Tri Basuki Joewono, Prawira Belgiawan, Muhammad Zudhy Irawan, Maya Safira, Yusak Susilo* | Impact of e-Shopping on Activity Participation in Indonesian Cities |	**Parallel session 8: Construction Science** ***Room:*** *LPPM Itenas* Moderator: Dr.techn. Indra N. Hamdhan **Presenters:** 1. **(13.50-14.10)** *Ratih Dewi Shima, Assyfa Indah Larasati* | A Comparative Analysis of Construction Tendering Practices in Indonesia Under Presidential Regulation No. 1of 201and Presidential Regulation No. 1of 2021 |

Time	Agenda	
	2. **(14.10-14.30)** *Tia Adelia Surysni, Nabilla Dina Adharina, Achmad Fauzan Iscahyono* | The Relationship Between Settlement Area Patterns and Commercial Area Patterns in Bandung City | 3. **(14.30-14.50)** *Anwar Subkiman* | Study of Eco-Friendly Stilt House Models for Middle-Income Housing | 4. **(14.50-15.10)** *Gusti Ayu Jessy Kartini, Rosa Karnita, Anisa Putri Setyaningrum, Jouristiany Jousristiani, Ajie Aryo Abduk Ghani, Arvin Kurniawan* | Comparative Evaluation of User Experience on Geoheritage Website Prototypes Developed with Canva and React.js | 5. **(15.10-15.30)** *Herdika Baruna Aridani, Muhammad Zudhy Irawan, Mukhammad Rizka Fahmi Amrozi, Nur Oktaviani Widiastuti, Anak Agung Sagung Sukmayonie Gayatri* | Green Hybrid Infrastructure for Semi-Urban Development: Integrating Spatial Sustainability and Social Acceptability in Designing Cultural Tourism Rest Area (HCTI Hub) near the Banyurejo Exit Toll | 6. **(15.30-15.50)** *Oka Purwanti, Gustian Nurfauzan, Isro Saputra, Nabila Dina Adharina, Eka Wardhani,, Willy Kriswardhana, and Muhamad Rizki* | Evolution of Adolescence Mode Choice: Evidence from a Modified Retrospective Survey in Bandung City |	2. **(14.10-14.30)** *Kamaludin, Bernat Ahmad Patria Syafiuddin* | Optimization of Reinforced Concrete Column Sections Using Python | 3. **(14.30-14.50)** *Indra Noer Hamdhan, Rahma Welan Ulfaida, Aurora Dwipantara, and Tasya Kamila Rachman* | Modelling of Reinforced Slope Stability Analysis With Sustainable Material Recycled Plastic Pin Using 3D Modeling Approach |

Time	Agenda	
04th December 2025, Thursday Place: Main Hall- GSG Bale Dayang Sumbi Itenas Topic: ICGTD 2025 Day 2 Join Zoom Meeting *ICGTD 2025* Meeting ID: 825 5420 1891 Passcode: 206590		
08:30 – 09:30	Invited Speaker 2 remark **Dr. Reza Asriadi, S.T., M.T.** (Higher College of Technology, UEA) Moderator: Dr. Fahmi Arif	
09:30 – 09:45	Coffee break (GSG Bale Dayang Sumbi Itenas)	
09:45 – 11:00	Invited Speaker 3 remark **Dr. Djoen San Santoso** (Asian Institute of Technology, Thailand) Moderator: Dr.nat.techn. Muhamad Rizki, S.T., M.T.	
11:00 – 11:45	Invited Speaker 4 remark **Dr. Vibianti Dwi Pratiwi** (Institut Teknologi Nasional Bandung, Indonesia) Moderator: Dr. Muhammad Aziz Mahardika	
11:45 – 13:00	Lunch break (GSG Bale Dayang Sumbi Itenas)	
	Parallel session (Smart Classroom, ITENAS Library)	
13.00 – 15.20	**Parallel session 9: Engineering, Energy Systems & Optimization 3** ***Room:*** *Smart Classroom (SCR) 1* Moderator: Dr.sc. Lisa Kristiana **Presenters:**	**Parallel session 10: Artificial Intelligence & Smart Systems 3** ***Room:*** *Smart Classroom (SCR)2* Moderator: Dr. Muhammad Usman Nisar **Presenters:**

	1. **(13.00-13.20)** *Muhammad Rendra Perdana Kusuma Djaka, Melinda Br Ginting, Dhabita Audrea Belindra, Edo Lutfi Mahanani* | Design and Performance Evaluation of a 2.GHz Smart-Material Flexible Antenna for Sustainable IoT Environmental Monitoring | 2. **(13.20-13.40)** *Abel Abimanyu, Fadhlrahman Fitra Arsil and Sarah A. Siahaan, Uke Kurniawan Usman, Tody Ariefianto Wibowo* | Measurement-Based Path Loss Analysis for 6G RAN in Urban Scenarios | 3. **(13.40-14.00)** *Yus Rama Denny, Izzuddin Farid* | Air-Processed Inverted Perovskite Solar Cells: Operating Range of PEDOT: PSS from Spin Coating to Annealing Temperature | 4. **(14.00-14.20)** *Arsyad Ramadhan Darlis, Lita Lidyawati Lita, Etih Hartati, Lisa Kristiana* | The Optimization of Receiver Sensor on Underwater Visible Light Communication Systems | 5. **(14.20-14.40)** *Fatah Sulaiman, Yus Rama Denny, Izzuddin Farid, Lataniya Nauvadilah Winanty, Adhitya Angga Pratama* | Circulating Incinerator Bottom Ash into Eco-Friendly Paving Blocks: Mechanics, Microstructure, and Environmental Compliance | 6. **(14.40-15.00)** *Circulating Incinerator Bottom Ash into Eco-Friendly Paving Blocks: Mechanics, Microstructure, and Environmental Compliance* | Thermal Safety Enhancement in Electric Vehicles via Battery Temperature Monitoring |	1. **(13.00-13.20)** *Muhammad Krisna Yudha, Marisa Permitasari* | Regional Clustering Based on the Fifteen Minutes City Concept Using the OPTICS Method | 2. **(13.20-13.40)** *Alisha Anggranidi Salsabila, Jondri Jondri, Indwiarti Indwiarti* | Breast Cancer Detection on Mammogram Images Using Transfer Learning Based on EfficientNet | 3. **(13.40-14.00)** *Anggin Meylani and Fahmi Arif* | Formulation of Quality Prediction Model Using Conventional Machine Learning for Multiclass Defect Detection in Crystal Sugar Production | 4. **(14.00-14.20)** *Muhammad Usman Nisar* | Machine Learning Based Job Urgency Assessment Model for Dynamic Job Shop Scheduling | 5. **(14.20-14.40)** *Henning Titi Ciptaningtyas, Khairun Nasihin, Ridho Rahman Hariadi, Rehana Putri Salsabila, Mutiara Nurhaliza, Steven Figo, Moch Zidan Hadipratama, Naufan Zaki Luqmanulhakim and Fuad Dary Rosyadi* | RoboIT: IoT-Based Smart Assistant with Knowledge Management System for Academic Visitor Interaction | 6. **(14.40-15.00)** *Ekki Kurniawan, Riko Ferdinand Alhakim, Fahmi Arif, Alif Ulfa Afifah* | Enhancing Multiclass Defect Detection in Crystal Sugar Production Using Advanced Ensemble Learning Techniques |

13.00 – 15.20	**Parallel session 11: Environmental and Infrastructure Monitoring & Sustainability 2** ***Room**: Smart Classroom (SCR) 3* Moderator: Dr. Rika Hernawati **Presenters:** 1. **(13.50-14.10)** *Khairul Nastiar, Muhamad Adriqri Yaqzhan Riswandi, Naufal Sukmawan, Rayhans Ilham Rachmadia, Anisa Nabila Rizki Ramadhani, Berlina Dwi Prapningtyas, Sofyan Chairul Anwar* | A Brief Review of LiDAR Application in Infrastructure Mapping | 2. **(14.10-14.30)** *Marisa Premitasari, Thonas Indra Maryanto, Choerunnisa Septiani Tri Noerdin, Jasman Pardede, Raihan Arkantama Gunawan, Rizka Milandga Millenio* | Monitoring Land Cover Change of Mangroves Using Vegetation Indices at Blanakan, Subang | 3. **(14.30-14.50)** *Rika Hernawati, Soni Darmawan, Josaphat Tetuko Sri Sumantyo* | L-Band SAR Backscatter Characteristics for Oil Palm Phenology Monitoring Using Two-Layer RVOG Decomposition | 4. **(14.50-15.10)** *Siti Atikah Ghazali, Balqis Aminuddin, Nurul Aishah Ghazali, Mainur Sofiya* | Enhancing the Efficiency, Accuracy, and Safety of Building Inspection through Drone Aviation Technology: A Literature Review | 5. **(15.10-15.30)** *Muhammad Rendra Perdana Kusuma Djaka, Melinda Br*	**Parallel session 12: Environmental and Infrastructure Monitoring & Sustainability 3** ***Room:** Smart Classroom (SCR) 4* Moderator: Dr. Nico Halomoan **Presenters:** 1. **(13.00-13.20)** *Daniel Sutopo Pamungkas, Muhammad Fandy Herdiyanto* | Development of an IoT-Based Water Quality Monitoring System for Tilapia Farming in Biofloc Ponds Using Mamdani Fuzzy Inference | 2. **(13.20-13.40)** *Mohamad Rangga Sururi* | Optimizing Water Treatment for Polluted Raw Water with Two-Stage Coagulation | 3. **(13.40-14.00)** *Iwan Juwana* | Re-Identification of Sampling Points of Water Quality Monitoring for Cisangkan River, Cimahi City, Indonesia, Based on National Standardisation of Indonesia and Water Quality Monitoring Guidelines | 4. **(14.00-14.20)** *Nico Halomoan, Shela Zahrawani, Prayatni Soewondo, Ahmad Setiyawan, Prasanti Widyasih Sarli* | Developing Sustainable Water and Sanitation Strategies in Manado: An EHRA and SWOT Approach | 5. **(14.20-14.40)** *Mohamad Rangga Sururi, Mila Dirgawati and Najla Shalmabillah Hidayat, Nur Alifah Fauzia, Geovania Alves Belo and Adila Shalahuddin Nur* | Raw Water Treatment for Drinking Water from Polluted Urban Rivers Using Two-Stage Coagulation | 6. **(14.40-15.00)** *Choerudin Choerudin, Vita Wonoputri, Tjandra Setiadi*

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   Indonesia's pursuit of Net Zero Emissions (NZE) by 2060 requires atechno-economic strategy that balances investment feasibility and renewable ex-pansion. This study applies the Long-range Energy Alternatives Planning (LEAP) model to project Indonesia's power sector through 2060 under four scenarios: Business-as-Usual (BAU), Geothermal (GEO), Solar & Wind (SAW), and Progressive (PRO). Distinct from previous studies, this research integrates long-term capacity expansion integrated with investment cost analysis aligned with national policy frameworks. Results show clear trade-offs: GEO demands the highest cumulative investment, S AW offers the lowest cost, and PRO provides the most balanced pathway with moderate cost. These findings indicate that Indonesia's transition is financially achievable through robust financing framework, policy alignment, and technology readiness. Although environmental impact analysis was not covered in this study, future research should incorporate emission modeling and system optimization to enhance sustainability assessment.

2. **Ten Years of Solar Tracker Research: From Mechanical Optimization to Intelligent Control Systems - *Krisno Cokro Dwi Margono***

   Abstract—Over the past decade, solar tracking systems have undergone significant technological evolution, transitioning from mechanical-only designs to intelligent, data-driven architectures. This paper presents a comprehensive review of global research on solar trackers between 2015 and 2025. The study identifies five major development trends: mechanical optimization, advanced control algorithms, sensor integration, artificial intelligence (AI) applications, and Internet of Things (IoT)-enabled monitoring. Emerging technologies such as edge computing, federated learning, and digital twins are also explored for their potential to enhance autonomy and energy efficiency. Key performance evaluation metrics—such as energy gain, tracking accuracy, cost-effectiveness, and system reliability—are compared across diverse climates and scales. Despite the advancements, challenges persist in terms of economic viability, environmental resilience, and standardization. This review concludes with research recommendations aimed at developing affordable, adaptive, and intelligent trackers suitable for decentralized and grid- connected energy systems. By mapping a decade of innovation, this paper offers critical insights to guide future solar tracker research and deployment strategies.

3. **Thin-Lip Rupture Analysis of Primary Superheater Tube in a 600 MW Coal-Fired Power Plant - *Meilinda Nurbanasari, Muhammad Ravli Sbastio, Abdurrachim, Burlian Prasetiyo, Hendra Hani, Alfan Ekajati Latief***

The 600 MW coal-fired power plant had stopped operating due to a leakage in the primary superheater tube. A comprehensive leakage analysis of the tube needs to be carried out to prevent a similar incident that may occur in the future. The failed tube was made of SA-213 T12 and exhibited a thin-lip rupture which is located around 35 cm from the U-bend area. Some laboratory tests were performed, including visual inspection, microstructural analysis, hardness measurement, and X-Ray Diffraction. Metallographic analysis confirmed ferritic–carbide microstructures typical of SA-213 and there are a magnetite layer in the inner tube with the thickness of 134–155 µm. This thickness of the magnetite layer is over to the critical exfoliation limit, causing deposits accumulation inside the tube, especially in the U-bend area. Based on comprehensive testing and analysis results, it is confirmed that the leak mechanism of SA 213 T12 PSH is subcritical short-term localized overheating caused by accumulation of deposits in the U-bend area. Steam flow through the U-bend was obstructed, resulting in a decrease in its mass flow rate and inability to absorb all the heat from the flue gas that should be absorbed by the steam. Excess heat from the flue gas was absorbed by the tube walls, causing localized overheating and as a consequence decreasing the ultimate strength of the tube and the tube is no longer able to withstand steam pressure, resulting in a thin lip rupture.

4. **Optimization of Fluid Collection and Reinjection System for Geothermal Power Plant in Indonesia - *Mohammad Hazairin Asyiddik Rahman, Sanggono Adisasmito***

This article aims to promote the Green Economy by integrating technical, financial, and business assessments through the Front-End Engineering Design (FEED) methodology for geothermal energy production facilities. The focus is the Certified Emission Reductions (CER) as incentives within the carbon market, enhancing the Internal Rate of Return (IRR) and Break Even Point (BEP) metrics.

The Fluid Collection and Reinjection System (FCRS) is projected to operate with a power generation capacity of 50-55 MW, handling a steam flow rate of 430-460 tons per hour, under final pressure and temperature conditions of 5.3-5.5 bar and 140-150°C. Technical evaluations include measuring dimensions of critical equipment such as the bottom cyclone separator, silencer, geothermal pond, steam trap, and pump. Economic analysis, driven by IRR and BEP calculations, ensures a balance between technical and financial considerations.

The initiatives support the economic analysis, with CER values estimated between 4-14 EUR per ton of CO2 equivalent. Over a 30-year project lifetime, power generation capacity is evaluated, converting potential revenue using a Levelized Cost of Electricity of USD 8.7

cents per kWh. Additionally, potential carbon emission reductions (ktCO2e/yr) are quantified as tradable assets in the carbon market, assuming a 95% load factor for the turbines. This research provides a comprehensive framework for sustainable geothermal energy development.

5. **Performance Evaluation of Additional Plate Heat Exchanger in CSCondensation Plant at PT.XX - *Miki Suharman, Johnner Sitompul***

Rayon fiber, as a manmade regenerated cellulose fiber, requires an efficient production process, which includes the recovery of carbon disulfide (CS_2) from the viscose solution. Currently, to maintain operation condition in the CS_2 condensation plant, soft water is directly injected. This method made high overflow hot water to sewer, also high consumption of soft water and caustic solution. This research purpose is to evaluate the feasibility if CS_2 condensation plant utilizes a heat exchanger in their system. The research methodology began with the validation of the simulation model by comparing two fluid packages: Acid gas Caustic wash and Electrolyte NRTL against actual plant operational data. Subsequently, the validation of the heat exchanger (based on others CS_2 condensation plant specifications) within HYSYS showed a deviation of 2% which confirming the model's reliability. The simulation of adding a heat exchanger demonstrated a significant performance improvement. The implementation successfully reduced the caustic solution consumption, decreased steam consumption, eliminated soft water injection for maintain operation condition, and also reducing load to effluent treatment plant. Financially, the overall operational cost savings amounted to USD 1,882 per day with Payback Period (PBP) of 8 months and a Return on Investment (ROI) of 149% (including installation). Addition of a heat exchanger is highly recommend based on technical and financial calculation to enhance the efficiency and sustainability of the CS_2 condensation plant.

6. **Designing a Digital Transformation Strategy Through Enterprise Architecture Using the TOGAF ADM Framework in the Renewable Energy Sector - *Mira Barmawi***

Digital transformation has become a strategic necessity for companies in the globalization era, including PT XYZ in the renewable energy sector. Currently, the utilization of information technology at PT XYZ is not fully integrated, leading to challenges such as inter-departmental miscommunication, manual document management, project delays, and limited automation in inventory control. These issues result in low operational efficiency, potential budget overruns, and decreased customer satisfaction. This study presents a strategy for digital transformation through the design of Enterprise Architecture (EA) using the TOGAF Architecture Development Method (ADM) framework. The approach enables systematic mapping of the current state (as-is) and desired future state (to-be) up

to the Technology Architecture phase. The resulting blueprint outlines business processes, application and data requirements, and IT infrastructure specifications, serving as a strategic guide to enhance inter-departmental collaboration, operational efficiency, and IT governance in compliance with state-owned enterprise regulations. This research provides practical insights for renewable energy companies to plan and implement digital transformation in a structured and measurable manner.

7. **Performance of Bulb Turbine as a Hydrokinetic Turbine For Harnessing Kinetic Energy of River/Irrigation Flow - *Mohammad Azis Mahardika, Tri Sigit Purwanto***

The utilization of renewable energy from rivers and irrigation channels offers a promising solution for sustainable electricity supply, particularly in rural areas that are not fully served by the grid. One of the applicable technologies is the bulb-type hydrokinetic turbine, designed to harness the kinetic energy of flowing water without the need for dams or significant head. This study aims to evaluate the performance of bulb turbines as hydrokinetic devices by examining key parameters such as power coefficient (Cp), hydraulic efficiency, and rota- tional characteristics under various river/irrigation flow velocities. The methodology involves literature review, theoretical analysis, and numerical modeling to investigate the turbine's performance in open-channel flow conditions with low velocities (0.5-3 m/s). The results indicate that bulb turbines can operate effec- tively in low to medium flow velocities, achieving efficiency levels of 30-45% depending on blade design and hydraulic conditions. Furthermore, the compact form of bulb turbines allows relatively easy installation in irrigation channels without major structural modifications. These findings suggest that bulb turbines hold significant potential as a practical solution for small- to medium-scale hydrokinetic energy utilization, particularly in supporting rural electrification through renewable energy sources.

8. **Comparative Study of Atmospheric, Vacuum, and Adiabatic Crystallization Methods in Palm Sap Granulated Sugar Production – *Yuono yuono, Ronny Kurniawan, ,Vibianti Dwi Pratiwi, Muhammad Zidan, Ahmad Nurfauzi, M Nur Fakhri Al Mujadid, Bimo Wicaksono.***

This study examines the effect of crystallization methods on the quality of palm sugar granules produced from palm sap (Arenga pinnata) processed using three methods: atmospheric, vacuum, and atmospheric–vacuum combination. The results indicate that the vacuum method is the most optimal, yielding 20.57%, with low moisture content (3.80%) and the highest reducing sugar content (10.07%), while the ash content remains stable (1.56 – 1.59%) and within SNI standards. Mineral analysis shows that palm sugar contains Fe 9.66 mg/kg, Zn 1.22 mg/kg, and Cu 1.51 mg/kg—superior to cane sugar, although

coconut sugar exhibits higher Fe content. Organoleptic tests demonstrate an average score >4.0, with the highest taste score (4.52), indicating excellent consumer acceptance. Therefore, vacuum crystallization is proven to be the most effective method to produce high-quality granulated palm sugar with maintained physicochemical quality and desirable sensory characteristics, supporting the development of modern and value-added palm sap processing technology.

9. **Biomass Utilization in Combine Heat and Power: Bibliometric Analysis** - ***Diki Ismail Permana, Muhammad Pramuda Nugraha Sirodz, Mohammad Alexin Putra, Mannir Usman, Istvan Farkas, Federico Fagioli, Maurizio De Lucia***

Two-stage coagulation offers opportunities for treating contaminated raw water better than conventional coagulation. The purpose of this study was to investigate the performance of two-stage coagulation in removing pollutants from contaminated raw water. The jar test method refers to SNI 195-6449-2000 to determine optimum coagulant dose. The experiment was conducted by adding the coagulant two times, with a 10-second interval. The interval was selected as can be applied in drinking water treatment plant at the study site. Adjustments were made to the existing dosage to vary the PAC dosage and raw water sampling time (morning, afternoon and evening). Based on this method, the applied dosage (15.5 mg/L) was not able to reduce turbidity to meet the quality standard (<3 NTU). In the sample taken at morning (08.00), the turbidity was 8.71 NTU, meanwhile at afternoon (13.00) and evening (18.00), the measured turbidity were 12.49 NTU and 15.70 NTU, respectively. The optimum dosage that able to reduce turbidity highest and hence meet the water quality standard was 29.5 mg/L in the morning, and 33 mg/L in the afternoon and evening. These optimum dosages result in a final turbidity of 2.65 NTU in the morning; 0.58 NTU in the afternoon; and 1.34 NTU in the evening. These findings suggets that while the use of two-stage coagulation method requires greater dose, it achives high efficiency for turbidity reduction.

10. **Advanced Biofuel Production Pathways and Technological Perspectives in Indonesia** - ***Ade Triharyanto, Dina Ferdinasari, Ahmad Azhar, Virdi Chaerusani, Jenny Rizkiana***

Advanced biofuels derived from non-food and low-carbon feedstocks are becoming an essential component of global decarbonization strategies under RED II and RED III. Several production pathways, including gasification followed by Fischer–Tropsch synthesis, pyrolysis-oil upgrading, hydrogenation of lipid-based feedstocks, and hydrothermal liquefaction, offer viable routes for producing renewable hydrocarbons such as bio-gasoline. These fuels deliver significantly lower lifecycle greenhouse gas emissions compared to conventional petroleum products. Feedstocks such as lignocellulosic biomass, agricultural residues, waste lipids, used cooking oil, and non-edible oil crops can

meet Annex IX sustainability requirements when managed appropriately. Each pathway must consider feedstock availability, conversion efficiency, technological readiness, and compatibility with existing refinery infrastructure, particularly for processes that require deoxygenation and hydrocarbon chain reconstruction. Increasing demand for low-carbon fuels across Europe, Asia, and North America is driving investment in bio-gasoline technologies. A clear understanding of each production pathway supports strategic planning and the development of robust, reliable supply chains.

11. Microalgae-Based CCS Technology for CO_2 Mitigation Using Photobioreactor Systems - *Vibianti Dwi Pratiwi, Dyah Setyo Pertiwi, Choerudin Choerudin*

Climate change remains one of the most pressing global challenges, primarily driven by rising concentrations of carbon dioxide (CO_2) in the atmosphere. Carbon Capture and Storage (CCS) technology offers a promising solution by capturing CO_2 emissions from sources such as power plants, industrial processes, and ambient air, then converting them into value-added products or storing them in geological formations. Among emerging CCS approaches, biological carbon capture using microalgae has gained significant attention due to its high photosynthetic efficiency and adaptability. This study explores the potential of microalgae-particularly species such as Spirulina sp., Chlorella vulgaris, and Cyanobacteria-in capturing atmospheric and flue gas CO_2 through cultivation in photobioreactor systems. Microalgae convert CO_2 into biomass via photosynthesis, producing organic compounds like proteins, lipids, and carbohydrates. Compared to terrestrial plants, microalgae demonstrate faster growth rates, higher carbon fixation capacity, and require less cultivation area, making them ideal for industrial-scale CCS applications. The research highlights key factors influencing microalgal performance, including light intensity, CO_2 concentration, temperature, and nutrient availability. Optimization of these parameters is essential to maximize biomass yield and carbon sequestration efficiency. Additionally, the resulting biomass can be utilized for biofuel production, animal feed, fertilizers, and cosmetic ingredients, supporting circular economy principles. Despite its promise, microalgae-based CCS faces challenges such as high operational costs, scalability limitations, and environmental stressors. Nonetheless, with Indonesia's rich microbial biodiversity and tropical climate, this approach presents a viable pathway for sustainable carbon mitigation and renewable resource development.

12. Multi-Feedstock Assessment for Advanced Biofuel to Support Indonesia's Energy Transition - *Ahmad Azhar, Dina Ferdinasari, Ade Triharyanto, Virdi Chaerusani, Jenny Rizkiana*

Indonesia's transition toward low-carbon energy requires the development of Advanced Biofuel aligned with global standards such as the FIA 2026 mandate and national commitments under the Enhanced NDC and Net Zero 2060 targets. This study assesses

Indonesia's biomass potential across four feedstock groups, wet energy crops, dry energy crops, biomass waste, and non-edible vegetable oils, and evaluates their compatibility with key conversion technologies, namely hydrothermal liquefaction, gasification FT/MtG, and hydrotreating. The analysis identifies distinct strengths within each category: wet energy crops for HTL due to high moisture and rapid growth; dry crops and biomass waste for gasification owing to favorable lignocellulosic properties; and non-edible oils for hydrotreating based on high triglyceride yields and sustainability. Results underscore the need for a multi-feedstock strategy to ensure supply security, support regional resource utilization, and enhance Indonesia's competitiveness in sustainable fuel production.

13. **Design and Performance Evaluation of a 2.GHz Smart-Material Flexible Antenna for Sustainable IoT Environmental Monitoring - *Muhammad Rendra Perdana Kusuma Djaka, Melinda Br Ginting, Dhabita Audrea Belindra, Edo Lutfi Mahanani***

This paper presents the design and comprehensive performance evaluation of a novel 2.4 GHz flexible antenna utilizing eco-friendly smart materials for sustainable Internet of Things (IoT) environmental monitoring applications. The proposed antenna addresses the growing need for green communication technologies by employing biodegradable substrates and conductive materials that minimize environmental impact while maintaining optimal electromagnetic performance. Through extensive simulations and experimental validation, the antenna demonstrates excellent impedance matching with a return loss of -32 dB at 2.4 GHz, a bandwidth of 150 MHz covering the entire ISM band, and a stable radiation pattern with 2.1 dBi gain. The flexible design enables conformal integration with various surfaces, making it suitable for diverse environmental monitoring scenarios including smart agriculture, building automation, and climate surveillance. The antenna's sustainability metrics were evaluated through lifecycle assessment, revealing a 45% reduction in carbon footprint compared to conventional FR4-based antennas. The results confirm that the proposed smart-material antenna provides a viable solution for energy-efficient, environmentally responsible wireless communication systems aligned with global sustainability goals.

14. **Measurement-Based Path Loss Analysis for 6G RAN in Urban Scenarios - *Abel Abimanyu, Fadhlrahman Fitra Arsil and Sarah A. Siahaan, Uke Kurniawan Usman, Tody Ariefianto Wibowo***

Accurate path loss models are critical for the design of future 6G Radio Access Networks (RAN), especially in urban scenarios. This paper presents a measurement-based comparison of several path loss models against real field data in an urban environment. A software-defined radio platform with a transmit power of 15 dBm and known antenna gains is used to collect received power at distances from 50 m to 500 m under both line-of-sight (LOS) and non-line-of-sight (NLOS) conditions. For each distance and carrier,

multiple repetitions over two days are averaged to obtain representative values. Path loss is then derived from the link budget and compared with widely used models, including Free-Space (FSPL), Close-In (CI), Alpha-Beta-Gamma (ABG), 3GPP urban microcell (UMi) and urban macrocell (UMa) LOS/NLOS models, as well as the SUI Terrain~B model. The agreement between model predictions and measurements is quantified using mean absolute error. The results show that some models systematically overestimate or underestimate the path loss, while one model exhibits noticeably lower error and closely follows the measured trends, making it a suitable reference for 6G RAN link budget and coverage planning in similar urban deployments.

15. **Air-Processed Inverted Perovskite Solar Cells: Operating Range of PEDOT: PSS from Spin Coating to Annealing Temperature - *Yus Rama Denny, Izzuddin Farid***

Air-processed fabrication is attractive for low-cost perovskite photovoltaics but remains sensitive to interfacial processing of PEDOT: PSS. Here we delineate the operating range of PEDOT: PSS in inverted perovskite solar cells (ITO/PEDOT: PSS/$CH_3NH_3PbI_{3-x}Cl_x$/$PC_{60}BM$/Ag) fabricated under ambient conditions (relative humidity ≈50%). We decouple spin speed (3800-5800 rpm) from annealing temperature (90-240 °C) and quantify their effects on PEDOT: PSS film thickness and sheet resistance, and on device metrics under AM1.5G illumination. UV-Vis analysis combined with Swanepoel modelling shows that annealing, rather than spin speed, predominantly governs film thickness, producing a monotonic thinning with temperature. Four-point probe measurements reveal concomitant changes in sheet resistance that track with the trends in open-circuit voltage (Voc) and fill factor (FF). While absolute efficiencies remain modest-consistent with contact losses and interfacial recombination-the data establish a clear processing-property-performance linkage for PEDOT: PSS in ambient fabrication. Practical implications follow: (i) prioritize annealing-temperature control over spin-speed tuning to set PEDOT: PSS thickness/resistance; (ii) pair the identified range with improved top-electrode formation (e.g., evaporated Ag and/or a thin BCP) and moisture-tolerant perovskite crystallization steps to unlock higher performance without abandoning air processing. The results provide a process map for PEDOT: PSS that can guide scalable, ambient manufacturing of inverted perovskite solar cells.

16. **The Optimization of Receiver Sensor on Underwater Visible Light Communication Systems- *Arsyad Ramadhan Darlis, Lita Lidyawati Lita, Etih Hartati, Lisa Kristiana***

Currently, underwater transportation, including submarines and unmanned underwater vehicles, is utilized for various applications, ranging from oceanographic survey activities to underwater military applications. The use of communication technology for underwater transportation has been studied, utilizing acoustic-based transmission media, as radio fre-

quency media are not suitable for use underwater. However, acoustic communication tech-nology has low speed and capacity. Therefore, a communication system that can be imple-mented and is reliable is needed, which supports faster and more accurate information ac-quisition for application in underwater transportation. In previous research, visible light has been proven to be a suitable medium for communication systems, known as Visible Light Communication (VLC), with high-speed communication capabilities. VLC is part of 6G technology that will be implemented in the next few years as a high-tech solution, so vari-ous studies are needed to test the performance of this technology in several environments, one of which is underwater (Underwater-VLC-UVLC). The purpose of this research is to conduct further studies on the performance of the UVLC system in underwater environ-ments, taking into account the characteristics of water in both freshwater and seawater. The results of the research will serve as the basis for the application and adjustment of the UVLC system's development, which will be applied to the upcoming 6G Technology. The method used involves sending information in the form of multimedia signals through visible light, utilizing the implemented UVLC system, in both freshwater and seawater media, thereby obtaining the model and characteristics of the water environment for the develop-ment of future UVLC systems. The results of the study show that the use of lenses has a significant effect on increasing the output voltage, both on ordinary photodiodes and BPW34. Additionally, BPW34 offers superior performance compared to conventional photo-diodes, although its maximum testing range is limited to 150 cm.

17. A Review on the Application of Chemical Absorption Using MEA as a Solvent in Biogas Upgrading for Higher Renewable Energy Value - *Nabila Azzahro*

The increasing demand for sustainable and environmentally friendly energy sources has encouraged the development of biogas as an alternative fuel, particularly in regions with abundant livestock waste. Cattle manure is a highly promising substrate for biogas production due to its high organic content and continuous availability. However, raw biogas contains significant levels of carbon dioxide (CO_2) and hydrogen sulfide (H_2S), which reduce its calorific value, decrease combustion efficiency, and pose risks of equipment corrosion. Therefore, upgrading processes are essential to enhance methane purity and improve the overall quality of biogas for household applications. Among various upgrading technologies, chemical absorption is widely discussed in scientific literature because of its high selectivity and effectiveness in removing CO_2 and H_2S. This method utilizes chemical absorbents such as amine-based solutions or alkaline reagents that react with gas impurities to produce purified biogas with higher methane content. Chemical absorption is also adaptable to different operational scales, making it suitable for both small communities and larger livestock-based systems. This study provides a literature-based analysis of the development and application of chemical absorption for biogas upgrading. The objective is to understand its mechanisms, advantages, and

potential for improving biogas derived from livestock manure so that it can function as a reliable renewable energy source for household activities.

18. Thermal Safety Enhancement in Electric Vehicles via Battery Temperature Monitoring - *Fei Lu Siaw, Tzer Hwai Gilbert Thio, Tarig Faisal, Anas Javaid*

Lithium-ion batteries, which serve as the primary energy storage units in electric vehicles (EVs), exhibit strong temperature dependence that critically influences their performance, lifespan, and safety. Elevated temperatures accelerate battery degradation rate and heighten the risk of thermal runaway, whereas excessively low temperatures substantially reduce efficiency and shorten the battery's service life. This paper addresses the need for robust and affordable thermal monitoring by detailing the implementation, and empirical validation of a thermal management subsystem. This system is integrated within a battery management system (BMS) architecture. The design utilizes low-power ATtiny841 microcontroller for localized sensing, coupled with NTC-MF52AT (47kΩ) thermistor for accurate temperature acquisition. A D1 Mini controller enables real-time monitoring and data visualization through a wireless webpage interface, demonstrating a scalable and accessible monitoring solution. Experimental validation confirmed the system's performance, demonstrating measurement accuracy within 1°C. Furthermore, the system successfully implemented an automatic safety cut-off at 50°C to mitigate overheating and prevent potential thermal damage. In conclusion, the developed thermal management solution provides a reliable, scalable, and low-cost framework for enhanced temperature protection, making it highly suitable for integration into next-generation electric vehicle battery applications.

Artificial Intelligence & Smart Systems

19. Activation Function's Influence on TabNet Performance for EEG-Based Mental Workload Classification - *Yusuf Miftahuddin, Pratama Bevan Nurrohman, Chalifa Chazar, Kreusna Bayu Prangga W*

This study evaluates the effect of activation function on TabNet attention mechanism for EEG based mental load classification. Data of 48 subjects were preprocessed through high-pass, notch, ICA, re-referencing, Welch's PSD extraction, and sliding window segmentation; feature selection was performed with NCA. Two configurations were tested on identical and subject-wise split protocols: the TabNet baseline using Sparsemax and the TabNet-EntMax variant ($\alpha \approx 1.5$). The baseline achieved a test accuracy of 0.73 and macro-F1 0.66 with a bias towards major classes. Changing the mask function to EntMax improved the accuracy to 0.83 and macro-F1 0.80, while raising the high class performance from recall 0.30 (F1 0.42) to 0.71 (F1 0.73); the high→low misclassification was reduced from 97 to 25.

The learning curve showed a higher validation plateau and a smaller generalization gap. These findings suggest EntMax produces more selective and calibrated attention, thus strengthening the reliability of TabNet for mental load level detection. The implication is that further research is directed towards hyperparameter tuning and more systematic subject-based class balancing strategies.

20. Implementing Transfer Learning and Fine-Tuning on Convolutional Neural Networks for Art Style Classification - *Yusuf Miftahuddin, Anisa Putri Setyanigrum, Rizal Naufal Robbani*

Painting is a medium of self-expression that represents perspectives and emotions through diverse visuals. One of the main challenges in the field of computer vision is automatically identifying artistic styles from paintings with high accuracy and stable model performance. Art style classification remains a problem due to visual similarities between styles and differences in the number of classes, which impact the performance of pre-trained convolutional neural network (CNN) models. This study evaluates the impact of transfer learning strategies on the performance of CNN models Xception, DenseNet121, and ResNet50 in classifying six painting art styles: Cubism, Symbolism, Realism, Romanticism, Expressionism, and Impressionism, using a total of 6,000 images. The models were trained using fine-tuning on the last 10% of the layers and evaluated using accuracy, precision, recall, F1-score, train loss, and val loss metrics. The experimental results show that the baseline Xception model achieved a validation accuracy of 57.33% (train loss 0.5041; val loss 1.0948), while DenseNet achieved 61.00% (train loss 0.6406; val loss 1.0978). After fine-tuning, the accuracy increased to 65.17% for Xception (train loss 0.5921; val loss 1.0804) and 65.00% for DenseNet (train loss 0.1674; val loss 1.3098), although DenseNet showed overfitting, as indicated by the large difference between the train loss and val loss values. Overall, the fine-tuning strategy on pretrained models was able to improve the accuracy of art style classification, but attention should be paid to overfitting, especially in certain models such as DenseNet.

21. Real-Time Detection of Online Gambling Comments on YouTube Using Long Short Term Memory (LSTM) – *Diash Firdaus, Galih Ashari Rakhmat, Afin Maulana Hidayat, Cikal Geminangtang Seya*

The widespread use of YouTube as a leading social media platform has facilitated large-scale interactions through comment sections, but it has also led to the increasing presence of illicit content, particularly online gambling promotion. Such comments are often disguised using informal language, abbreviations, or links, which makes them difficult to detect manually. To address this issue this study proposes a detection system for online gambling comments on YouTube using Long Short-Term Memory (LSTM) and compares its performance with Convolutional Neural Networks (CNN), Random Forest, and tree-

based boosting algorithms. A dataset of 30,268 manually labeled YouTube comments was constructed, comprising 19,912 normal comments and 10,356 gambling-related comments. Preprocessing included cleaning, label encoding, tokenization, and padding to prepare the text for supervised classification. Experimental results demonstrate that LSTM achieved the best performance on the full dataset with an F1-score of 0.9454, outperforming CNN (0.9392) and Random Forest (0.8284). These findings suggest that while LSTM performs well on large-scale datasets, boosting methods are more robust for imbalanced or un-seen data. The results provide useful insights for developing automated moderation tools to improve digital safety on social media.

22. **Multimodal Information Credibility Detection on X Using Hybrid Deep Learning with FastText Feature Expansion and Firefly Algorithm Optimization - *Kirana Octa***

The credibility of information on social media refers to the level of user trust in the content being disseminated, which is influenced by perceptions of the content, source, and platform. Platforms such as X (formerly Twitter) facilitate the rapid dissemination of information, but are prone to hoaxes and rumors, making credibility detection crucial for maintaining the quality of public information. This study aims to develop a multimodal information credibility detection model for Indonesian-language posts on X using a hybrid deep learning approach, including CNN-BiGRU, and BiGRU-CNN, with FastText feature expansion, Firefly Algorithm optimization, and image feature extraction via MobileNetV1. The data consists of 25,000 samples and 29,352 similarity corpora for feature expansion. The evaluation was conducted through five scenarios: Baseline, N-gram, Feature Expansion, Optimization, and Multimodal. Analysis of the dataset shows that the implementation of the Firefly Algorithm in the CNN-BiGRU hybrid model with multimodal data achieved the highest accuracy of 77.03%, emphasizing that multimodal data provides a more significant accuracy improvement 1.27% compared to using text data alone in the BiGRU-CNN model with FastText and Firefly Algorithm features. These findings confirm that multimodality (text and images) improves detection accuracy more effectively, supports the dissemination of credible information, and contributes to a safer and more constructive social media ecosystem.

23. **Physics-Informed Neural Network-Based Modeling of IoT-Sensed Greenhouse Microclimates for Resilient, Energy-Efficient Climate Control - *Tunggul Arief Nugroho***

This study introduces a Physics-Informed Neural Network (PINN) for modeling IoT-sensed microclimates in a laboratory-scale greenhouse (5x5x4 m), aiming to support resilient and energy-efficient climate control. The methodology involved extensive preprocessing of DATA2011.csv, including time-based interpolation for missing values, IQR-based outlier capping, Min-Max normalization, uniform 1-minute resampling, advanced rolling mean smoothing, and cyclic temporal feature generation. Crucially, smoothed first-order time derivatives were computed for key physical parameters like T_in, H_in, and CO2_in. The PINN model, a feed-forward neural network with 5 hidden layers and 128 neurons, was trained for 1,000 epochs. Its custom loss function integrated a data-driven Mean Squared Error (MSE) with a physics-informed MSE, derived from the residuals of three Ordinary Differential Equations (ODEs) governing energy, humidity, and CO2 balance, utilizing automatic differentiation. Key findings demonstrate outstanding physical adherence, with a total physics loss of only 0.00000883 on the validation set, confirming the model's consistency with fundamental physical laws. While the model successfully captured general trends in T_in, H_in, and CO2_in, the data loss (MSE = 0.15131769, RMSE \approx 0.389) indicates room for predictive accuracy improvement. This discrepancy is largely attributed to the use of fixed placeholder physical parameters in the ODEs. The PINN approach offers robust and interpretable microclimate dynamics essential for advanced control strategies and digital twin development in greenhouses. Future work will focus on making physical parameters learnable and refining physical equations to enhance predictive accuracy while maintaining strong physical consistency.

24. Extending the DeLone and McLean Model with Trust and Security: A Study of a Business Communication - *Raden Budiraharjo, Mira Barmawi, Sofia Umaroh, Nazillah Wahidyah*

In today's environment, instant messaging platforms have become key tools in business interactions. WhatsApp Business, in particular, offers features tailored for enterprises to enhance customer service, engagement, and operational efficiency. However, studies evaluating WhatsApp Business using the DeLone and McLean Information Systems Success Model in the Indonesian context remain limited. This research seeks to address that gap by extending the model with two additional constructs: security and trust. Information was gathered via a survey distributed among WhatsApp Business users in Bandung and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The outcomes confirm that system quality, information quality, service quality, security, and trust significantly influence user satisfaction, which in turn positively shapes net benefits. Importantly, this research empirically demonstrates the critical role of security in building trust, and further, that trust significantly enhances user satisfaction. These findings provide practical insights for enhancing business communication via messaging platforms.

25. AI-Based Automated Assessment for English Speaking Proficiency – *Nur Fitrianti Fahrudin, Corry Caromawati, Sofia Umaroh, Wahyudi*

In the era of globalization, English proficiency is essential for academic and professional success. Yet, many Indonesian learners, including those at Institut Teknologi Nasional (Itenas), face challenges in speaking due to limited practice opportunities and the absence of reliable, affordable tools for low-stakes speaking assessment. To address this gap, this study employed a Design-Based Research (DBR) approach to develop an AI-powered assessment tool named I- Speak. Three task types—read-aloud, picture description, and free speech were examined, with findings showing that free speech tasks allow more holistic assessment of speaking sub-constructs compared to the other types. The I-Speak system was designed to collect learner audio, extract features, and measure seven sub-constructs: fluency, accuracy, complexity, pronunciation, prosody, functional adequacy, and coherence & cohesion. From 102 usable audio samples, human experts provided CEFR-based ground-truth labels. Although the dataset was imbalanced across proficiency levels, the Synthetic Minority Oversampling Technique (SMOTE) was applied to improve distribution. Several models were tested, including Random Forest, Support Vector Machine (SVM), XGBoost, and Naïve Bayes, with results indicating that Random Forest combined with SMOTE produced the highest accuracy in predicting learners' proficiency. This study demonstrates the potential of I-Speak as a reliable and practical tool for low-stakes automated speaking assessment, offering scalable solutions.

26. Hierarchical Attention-Based Fusion with Multi-Loss Optimization for Multimodal Human Communication - *Sari Widya Sihwi*

Understanding human communication requires the integration of signals from multi-ple modalities, such as text, audio, and visuals. However, modelling the complex interaction of these modalities is still a challenge. In this study, we propose a Hierar-chical Attention-Based Fusion enhanced with a multi-loss optimization to handling this issue. Our model features three hierarchical layers: intramodality attention for refining single modalities, dual-modality cross-attention for examining pairwise inter-actions, and inter-modality attention for holistic multimodal integration. We also investigate fusion strategies such as concatenation and additional attention strategies to enhance its performance. Furthermore, we use multi-loss training scheme, combin-ing task loss, mutual information maximization, and also cosine similarity as atten-tion-based loss functions. The objectives of using multi-loss are to reduce modality bias and to enhance representation learning. Analysis of the CMU-MOSI dataset indi-cates that our framework is effective, accomplishing cutting-edge metrics like MAE, Correlation, Acc-2, and F1-score. These results highlight the potential of hierarchical attention mechanisms to improve multimodal learning through effective intra- and intermodal interaction capture.

27. **Customer Churn Risk Analysis Using a TabNet and SHAP Model in Banking Sector - *Ryansyah Fathin, Dede Rohidin, Jondri Jondri***

Customer churn presents a significant challenge for the banking industry, impacting revenue and business sustainability. However, identifying at risk customers often relies on traditional methods that may lack accuracy or interpretability. This study develops a robust and interpretable churn prediction model using TabNet (Tabular Network) and SHAP (SHapley Additive exPlanations). The model was trained on a large-scale dataset of 115,640 banking customers with a significant class imbalance (12.2% churn) without employing synthetic sampling. The experimental results demonstrate that the proposed TabNet model achieved superior performance, yielding an Accuracy of 99,87% and an F1-score of 99,48% for the churn class, significantly outperforming baseline models, including MLP, DNN, and Simple RNN. Furthermore, SHAP analysis successfully identified 'Balance', 'NumComplaints', 'NumOfProducts', and 'Credit Score' as the most critical features influencing churn risk. This combined approach provides financial institutions with a highly accurate predictive tool and actionable insight to formulate targeted retention strategies.

28. **Natural Language Processing for Automated Environmental Impact Assessment in Green Product Design - *Nor Anis Asma Sulaiman, Fazidah Wahit, Muhammad Zahiruddin Ibrahim, Hamizah Hariri, Xu Feng, Siti Nazirah***

Environmental Impact Assessment (EIA) remains an essential yet labour-intensive process in sustainable product design. Traditional EIAs depend on human interpretation of design documentation, leading to delays, subjective bias, and inconsistent evaluation. This study demonstrates how NLP-driven analytics can standardize green design reporting, offering a foundation for intelligent sustainability auditing systems. Also, it's presented an NLP-driven automated EIA framework that analyses textual product descriptions, material specifications, and sustainability reports to infer environmental impact categories aligned with UNEP-SETAC Life Cycle Management (LCM) principles. A dataset comprising 1,500 design cases and 12,000 annotated statements was compiled from carbon and water footprint training materials, UNEP "Measuring Water in a Green Economy," and corporate water accounting reports. Text data were annotated under ISO 14067 and PAS 2050 categories such as energy, carbon, water, and waste intensity and validated by domain experts. Using a fine-tuned BERT-base model and an interpretable rule-based layer, the system achieved an F1-score of 0.88 and Cohen's $\kappa = 0.81$ against expert EIA benchmarks. Compared to manual review, the NLP framework reduced analysis time by 65 % and increased inter-rater consistency by 23 %. The findings demonstrate how NLP can operationalize life-cycle thinking for early-stage design assessment, providing a scalable pathway for sustainable innovation in industry. The outcomes support SDG 12

(Responsible Consumption and Production) and SDG 13 (Climate Action) by promoting scalable, transparent, and data-driven EIA practices.

29. Regional Clustering Based on the Fifteen Minutes City Concept Using the OPTICS Method - *Muhammad Krisna Yudha, Marisa Permitasari*

Rapid urbanization in Indonesia has intensified challenges such as environmental degradation, social inequality, and uncontrolled urban sprawl, all of which threaten long-term urban sustainability. To address these issues, this study applies the Fifteen Minutes City (FMC) concept, which promotes sustainable accessibility to essential services within a 15-minute walk or cycling distance, thereby reducing dependency on motorized transport and fostering greener urban living. Using the OPTICS clustering algorithm and GIS-based visualization, public facility data from OpenStreetMap in the Bandung Metropolitan Region were analyzed. Results for motorized transport show a Silhouette Score of 0.595 and a Calinski-Harabasz Score of 992.992, with 33 clusters formed and 51% noise. For walking mode, OPTICS produced a Silhouette Score of 0.688 and a CalinskiHarabasz Score of 1161.282, also with 33 clusters and 50.9% noise. These results demonstrate the potential of integrating FMC principles with data-driven approaches to identify sustainable urban zones, reduce carbon emissions, and guide equitable, resilient spatial planning in Indonesian cities.

30. Breast Cancer Detection on Mammogram Images Using Transfer Learning Based on EfficientNet - *Alisha Anggranidi Salsabila, Jondri Jondri, Indwiarti Indwiarti*

Breast cancer remains a leading cause of cancer related mortality among women globally. While early detection through mammography significantly improves survival rates, manual interpretation is challenging, time consuming, and prone to inter observer variability. Recent Deep Learning studies often report classification accuracies exceeding 90% on public datasets like INbreast. However, a critical methodological review reveals that many of these studies employ random data splitting, which can lead to "data leakage" a phenomenon where images from the same patient appear in both training and testing sets, inflating performance metrics. This study proposes an automated detection system using EfficientNetV2-B0 with a rigorous Group K Fold Cross Validation protocol to ensure strict patient level separation. We implemented a comprehensive preprocessing pipeline including artifact removal, breast Region of Interest (ROI) cropping, and balanced oversampling to handle the small, imbalanced dataset (108 unique patients). Experimental results across 5 folds yield an average accuracy of 63.19% and an AUC of 0.6201. While these figures are lower than literature baselines that utilize random splits or extensive external pretraining, these results provide a realistic and scientifically valid benchmark for Deep Learning performance on limited medical datasets when data leakage is strictly

eliminated. The study highlights the critical tradeoff between reported accuracy and methodological validity in medical image analysis.

31. Formulation of Quality Prediction Model Using Conventional Machine Learning for Multiclass Defect Detection in Crystal Sugar Production - *Anggin Meylani, Fahmi Arif*

Quality is a crucial aspect of the industry, contributing directly to reputation and compliance with set standards. Effective quality control can reduce losses due to defective products and increase consumer satisfaction. A machine learning-based prediction model was developed to detect multiclass defects in crystal sugar production. Using CRISP-DM methodology, an analysis was conducted to understand the relationship between production process parameters and the quality of sugar produced. Six classification algorithms were tested to determine the best model, including K-Nearest Neighbours (KNN), Support Vector Machine (SVM), and Random Forest. The evaluation results showed that KNN had the highest accuracy and effectively handled diverse data. This study demonstrates the potential of machine learning to enhance quality control, minimise defects, and boost customer satisfaction in crystal sugar production.

32. Machine Learning Based Job Urgency Assessment Model for Dynamic Job Shop Scheduling - *Muhammad Usman Nisar*

Modern manufacturing systems must remain productive while adapting to frequent disruptions such as new job arrivals () and rush orders (). These disruptions disturb production flow, leading to idle machines, longer flow time, and unnecessary energy consumption if not handled intelligently. Traditional scheduling methods, which are mostly designed for static environments, lack adaptability and fail to respond efficiently to such disruptions. To address these challenges, this study proposes a Decision Support System () that classifies based on their urgency to support adaptive rescheduling in dynamic environments. The employs an interpretable Decision Tree Classifier () to determine whether a should be treated as rush or regular, allowing planners to understand the rationale behind the classification. The model is proposed to be trained using an Oracle framework that simulates optimal scheduling behavior by minimizing the maximum tardiness (), ensuring focus on the worst-case job delay. Results are generated by comparing the outcomes of different attribute-based priority rules such as earlies due date (), shortest processing time (), longest processing time (), first in first out (), and last in first out (), with a minimum slack time () rule to identify optimal prioritization decisions. The proposed framework is expected to reduce idle energy waste, improve system responsiveness, and enhance overall scheduling efficiency. By integrating machine learning–based urgency assessment with energy-aware rescheduling, this study aims to

contribute to sustainable and intelligent manufacturing systems that align with the broader vision of green, adaptive production planning.

33. **RoboIT: IoT-Based Smart Assistant with Knowledge Management System for Academic Visitor Interaction** - ***Henning Titi Ciptaningtyas, Khairun Nasihin, Ridho Rahman Hariadi, Rehana Putri Salsabila, Mutiara Nurhaliza, Steven Figo, Moch Zidan Hadipratama, Naufan Zaki Luqmanulhakim and Fuad Dary Rosyadi***

The increasing demand for interactive and intelligent public services in higher education has driven the development of smart assistants that combine Internet of Things (IoT) and knowledge management technologies. This paper presents RoboIT, a smart assistant implemented at the Department of Information Technology, Institut Teknologi Sepuluh Nopember (ITS), designed to guide and serve visitors while providing reliable academic information. The system integrates an ultrasonic sensor to detect visitor presence, an ESP32 microcontroller as the central controller, and a speaker for automatic voice greetings through Text-to-Speech (TTS). A tablet functions as the primary interface, enabling users to access multimedia content, departmental information, and an interactive Q&A bot. To ensure accurate and trustworthy responses, RoboIT incorporates a Knowledge Management System supported by Retrieval Augmented Generation (RAG), ChromaDB for vector search, and a locally deployed language model. The modular architecture enables seamless integration between hardware and software components, while Docker containerization ensures scalability and maintainability. System testing included functional validation of hardware components, user interaction evaluation, and chatbot performance assessment. Results indicate that RoboIT successfully detects visitors in real time, delivers responsive and contextually accurate information, and achieves high user satisfaction in usability and interactivity. This work demonstrates how the combination of IoT sensing, human robot interaction, and knowledge-based AI can transform public spaces in academia into interactive, informative, and engaging environments. Future work will focus on enhancing personalization, expanding conversational knowledge, and integrating the system into broader campus-wide smart services.

34. **Enhancing Multiclass Defect Detection in Crystal Sugar Production Using Advanced Ensemble Learning Techniques** - ***Ekki Kurniawan, Riko Ferdinand Alhakim, Fahmi Arif, Alif Ulfa Afifah***

This study focuses on developing a multiclass defect prediction model in the crystal sugar production process by utilizing ensemble learning-based machine learning algorithms to address product defect issues. Nine models were evaluated, including the model resulted

from boosting, voting, and stacking techniques. The evaluation was conducted using accuracy, F1-score, and cross-validation metrics to ensure the stability and generalization ability of the model to new data. The results show that the super stacking algorithm excels with an accuracy of 92.59% and an F1-score of 88.10%, which indicates the ability of ensemble learning to capture complex non-linear patterns between production process variables. This model is more accurate than a single model, thus having the potential to optimize quality control, reduce product defects, and support the transition to smart manufacturing in the sugar sector.

Environmental and Infrastructure Monitoring & Sustainability

35. A Brief Review of LiDAR Application in Infrastructure Mapping – *Khairul Nastiar, Muhamad Adriqri Yaqzhan Riswandi, Naufal Sukmawan, Rayhans Ilham Rachmadia, Anisa Nabila Rizki Ramadhani, Berlina Dwi Prapningtyas, Sofyan Chairul Anwar*

LiDAR (Light Detection and Ranging) has emerged as a transformative technology in infrastructure mapping, offering rapid and precise acquisition of three-dimensional spatial data. By integrating with GNSS and inertial navigation systems, LiDAR enables accurate modelling of roads, bridges, and urban assets across airborne, terrestrial, and mobile platforms. The study's findings show that LiDAR-derived point clouds provide sub-decimeter accuracy, supporting the reliable extraction of structural parameters such as elevation, deformation, and volumetric change. Data fusion with photogrammetry and RGB imagery further enhances classification accuracy and visualization quality, enabling comprehensive assessments of infrastructure condition. The results confirm that LiDAR not only improves mapping efficiency and monitoring precision but also strengthens the integration of spatial data within Building Information Modelling (BIM) and smart infrastructure systems. In conclusion, LiDAR represents a robust and scalable solution for sustainable urban development, enabling data-driven decision-making and advancing the future of intelligent infrastructure management.

36. Monitoring Land Cover Change of Mangroves Using Vegetation Indices at Blanakan, Subang – *Marisa Premitasari, Thonas Indra Maryanto, Choerunnisa Septiani Tri Noerdin, Jasman Pardede, Raihan Arkantama Gunawan, Rizka Milandga Millenio*

Mangroves are vital coastal vegetation that protect shorelines and support local livelihoods. This study analyzes mangrove land cover changes in Blanakan, Subang, using Landsat imagery (1990–2025) and drone data (July 2025). The Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI) were applied to

classify mangrove and non-mangrove areas. Results show a notable NDVI increase from 0.051 in 1990 to 0.095 in 2025 and an NDWI decrease to -0.054, indicating a significant mangrove expansion from 78.17% to 99.26%. These findings confirm NDVI's reliability for mangrove classification and monitoring. The observed growth reflects successful restoration and conservation efforts that strengthen coastal resilience and contribute to sustainable ecosystem management in the Blanakan–Ciasem region. Keywords: Mangrove, Non Mangrove, Classification.NDVI, NDWI, Blanakan Subang.

37. L-Band SAR Backscatter Characteristics for Oil Palm Phenology Monitoring Using Two-Layer RVOG Decomposition - *Rika Hernawati, Soni Darmawan, Josaphat Tetuko Sri Sumantyo*

Oil palm plantation monitoring is essential for sustainable agricultural management in Indonesia. This study investigates L-band (ALOS PALSAR-2) SAR backscatter characteristics for oil palm phenology monitoring using the Two-Layer Random Volume over Ground (RVOG) decomposition approach. The research was conducted at PTPN III Sei Dadap plantation, North Sumatra, covering 50 plots with ages ranging from 0.3 to 22 years. RVOG decomposition successfully separated three scattering components: volume scattering (Pv), double-bounce scattering (Pd), and surface scattering (Ps). Results demonstrate that L-band exhibits superior capability in detecting structural changes across growth phases with an average R^2=0.66 for all scattering mechanisms. Volume scattering shows a quadratic pattern (R^2=0.7463) with peak values at the mature phase (5-15 years), double-bounce shows logarithmic increase (R^2=0.6145) indicating stable trunk detection, and surface scattering with logarithmic pattern (R^2=0.636) shows consistent ground penetration. Polynomial regression (degree-2) achieved the best age prediction performance with R^2=0.699 and MAE=3.47 years. The deeper penetration capability of L-band (~23.5 cm wavelength) enables consistent detection of subcanopy structures including trunk-ground interactions, throughout the plantation lifecycle, making it more suitable for long-term phenology monitoring compared to shorter wavelengths.

38. Enhancing the Efficiency, Accuracy, and Safety of Building Inspection through Drone Aviation Technology: A Literature Review - *Siti Atikah Ghazali, Balqis Aminuddin, Nurul Aishah Ghazali, Mainur Sofiya*

This literature review focuses on the application of building drone inspection technology and how it may improve the inspection process regarding efficiency, precision, and safety. Building the inspection process may improve efficiency, precision, and safety. The time, risk of injury, and difficulty of manual inspections, particularly of tall buildings, can be a considerable drawback of traditional methods. Drones facilitated the reduction of human risk by allowing real-time data collection via high-resolution cameras and advanced sensors, and they provided easier access to previously difficult-to-reach building portions,

thereby lessening human error risk during data collection. This review focuses on recent studies regarding current implementations, technology advancements, and challenges to the implementation of drones in building inspections. The overall consensus is that drones provide technology that transforms building inspections by enhancing the value of inspections and reducing the risk and costs involved in the process. This suggests a change in the future of construction and building management.

39. Energy-Efficient Geo-Spatial Radar Sensing System for Environmental Risk Detection Using Optimized Antenna Arrays - *Muhammad Rendra Perdana Kusuma Djaka, Melinda Br Ginting, Dhabita Audrea Belindra, Ms, Edo Lutfi Mahanani*

This study presents an energy-efficient geo-spatial radar sensing system designed to enhance environmental risk detection through the use of optimized C-band antenna arrays. The proposed 10×8 phased array architecture integrates adaptive beamforming, dual-polarization signal processing, and multi-source geospatial data fusion to improve precipitation estimation and hazard monitoring in complex terrains. The λ /2 element spacing enables precise 3D electronic steering, reducing mechanical load while maintaining high directional accuracy. Advanced calibration and interference suppression techniques ensure polarimetric fidelity across wide scan angles, supporting accurate hydrometeor classification and robust environmental monitoring. Simulation results demonstrate strong performance, including 19.0 dB array gain, sidelobe levels below -30 dB, beam steering accuracy of 0.05°, -33 dB return loss, 1.046 VSWR, and -60 dB inter element isolation. The adaptive scanning strategy reduces overall power consumption by approximately 42%, decreasing operational demand from 8.5 kW to 2.1 kW while sustaining a 90 second volumetric update rate. Compared to conventional C-band radar systems, the proposed design improves scan time by 67% and enhances range resolution by 40%, making it suitable for sustainable, real-time environmental risk assessment in energy-constrained regions.

40. Development of an IoT-Based Water Quality Monitoring System for Tilapia Farming in Biofloc Ponds Using Mamdani Fuzzy Inference - *Daniel Sutopo Pamungkas, Muhammad Fandy Herdiyanto*

This study presents the development and validation of an Internet of Things (IoT)-based monitoring system for aquaculture water quality, with a specific focus on tilapia biofloc farming. The system integrates pH, dissolved oxygen (DO), and total dissolved solids (TDS) sensors connected to an ESP32 microcontroller. Data is processed locally and transmitted to Firebase, enabling real-time visualization via a smartphone application. Sensor calibration was performed using standard buffer solutions and linear regression correction,

yielding improved accuracy. A Mamdani fuzzy inference system was employed to classify pond conditions into Poor, Fair, and Good. Field experiments demonstrated significant error reduction after calibration (MAE for pH: 0.15, DO: 0.15 mg/L, TDS: 25 ppm). The fuzzy classifier achieved 98% agreement with LabVIEW based reference results. This paper contributes a scalable, low-cost, and interpretable system to support aquaculture productivity.

41. Optimizing Water Treatment for Polluted Raw Water with Two-Stage Coagulation - *Mohamad Rangga Sururi*

Two-stage coagulation offers opportunities for treating contaminated raw water better than conventional coagulation. The purpose of this study was to investigate the performance of two-stage coagulation in removing pollutants from contaminated raw water. The jar test method refers to SNI 195-6449-2000 to determine optimum coagulant dose. The experiment was conducted by adding the coagulant two times, with a 10-second interval. The interval was selected as can be applied in drinking water treatment plant at the study site. Adjustments were made to the existing dosage to vary the PAC dosage and raw water sampling time (morning, afternoon and evening). Based on this method, the applied dosage (15.5 mg/L) was not able to reduce turbidity to meet the quality standard (<3 NTU). In the sample taken at morning (08.00), the turbidity was 8.71 NTU, meanwhile at afternoon (13.00) and evening (18.00), the measured turbidity were 12.49 NTU and 15.70 NTU, respectively. The optimum dosage that able to reduce turbidity highest and hence meet the water quality standard was 29.5 mg/L in the morning, and 33 mg/L in the afternoon and evening. These optimum dosages result in a final turbidity of 2.65 NTU in the morning; 0.58 NTU in the afternoon; and 1.34 NTU in the evening. These findings suggets that while the use of two-stage coagulation method requires greater dose, it achives high efficiency for turbidity reduction.

42. Re-Identification of Sampling Points of Water Quality Monitoring for Cisangkan River, Cimahi City, Indonesia, Based on National Standardisation of Indonesia and Water Quality Monitoring Guidelines – *Iwan Juwana*

Integrated watershed management (DAS) is a crucial factor in maintaining the water quality of the Cisangkan River in Cimahi City. However, rapid urbanization and suboptimal regulatory enforcement can accelerate environmental degradation, including eutrophication and oxygen depletion, due to unmanaged pollution loads. Activities within the Cisangkan watershed are dominated by dense residential areas and a mix of small to medium-sized industries, which collectively generate significant volumes of untreated domestic and industrial wastewater. To manage and monitor this impact, the Cimahi City Environmental Agency performs regular water quality monitoring at 15 existing points, referencing national standards, specifically Government Regulation No. 22/2021. This

study evaluates the effectiveness and representativeness of these monitoring points by systematically assessing their spatial location relative to hydrological conditions, pollution inflow points, and land-use changes within the river basin. Preliminary findings, corroborated by periodic regulatory testing, indicate that the upstream segment of the Cisangkan River is already classified as "Heavily Polluted" (Tercemar Berat). This severe pollution status is largely attributed to high organic and bacterial load inputs from the dense urban population near the headwaters. The analysis confirms a strong correlation between high-risk land-use zones (dense, unmanaged settlements) and severe water quality degradation. These results emphasize the urgent need to re-evaluate the monitoring network design to ensure representative data is captured at critical pollution points, thereby supporting data-driven policy for effective river restoration and environmental impact mitigation.

43. Developing Sustainable Water and Sanitation Strategies in Manado: An EHRA and SWOT Approach - *Nico Halomoan, Shela Zahrawani, Prayatni Soewondo, Ahmad Setiyawan, Prasanti Widyasih Sarli*

Manado City, faces significant challenges as a water-sensitive area, characterized by its vulnerability to disasters across riversides, coastlines, and hilly terrains, coupled with limited access to safe water and sanitation. This study addresses the critical problem of declining water quality and quantity due to escalating population, rapid urbanization, and changes in consumption patterns, which threaten environmental sustainability and public health. The research aims to formulate effective strategies to enhance access to safe and sustainable water and sanitation within these vulnerable settlements. The methodology involved primary data collection through direct observation of field conditions and secondary data review, followed by a comprehensive Strength, Weakness, Opportunity, and Threat (SWOT) analysis. Environmental Health Risk Assessment (EHRA) and a SWOT analysis questionnaire administered to 14 stakeholders were key analytical tools. Data were processed using descriptive statistics Key findings reveal current community practices: 76.33% use refilled water for drinking, 37.67% use portable water for bathing and washing, 73% utilize latrines for feces collection, and 91% manage solid waste by collecting and transporting it to landfills. The SWOT analysis positioned the strategic approach in Quadrant I (progressive), indicating a strong potential to leverage existing strengths and opportunities. The identified strategic actions include enforcing regulations, establishing dedicated supervision, developing essential facilities and infrastructure, and fostering community engagement through socialization programs. The implications of this study highlight that implementing strategies focused on leveraging internal strengths and external opportunities is the most effective pathway to achieving sustainable improvements in water and sanitation access in water-sensitive regions.

44. Raw Water Treatment for Drinking Water from Polluted Urban Rivers Using Two-Stage Coagulation - *Mohamad Rangga Sururi, Mila Dirgawati, Najla Shalmabillah Hidayat, Nur Alifah Fauzia, Geovania Alves Belo, Adila Shalahuddin Nur*

Urban rivers that cross cities are often an important source of raw water for drinking water treatment plants (IPAM) to produce safe drinking water. Through measuring FDOM and CDOM, it is known that polluted river water contain protein is difficult to treat. The aim of this study was to obtain the optimum dose of PAC in the two-stage coagulation process by reviewing the removal of common parameters (turbidity) and NOM in urban rivers. Two stage coagulation was used during jar test. In this study, the coagulant was added gradually with a 50:50 ratio to the sample, and there was a time interval between the two. Samples were taken in the morning and afternoon, when the antrophogenic activities affaected polluted river. The optimum two-stage coagulation dose for raw water at the Cimahi City BLUD Water Treatment Plant (IPAM BLUD) reached 22.5 mg/L in the morning and 33 mg/L in the afternoon. This value is higher than the existing dose (15.5 mg/L) using the conventional method.

45. Microbial Community and Sediment Characteristics of Energy-Efficient Aerobic Granular Sludge in Textile Wastewater Treatment - *hoerudin Choerudin, Vita Wonoputri, Tjandra Setiadi*

This study examines the microbial community structure and sediment characteristics of energy-efficient aerobic granular sludge (AGS) cultivated in textile wastewater. AGS was operated under low aeration to reduce energy demand while maintaining granulation performance. Next-generation sequencing (NGS) produced 140,156 high-quality reads, revealing four dominant phyla-Proteobacteria, Bacteroidetes, Acidobacteria, and Deinococcus-Thermus. Thermomonas and Rhodanobacter were the most abundant genera and are associated with organic matter degradation, EPS formation, and dye-related pollutant breakdown, while Truepera and Haliangium contributed to stress tolerance in high-nutrient, saline conditions. Complementary SEM-EDX analysis showed substantial mineral precipitation within the granule matrix, dominated by oxygen, phosphorus, calcium, magnesium, and metals. Minerals were uniformly distributed across the granule surface and interior, indicating stable substrate penetration and structural integrity. Higher aeration resulted in slightly lower sediment deposition, confirming its influence on mineral accumulation. The combined microbial and mineral profiles demonstrate that AGS possesses functional microbial consortia and robust matrix composition suitable for treating complex textile wastewater under energy-efficient conditions. These findings support the potential of AGS as a sustainable option for

industrial wastewater treatment, particularly in systems constrained by energy consumption.

46. Prediction of Exposure to PM10 by Integrating AERMOD and Land Use Regression Models in the City of Bandung – *Mila Dirgawati*

Exposure to particulate matter with an aerodynamic diameter of less than 10 µm (PM10) can cause effects on human health even at low concentrations. PM_{10} concentrations are not only dependent on direct emissions (such as road dust, construction activities, or transportation), but are also greatly influenced by land use patterns. The city of Bandung only has one Air Quality Monitoring System to measure particulate concentrations, hence limited to accurately assess exposure to PM10 at the individual level. Therefore, modelling is needed to predict PM10 concentrations at various points that are not measured by AQMS, using a combination of AERMOD and Land Use Regression (LUR) modelling. AERMOD modelling was used to simulate the distribution of PM_{10} concentrations from various emission sources based on local meteorological conditions, topography, and annual emission patterns, resulting in a map of pollutant concentrations with high spatial resolution. Meanwhile, exposure to PM10 at individual level were predicted by the LUR model. The AERMOD simulation results were then applied as a dependent variable (pollutant concentration value) in the LUR modelling, while the independent variables were the spatial parameters including land use type, traffic density and networks, as well as distance from various roads. The LUR model explained the PM10 concentrations variation of 84%. The modelling results showed that traffic predictor variables (length of local roads at the 1000m buffer, length of collector roads at the 1000 m buffer, and the closest distance to arterial roads, the motor vehicles density at the 500 m buffer) were the main contributors to the PM10. The predicted spatial distribution of PM10 concentrations throughout the city show that the highest PM10 concentration was located in transportation dense areas (Astana Anyar District) with a concentration of 144.70 µg/m^3, exceeding national ambient air quality standard.

47. Evaluating Environmental Impact of NCG Emissions from Geothermal Power Plants Through Air Dispersion Modeling - *Aulya Adisti Febriyanti, Didin Agustian Permadi*

This research investigates the dispersion characteristics of non-condensable gases (NCGs), specifically hydrogen sulfide (H_2S) and ammonia (NH_3), emitted from geothermal power plant (PLTP) operations in Indonesia. Using the AERMOD air dispersion model, the study integrates local meteorological and terrain data to predict how these gases are distributed over a 20 km radius from the emission source. The results indicate that H_2S, being heavier than air, tends to accumulate in low-lying areas, with concentrations reaching up to 1173 µg/m^3, particularly during the dry season when atmospheric dispersion is reduced. In

contrast, NH_3, which is lighter than air, disperses more readily but exhibits increased concentra-tions (up to 20.02 µg/m^3) during the rainy season, likely due to enhanced volati-lization from wet soils. Seasonal variation, wind direction, and topographical fea-tures are shown to significantly influence dispersion patterns. The findings high-light the importance of continuous ambient air quality monitoring and proper emission management to mitigate potential health and environmental impacts as-sociated with geothermal NCG emissions. This study underscores the utility of AERMOD as an effective tool for predicting pollutant behavior and supports regulatory efforts to minimize the risks posed by geothermal energy production.

48. Assessment of Open Biomass Burning Contributions to Surface Ozone Formation in the Southeast Asian Region Using the WRF-CAMx Modeling System - *Aristian Nurfauzi, Taufik Rizki Ramadhan, Ramadhan and Didin Agustian Permadi*

Biomass burning in Sumatra and Kalimantan routinely triggers transboundary haze episodes in Southeast Asia and releases large amounts of ozone precur-sors that impact regional air quality. This study uses the WRF-CAMx model-ing system to quantify the contribution of fire emissions to surface ozone concentrations during haze (September 2011) and non-haze (May 2012) pe-riods in five major cities: Jakarta, Palembang, Batam, Pontianak, and Kuala Lumpur. Meteorological evaluation showed that the WRF model was able to reproduce temperature, humidity, and wind patterns with sufficient accuracy for chemical modeling applications. Simulation results showed strong sea-sonal contrasts. In May 2012, wet and convective conditions resulted in low ozone concentrations, while September 2011 showed a significant increase in ozone due to high levels of forest and peat burning. Biomass burning emissions proved to be the main source of ozone precursors during the dry season, resulting in intense photochemical ozone formation in Sumatra and Kalimantan and increasing surface ozone concentrations in the source re-gions and surrounding areas.

49. Analysis of the Sectoral Contribution of Transportation and Industry Emissions to PM2.Concentration in DKI Jakarta Using the WRF-CAMx Model - *Firman Apriana Prawira*

This study quantifies the specific contribution of emissions from the transportation and industrial sectors to PM2.5 concentration in DKI Jakarta using the WRF-CAMx modeling framework during the July 15-16, 2021 episode. DKI Jakarta faces acute PM2.5 pollution challenges exceeding national air quality standards. The WRF model was well-validated for Temperature and Wind Speed parameters, but showed a significant deviation in Relative Humidity (RH) with a MAGE 9.86%. The CAMx model exhibited poor instantaneous skill (R

2 0.05) but was validated for relative sectoral contribution analysis (zero-out sensitivity). Simulation results showed that the total PM2.5 concentration peaked at 309.49 ug/m3 at 24:00 LST. This pattern is confirmed to be caused by the phenomenon of nocturnal accumulation due to the collapsing Planetary Boundary Layer (PBL), which compresses pollutants near the surface. The zero-out analysis identified the Transportation sector as the dominant contributor, with an absolute maximum contribution of 90.72 ug/m3, significantly surpassing the Industrial sector (28.16 ug/m3). Therefore, air pollution mitigation strategies in DKI Jakarta must place pri-mary focus on reducing emissions from the transportation sector to achieve effective PM2.5 concentration reduction across the metropolitan area.

Material Science

50. Influence of CNT Functionalization on the Structural and Surface Properties of Polyethersulfone Membranes – *Jono Suhartono*

Indonesia has a vast biogas potential, reaching 49,810 MW, primarily from the livestock sector, palm oil plantations, and household waste. However, its utilization remains low due to limitations in purification technology and supporting infrastructure. Raw biogas contains only 50-70% methane, making it necessary to purify it into biomethane with a methane content of more than 90% so that it can be optimally used as an environmentally friendly fuel in the household, transportation, industrial, and power generation sectors. One promising technology for this purification is polymer-based membranes modified with nanomaterials, as they are efficient, flexible, and environmentally friendly. This study compares the performance of pristine Polyethersulfone (PES) membranes with composite membranes incorporating Carbon Nanotubes (CNTs) and oxidized Carbon Nanotubes (CNT-O) for methane purification from biogas. All membranes were fabricated via the phase inversion method and characterized using Scanning Electron Microscopy (SEM) and contact angle measurements. SEM analysis revealed that pristine PES membranes exhibited long, uniform finger-like macrovoids typical of instantaneous demixing, whereas the incorporation of CNTs produced narrower finger-like pores and thicker walls, indicating a delayed demixing process. The oxidized CNTs (CNT-O) enhanced pore uniformity and promoted greater macrovoid development compared to non-oxidized CNTs, due to better dispersion and interfacial interaction within the polymer matrix. Contact angle measurements demonstrated that pristine PES possessed the highest hydrophobicity (≈72.7°), while the addition of CNTs reduced the angle, confirming increased hydrophilicity. The CNT-O composite exhibited the lowest contact angle among all samples, reflecting improved surface wettability derived from oxygen-containing functional groups (-COOH, -OH). These findings indicate that CNT incorporation enhances both the morphological uniformity and hydrophilicity of PES membranes, with oxidized

CNTs offering superior structural and wetting properties suitable for improved gas separation performance.

51. A Green Process to a Mesoporous Cellular Foam Silica Product: An Alternative from Palm Oil Boiler Ash – *Joni Agustian, Lilis Hermida, Darmansyah*

Mesoporous cellular foam (MCF) silica is conventionally produced from tetraethyl orthosilicate (TEOS); however, alternative methods have also been identified for synthesizing MCF silica using bagasse bottom ash (BBA) and sodium silicate solution. Given that the TEOS-based method is regarded as haz- ardous to both human health and the environment, it is crucial to explore a new, eco-friendly synthetic pathway. The synthesis of MCF silica from palm oil boiler ash (POBA) serves as a substitute for TEOS. Experiments were carried out to transform POBA into MCF silica utilizing H2SO4, NaOH, pluronic P123, acetic acid, and KCl. The product obtained from the POBA-based process was compared with the MCF silica derived from both the TEOS-based and BBA-based process. The POBA-based process necessitated a minimum of three processin steps, similar to the BBA-based approach, whereas the TEOS-based method di- rectly produced the MCF silica. The BET and SEM analyses revealed that the MCF silica generated from both the POBA-based and TEOS-based methods exhibited comparable characteristics. The POBA-based method offers a feasible alternative to the TEOS-based approach, as it yields relatively high SBET and Vpore values while being more environmentally friendly.

52. Circulating Incinerator Bottom Ash into Eco-Friendly Paving Blocks: Mechanics, Microstructure, and Environmental Compliance - *Fatah Sulaiman, Yus Rama Denny, Izzuddin Farid, Lataniya Nauvadilah Winanty, Adhitya Angga Pratama*

Urban solid-waste management faces land scarcity and landfill-related risks. Incineration reduces waste volume by up to 90% but generates incinerator bottom ash (IBA) that requires safe, value-added utilization. This study assesses municipal solid waste in cinerator (MSWI) IBA as a partial sand replacement in eco-friendly paving blocks, targeting compliance with Indonesian National Standard SNI 03-0691-1996 and environmental safety (EPA SW-846 1311, TCLP). IBA was characterized by XRD and FTIR, then incorporated at 10, 15, 20, and 25% replacement levels. After 10-day curing, specimens were tested for dimensional accuracy, compressive strength, water absorption, and heavy-metal leaching. The 15% IBA mixture achieved the highest compressive strength (20.87 MPa), meeting the Grade-B strength criterion for moderate traffic. Water absorption (8-15%) exceeded the SNI target (6%), indicating porosity penalties at higher IBA contents. TCLP results confirmed environmental safety, with Pb at 0.0047-0.0133 ppm, Zn at 0.0313-3.878 ppm, and Cd undetected-well below regulatory thresholds. Overall, MSWI IBA can be safely incorporated into paving blocks while maintaining Grade-B strength; however, mitigating

water uptake (e.g., via washing or carbonation pre-treatments and extended curing) is recommended to enhance durability and fully satisfy standard specifications.

53. Preliminary Physicochemical and Mechanical Evaluation of Recycled Face Masks Composites - *Kanageswary Sockalingam, Muaamar Mohammed, Lim Tiong Seng, Mathan Sambu, Noor Farhana Halil Abdul Razak, Erum Pathan*

This literature review focuses on the application of building drone inspectiontechnology and how it may improve the inspection process regarding efficiency, precision, and safety. Building the inspection process may improve efficiency, precision, and safety. The time, risk of injury, and difficulty of manual inspections, particularly of tall buildings, can be a considerable drawback of traditional methods. Drones facilitated the reduction of human risk by allowing real-time data collection via high-resolution cameras and advanced sensors, and they provided easier access to previously difficult-to-reach building portions, thereby lessening human error risk during data collection. This review focuses on recent studies regarding current implementations, technology advancements, and challenges to the implementation of drones in building inspections. The overall consensus is that drones provide technology that transforms building inspections by enhancing the value of inspections and reducing the risk and costs involved in the process. This suggests a change in the future of construction and building management.

54. Fabrication and Mechanical Characterization of Jute Fiber-Reinforced Polypropylene Sheet Composites Processed via Hot Press Method - *Fadzilah Adnan, Sharifah Fathin Adlina Syed Abdullah, Najmi Haziq Badrulhisam, Teh Sabariah Abd Manan, Affiani Machmudah*

The increasing demand for sustainable and lightweight materials has urged research on natural fiber reinforced composites. Among natural fibers, jute has gained attention due to its abundance, low cost, and favorable mechanical and thermal properties. While polypropylene (PP) is widely used as a matrix in jute composites, most previous studies have focused on PP granules and fabrication techniques such as hand layup and compression molding, with limited emphasis on fiber layering effect of PP sheet based on Jute Fiber Reinforced Composites (JFRC) processed via hot pressing. This study investigates the effect of jute fiber layering on the mechanical properties of polypropylene (PP) composites fabricated via hot press method. PP sheet with jute fiber content of 30 wt%, 40 wt% and 50 wt% were prepared to evaluate the mechanical properties behaviors. The results revealed that incorporating jute fibers significantly enhanced the mechanical performance of PP up to an optimum fiber loading. Overall, the results demonstrate that 40 wt% jute fiber loading provides the optimum balance between strength and stiffness for PP composites fabricated via hot pressing. The findings highlight the potential of jute

fiber as a sustainable reinforcement for developing lightweight, ecofriendly composite materials that suitable for sustainable manufacturing applications.

55. Engineering a Natural Microemulsion via Mixture Design as a Novel Template for Eco-Friendly Nanoparticle Synthesis - *Riny Yolandha Parapat, Ayunita Yuniar and Muthi Hannindyah, Milda Husada, Jasman Pardede*

Conventional nanoparticle synthesis faces significant environmental challenges due to its reliance on hazardous chemicals and energy-intensive processes. This study addresses these limitations by developing a fully natural microemulsion system as a sustainable alternative for nanoparticle templating. The research pioneers an eco-friendly approach utilizing exclusively natural oils, food-grade surfactants, and aqueous extracts while completely avoiding synthetic solvents. The formulation was systematically engineered using Mixture Design methodology to navigate the complex multi-component system efficiently. Seven critical factors were investigated: oil viscosity, oil amount, surfactant HLB, surfactant amount, aqueous phase reduction potential, water amount, and Ratio of Surf/Co-Surf. This statistical approach enabled precise mapping of the formulation landscape and identification of optimal compositions for stable microemulsion formation. Remarkably, the study achieved perfect optimization (composite desirability D=1.000) for multiple target droplet sizes. Through strategic component adjustments, monodisperse microemulsions with precise sizes of 2.0, 5.0, 10.0, and 20.0 nm were successfully formulated. The transition between sizes was primarily governed by modulating oil viscosity and quantity while adjusting surfactant HLB to accommodate different core dimensions. Variable importance analysis revealed distinct factor hierarchies for phase stability versus droplet size control. Surfactant HLB (100%), oil viscosity (85.2%), and aqueous phase reduction potential (56.5%) dominated phase stability, while compositional factors - total surfactant (100%), S/Cos ratio (83.3%), and oil/water amounts (66.7%/50.0%) - primarily determined droplet size. This delineates a clear two-stage formulation strategy: chemical properties dictate stability, while composition ratios control structure. The optimized natural microemulsion demonstrated excellent performance as a nanoreactor template for silver nanoparticle synthesis. Characterization confirmed the formation of spherical, monodisperse nanoparticles with narrow size distribution, validating the template's efficacy for controlled nanoparticle growth under ambient, eco-friendly conditions. The key innovation lies in establishing a verifiable platform that merges green chemistry principles with advanced statistical design. This approach provides unprecedented control over nanoreactor dimensions while maintaining full environmental compatibility from template formation through to final nanoparticle synthesis. This research represents a significant advancement in sustainable nanomanufacturing, offering a viable, scalable alternative to conventional methods. The strategy opens new pathways for eco friendly production of tailored nanomaterials with potential applications across biomedicine, catalysis, and environmental technology.

56. Evolutionary Design of Melamine-Urea-Formaldehyde Resin for Medium Density Fiberboard Application - *Dicky Dermawan, Dyah Setyo Pertiwi*

This study presents the evolutionary reformulation of a melamine-urea-formaldehyde (MUF) resin, originally prepared by blending melamine-formaldehyde (MF) and urea-formaldehyde (UF) resins, with the goal of reducing formaldehyde emissions (FE). An iterative design approach was adopted. Each reformulation involves selecting raw material compositions, modifying processing conditions, or incorporating additives. After each iteration, resin shelf life, gel time, and free formaldehyde content were measured.
Key modifications-including lowering the F/(U+M) molar ratio, eliminating the use of pre-synthesized UF resin, and adjusting the processing sequence-resulted in progressively lower FE while maintaining acceptable shelf life and gel time. Laboratory-scale hot pressing of medium-density fiberboard (MDF) produced with the optimized resin showed improved mechanical properties. Incorporating urea as a formaldehyde scavenger achieved further FE reduction but led to diminished mechanical strength and durability of the MDF panels. These findings illustrate the trade-offs inherent in MUF resin design and provide guidance for developing low-emission resin systems that balance emission control with performance requirements.

Human-centered Evaluation, Urban Planning, & Housing

57. Impact of e-Shopping on Activity Participation in Indonesian Cities – *Muhamad Rizki, Tri Basuki Joewono, Prawira Belgiawan, Muhammad Zudhy Irawan, Maya Safira,Yusak Susilo*

The expansion of e-shopping and the ongoing evolution of its platforms are reshaping travel demand and transforming transportation systems. As online shopping continues to grow, it is crucial to understand its influence on individuals' activity choices and to anticipate its broader social and environmental consequences. This research examines how e-shopping reshapes daily time allocation across spatial and temporal settings, with particular attention to the timing of usage. Using one-week time-use and app-use diaries combined with a Multiple Discrete-Continuous Extreme Value model, the study compares differences between users and non-users, weekdays and weekends, and home-based versus out-of-home activities. The results reveal both substitution and rebound effects. While e-shopping reduces out-of-home maintenance activities such as physical shopping, the freed time is reallocated differently depending on when and where the service is used. On weekdays, e-shopping tends to support productivity by reinforcing work and study commitments, whereas on weekends it facilitates more flexible social and recreational activities. Cross-day spillovers reveal asymmetric rebound effects: weekday e-shopping

enables more leisure outside the home on weekends, while weekend e-shopping sustains home-based leisure throughout the week. Urban differences also emerge, with larger metropolitan areas showing stronger generation effects, while smaller cities exhibit more pronounced substitution effects.

58. The Relationship Between Settlement Area Patterns and Commercial Area Patterns in Bandung City – *Tia Adelia Surysni, Nabilla Dina Adharina, Achmad Fauzan Iscahyono*

The increasing population growth rate in Bandung City has resulted in a high demand for urban setttlement. On the other hand, recurring traffic jams that occur during weekdays and holidays indicate an increase in population mobilization. Commercial areas as one of the attractions for Bandung residents are currently becoming travel destinations for residents. Population distribution is identical to settlement areas as places where people live. The purpose of this study is to analyze the relationship between the distribution patterns of settlement areas and commercial areas in Bandung City. The study uses spatial analysis to identify patterns with Nearest Neighbor Analysis using QGIS software. Meanwhile, in analyzing the relationship, quantitative descriptive analysis is used. The results of the study show that Andir and Antapani Districts have clustered settlement and commercial distribution patterns. Other districts in Bandung City have dispersed settlement and commercial distribution patterns. This indicates a relationship between the distribution of settlement areas and commercial areas in Bandung City, although it cannot be stated as significant in this study. The results of the analysis in this study indicate that there are challenges in controlling the use of space, especially the importance of integrating settlement and commercial areas

59. Study of Eco-Friendly Stilt House Models for Middle-Income Housing – *Anwar Subkiman*

This research aims to propose solutions to contemporary housing challenges by exploring the stilt house concept through gap analysis and architectural modeling. Housing issues were identified via field observations, producing empirical data that informed the problem-solving framework. These findings were then integrated with the initial hypothesis that traditional stilt houses may serve as a viable design inspiration for modern housing development. Beyond addressing the gap between housing needs and current realities, the proposed model incorporates environmentally friendly design principles. The study is expected to yield a stilt house prototype that can be adopted by housing developers seeking sustainable and culturally rooted solutions.

60. **Comparative Evaluation of User Experience on Geoheritage Website Prototypes Developed with Canva and React.js** – ***Gusti Ayu Jessy Kartini, Rosa Karnita, Anisa Putri Setyaningrum, Jouristiany Jousristiani, Ajie Aryo Abduk Ghani, Arvin Kurniawan***

Geoheritage is an essential component of natural heritage formed through geological processes over millions of years, holding scientific, cultural, and educational value. Karst landscapes, one of the most significant forms of geoheritage, record both geological evolution and traces of prehistoric human activity. However, preserving such sites faces increasing threats from natural and human-induced factors. High-resolution documentation and 3D visualization technologies have emerged as effective tools for heritage management, improving interactivity, accessibility, and public awareness. Despite this, many geoheritage documentation efforts remain technically focused, lacking consideration of broader user needs. A user-centered design approach is therefore necessary to ensure accessibility and engagement across diverse stakeholders.

This study explores the development of a geoheritage website through an iterative, user-centered process using two design platforms: Canva for the initial prototype and React.js for the interactive beta version. Each version was evaluated using online questionnaires distributed via Google Forms to assess usability, accessibility, visual appeal, and content effectiveness. Thirty-six respondents participated in the prototype phase and thirty-three in the beta phase. Results indicate notable improvements in accessibility, ease of use, and visual appeal in the React.js version. Users rated the website as "very easy to access and use," and the visual presentation as "attractive." Content related to the 3D Explorer remained valuable across both stages, reinforcing the educational potential of the platform.

However, technical issues such as slow loading times and limited 3D optimization emerged as key challenges. Despite this, user satisfaction, recommendations, and revisit intentions remained high. Overall, the results demonstrate that integrating geospatial data visualization within a user-centered web framework can enhance geoheritage accessibility and awareness, offering a promising model for digital heritage management.

61. **Green Hybrid Infrastructure for Semi-Urban Development: Integrating Spatial Sustainability and Social Acceptability in Designing Cultural Tourism Rest Area (HCTI Hub) near the Banyurejo Exit Toll** - ***Herdika Baruna Aridani, Muhammad Zudhy Irawan, Mukhammad Rizka Fahmi Amrozi, Nur Oktaviani Widiastuti, Anak Agung Sagung Sukmayonie Gayatri***

Toll-road development in Indonesia has often generated a tunnel effect in which increased mobility does not translate into broader spatial or economic benefits for peri-urban communities. The Hybrid Cultural-Tourism Infrastructure Hub (HCTI Hub) proposed at the

Banyurejo toll exit in Yogyakarta offers an alternative model that integrates mobility services with cultural functions, community-based economic activities, and green-infrastructure principles. This study evaluates the spatial suitability of the proposed site and examines the social acceptability of the HCTI concept within a semi-urban cultural landscape. A mixed methodological approach was applied, combining corridor-based GIS analysis to assess spatial configuration, land-use dynamics, and connective potential, with Binary Logistic Regression (BLR) using data from 356 respondents to measure behavioural and socio-cultural determinants of public acceptance. The results reveal a high acceptance level (79.2%), with support for local SMEs (Odds Ratio = 2.66) and cultural relevance (Odds Ratio = 2.17) emerging as the most influential predictors. Spatial analysis indicates that Banyurejo occupies a strategically advantageous position as a Tourism Connector Node within the Borobudur-Yogyakarta-Prambanan corridor, with strong potential to generate meaningful regional spillover. The study concludes that the long-term viability of the HCTI Hub depends not only on physical accessibility but also on its ability to cultivate social legitimacy through economic inclusion, cultural integration, and environmentally sensitive design. These findings highlight the importance of hybrid, culturally embedded, and ecologically responsive approaches in rethinking the future of toll-road service infrastructure in Indonesia.

62. The Evolution of Adolescence Mode Choice: Evidence from a Modified Retrospective Survey in Bandung City - ***Andrean Maulana, Muhamad Rizki, Tarlani, Niffah Roffifah***

Understanding how adolescents develop their travel mode choices is essential for anticipating long-term mobility patterns and supporting policies that promote safe and sustainable transport. This study investigates the evolution of mode choice from age 10 to 19 among adolescents in Bandung, Indonesia, using a modified retrospective survey designed to reconstruct yearly mobility histories. A total of 310 university students participated, providing recall-based information on their school travel mode for each year of adolescence. Reported modes were grouped into private motorized, public transport, and non-motorized categories, with additional distinction between independent travel and being dropped off to capture transitions in mobility autonomy. The results show clear developmental trajectories across the adolescent period. Private vehicle drop-off is the dominant mode from ages 10 to 13, while non-motorized travel appears prominently in early adolescence but declines steadily with age. Public transport maintains moderate shares across ages 12 to 16. A marked shift occurs around ages 16 to 19, when independent private vehicle use, particularly motorcycles, rises sharply and becomes the predominant mode by age 18 and 19. Gender-based analysis reveals distinct patterns: males transition much earlier and more strongly toward independent motorized travel, whereas females retain higher shares of drop-off and public transport use through late adolescence.

63. Pedestrians' Risk Perception Regarding Electric Vehicles' Low Noise: Questionnaire Validity and Reliability Study – *Irianti, Widyanti, Muslim*

EVs, with the environmentally friendly nature, create new challenges related to safety. EVs' low noise has become safety issues, especially for pedestrians. EV adoption in Indonesia, as one of developing countries, is increasing every year. As a pilot study, the purpose of this study is to analyze the validity and reliability of the risk perception questionnaire for Indonesian pedestrians. Data was collected through a Google Form questionnaire and distributed via social media. There were three sections of questionnaire: demographic data, risk situation and risk perception. The validity and reliability tests were conducted to evaluate the risk percetion items. A total of 50 respondents (24 females, 26 males) participated in this study. The validity test showed that all risk perception items on the Corrected Item-Total Correlation (CITC < 0,30) criteria, with RP7 (0,833) has the highest value and RP8 (0,321) has the lowest. The reliability test show that Cronbach's Alpha (α = 0,850) that indicate the consistency of the instrument. These findings shows that the instrument is both valid and reliable, also suitable for further research , which is structural modelling analysis.

64. Driver's Understanding and Intention Towards Advanced Driver Assistance Systems - *Mudiastuti, R.D, Widyanti A, Yamin P A R, Fathia F A*

Autonomous vehicles (AVs) represent an automotive innovation with the potential to reduce the ecological footprint through automated driving systems that enable more efficient energy use. AVs are equipped with Advanced Driver Assistance Systems (ADAS) which potentially can mitigate human error and lower accident fatality rates. However, in Indonesia, the recent transition from conventional driving to AVs introduces critical challenges, particularly the limited understanding of and intention to use ADAS among drivers—factors that may hinder the anticipated safety benefits. Moreover, previous studies showed that research addressing drivers' understanding and intentions toward different types of ADAS is still very limited. This study aimed to evaluate drivers' understanding and intention to use ADAS in Indonesia and to examine the relationship between understanding and intention to use such systems. Data were collected via questionnaires administered to 100 respondents who had experience driving vehicles equipped with ADAS in Indonesia. The findings revealed that Parking Assistance (PA) was the most well-understood ADAS feature among Indonesian drivers (mean: 4.21), while Lane Keeping Assistance (LKA) and Lane Departure Warning (LDW) were the least understood (mean: 3.72). Notably, 22% of respondents reported being unaware of

whether their vehicle was equipped with LDW, and 21% were unsure about the presence of LKA. These results provided important insights into the characteristics of AV drivers in Indonesia, offering valuable input for prioritizing ADAS development in the country. Furthermore, the findings may be extended to other nations with similar characteristics, particularly developing countries and those in Southeast Asia.

65. Relation Logistic Costs and Surplus due to Shared Storage Operation – *Andrean Maulana, Muhammad Rizki, Tarlani, Niffah Roffifah*

Agriculture remains a strategically important sector in Indonesia, with rice serving as a primary staple commodity. The rice supply chain involves collectors, wholesalers, and retailers who operate competitively under dynamic, free-market conditions. Their profitability depends on the margin between selling prices and total logistics costs, which include transportation, collection, storage, and loading–unloading activities. As products move across multiple intermediaries, logistics costs accumulate, often reducing overall system efficiency. Shared storage has been identified as a promising intervention to enhance coordination, reduce losses, and optimize logistics operations across actors. This study reviews the role of shared storage within agricultural supply-chain networks and examines its potential impact on logistics cost structures and stakeholder surplus. Using a bi-level modelling approach that incorporates User Equilibrium (UE) at the Lower Level and a GA–GLS optimization framework at the Upper Level, the study evaluates how changes in logistics cost—from shared storage consolidation—affect overall system outcomes. Findings indicate that the relationship between logistics cost and stakeholder surplus, small cost reductions may not improve system performance, while larger cost adjustments—whether increases or decreases—can trigger equilibrium shifts that lead to more efficient routing, greater consolidation, and higher surplus. These insights highlight the importance of viewing shared storage not only as a physical facility but as a behavioral and equilibrium-altering mechanism that shapes flow distribution and market outcomes.

66. Application of Actuated Traffic Control to Improve Signalized Intersection Performance - *Mohammad Idza Faizurrahim, Bernaditha Catur Marina, Michael, Muhammad Alfat Rizki Pratama, Reza Asriandi Ekaputra*

The Sultan Agung – Ki Maja intersection is an urban roadway characterized by high social activity due to its location in a commercial area. The high traffic volume at the intersection results in congestion, especially during peak hours. This study aims to analyze the existing cycle time and explore an alternative scheme by replacing the existing traffic signal system with an Actuated Traffic Controller. After modeling the traffic conditions using PTV VISSIM, the vehicle volume output data was validated using the paired two-sample test method. The peak hour for the existing condition occurred from 17:15 to 18:15 WIB, with a vehicle volume of 9,854 vehicles per hour, an average queue length of 131.94 meters, and an average delay of 210.41 seconds. The alternative scenario modeling was conducted using

a previously developed base model. Detectors were placed at each leg of the intersection as the study applied a fully actuated traffic control system. The traffic signal system detects demand on each approach and adjusts the cycle time adaptively based on the intersection's traffic conditions by formulating an interstage file and designing computational logic using VisVAP. After applying the alternative scheme involving the Actuated Traffic Controller, the PTV VISSIM modeling results showed an average queue length of 106.81 meters and an average delay of 143.50 seconds.

67. Quick-Wins in Green Road Freight Transportation: Evidence-Based Options for Indonesia - *Fenty Wardani*

The accelerated growth of e-commerce in Indonesia has led to a significant increase in long-distance freight transport using diesel trucks. This has had a substantial impact on the carbon emissions from the transport sector. On the one hand, long-term policies emphasize the development of rail infrastructure, large-scale electrification, and investment in clean energy. Conversely, policymakers and logistics operators require pragmatic, cost-effective measures that can be executed within a 1-3 year timeframe, yielding expeditious gains in the pursuit of decarbonization.

This paper will examine the strategies employed by Green Road Freight Transportation to achieve expeditious outcomes in the domain of transportation logistics. It will also examine evidence-based options for Indonesia. This article synthesizes findings from eighteen international studies on road freight decarbonization, two recent empirical studies on truck triangulation and truck collaboration in Indonesia, and one policy paper on national land logistics. The synthesis was conducted to formulate a portfolio of quick wins grouped into the following categories: The operational efficiency of the system is contingent upon three factors: the load factor, empty backhaul, truck triangulation, and truck sharing. The viability of low-carbon technology options, such as battery electric trucks, alternative fuels, and smart fleet management, is also a primary concern. To ensure the optimal functioning of the system, policy and governance instruments must be considered, including fiscal incentives, the National Logistics Ecosystem/NLE, carbon pricing, and national network design.

The review's findings indicate that operational efficiency measures, including the augmentation of load factors, the implementation of collaborative return routes, and the integration of truck triangulation models, have the potential to curtail emissions by 10-20% at a relatively modest investment cost. The integration of battery electric truck technology and smart charging management holds considerable potential for reducing emissions by approximately 30% in designated corridors. Furthermore, a strategic combination of rail subsidies and carbon trading mechanisms can substantially promote modal shift in countries with well-developed rail infrastructure. In the context of Indonesia, these findings align with the national objective of reducing logistics expenditures to approximately 8% of GDP by the year 2045. This objective is supported by pivotal policies,

including PMK No. 71/2022, and the implementation of the NLE. This article proposes a 12-24-month roadmap for priority corridors that is intended to yield immediate benefits. The roadmap is supported by performance indicators, including increased load factor, reduced empty kilometers, and the proportion of low-carbon vehicle kilometers.

68. Filling the Gap in Transport Electrification: Investigating the Intention to Adopt Small E-Trucks in Bandung, Indonesia - *Filteran Teradha Fisabihlillah, Oka Purwanti, n Maulana, Herman, Yusfita Chrisnawati, Muhamad Rizki*

Urban transportation emissions continue to contribute significantly to environmental degradation in rapidly growing cities, highlighting the importance of transitioning toward cleaner mobility solutions. While electric vehicle (EV) adoption has been widely studied in the context of private cars and motorcycles, limited research has explored the adoption of electric trucks, particularly small commercial vehicles essential to urban logistics operations. This study investigates the intention to adopt small electric trucks (e-trucks) among business operators in Bandung, Indonesia, with a focus on understanding current perceptions, vehicle usage characteristics, and business operational profiles. Primary data were collected through a structured questionnaire distributed to entrepreneurs who utilize light commercial vehicles such as pickup trucks, box trucks, and light-duty trucks for goods distribution and service activities. A total of 133 valid responses were analyzed using descriptive methods, and behavioral intention to adopt e-trucks was measured using a five-item Likert scale based on the Technology Acceptance Model construct of behavioral intention. The results show that respondents' overall intention to adopt e-trucks remains low, with an average score of 2.68, positioned between disagree and neutral. Interest levels displayed similar patterns across socio-demographic characteristics, business profiles, and vehicle specifications. Although variations existed among business scale, customer types, and maintenance cost categories, the general trend indicated limited readiness and preference for electric trucks in current business operations. These findings provide a baseline understanding of existing adoption conditions and highlight the need for further efforts to increase awareness, evaluate infrastructure and economic feasibility, and explore strategies to support the transition toward sustainable commercial transportation.

Institutional/Organization, Culture & Political Communication

69. Decoding Visual Ideology in the Film *Secretly, Greatly (2013)* Within the Framework of Indonesian Political Communication - *Agustina Kusuma Dewi, Adi Surahman*

Secretly, Greatly (2013), directed by Jang Cheol-soo and adapted from Hun's webcomic Covertness, tells the story of three North Korean agents sent undercover to South Korea. While packaged as an action-comedy, the film explores deeper themes of identity, loyalty, and the tension between individual desires and state control. As a cultural product, it

employs local traditions, symbols, and visual aesthetics, transforming the narrative into a reflection of political and social realities. Using a semiotic approach, the film can be analyzed through its signs and cinematographic elements. Colors, costumes, gestures, spatial settings, and character expressions are orchestrated to produce layered meanings. The recurring use of military green uniforms suggests loyalty and discipline but also surveillance and repression. Narrow spaces and restricted settings reflect the constraints imposed by authoritarian systems, while the agents' conflicting expressions reveal the burden of living under imposed identities. Beneath its humor and action, the film constructs a strong visual ideology of authoritarian nationalism and suppressed individuality. Although rooted in the Korean context, Secretly, Greatly resonates with Indonesia's political communication dynamics. Both countries face issues of polarization, leadership transitions, national security anxieties, and the influence of popular culture in the digital era. Global connectivity, while promoting openness, also risks eroding national ideology and replacing it with constructed political imagery. In this sense, the film serves as a reflective mirror for Indonesia, showing how power relies on visual symbols and roles to preserve ideological stability. It underscores the political force of visual culture in shaping collective perceptions.

70. The Impact of Digital Technology on the Psychology of Human Communication in the Context of Global Flows Arjun Appadurai - *Agustina Kusuma Dewi, Adi Surahman, Levita Dwinaya*

Technological developments over the past two decades have radically changed the way humans communicate. From traditional letters and landline telephones to the rise of social media and online communication platforms, each technological leap has brought consequences that are not only technical but also psychological. Human communication is no longer limited by space and time; conversations can take place in real time even if participants are on different continents. However, this acceleration has also had significant psychological impacts, ranging from changes in thinking patterns and interaction patterns to the formation of self-identity. Arjun Appadurai, an Indian cultural anthropologist, is known for his ideas about 'global flows'. According to him, globalization is not only about economics and trade, but also about cultural, symbolic, and imaginative flows that cross national borders. He proposed the concept of five scapes: ethnoscape, technoscape, finanscape, mediascape, and ideoscape. Using systematic literature review as a method, this article aim to analyze how digital technology and psychological effect changes in human communication; also, global world communication. The research identified that refers to Appadurai's perspective, in the digital era, global flows concept is highly relevant for understanding how technology influences the psychology of human communication. Digital technology is not only a tool but also a medium that shapes how humans think, feel, and construct identities in both global and local contexts. This phenomenon is often referred to 'glocalization'—the process by which global flows are adapted to local

contexts, producing new, hybrid cultural forms. It also conclude that digital technology has become the primary medium for global flows that shape the psychology of human communication, creating hybrid glocal identities.

71. Innovative Institutional Models for Inclusive Community-Based Paratransit - ***Achmad Fauzan Iscahyonoab, Miming Miharjaa, Heru Purboyo Hidayat Putroa***

The main problem in developing community-based paratransit services for people with disabilities in Yogyakarta City is the suboptimal institutional framework due to the lack of a clear legal basis and fragmented roles among stakeholders. Although there are initiatives such as Difa Bike operated by the community of people with disabilities themselves, the legality of three-wheeled vehicles as public transportation remains debated, and the regulatory process is slow, thus limiting the accessibility and sustainability of services. This condition has an impact on the limited participation of people with disabilities in social and economic life due to mobility barriers that have not been systematically addressed. This study aims to explore and analyze the institutional model in the development of community-based paratransit services for people with disabilities in Yogyakarta City. The main focus is to map the stakeholder network and uncover the main obstacles in the governance of community paratransit service development. This study is expected to provide strategic recommendations to strengthen governance and encourage the creation of an inclusive and sustainable transportation system. The methodology used is an exploratory approach with an emphasis on qualitative methods. Primary data were collected through semi-structured interviews using purposive and snowball sampling techniques with relevant stakeholders, as well as direct field observations. Data analysis was conducted using Social Network Analysis (SNA) to map the network structure and influence between actors and content analysis to identify key barriers from documents, reports, and interview results. The development of community-based paratransit for people with disabilities can be implemented consistently with the implementation of a government system that supports the local cultural value of "Guyub". In terms of trust, the involvement of the Ngayogyakarta Palace as a government system in Yogyakarta under the leadership of Sultan HB X is not only symbolic but also provides a foundation for Javanese cultural values, such as "guyub" (togetherness), mutual cooperation, and tolerance, which strengthen public acceptance of this inclusive transportation innovation and make the implementation of community-based paratransit development for people with disabilities able to be carried out effectively. In terms of norms, both written and unwritten, they play a role in preventing conflicts between actors involved in the development of community-based paratransit for people with disabilities and also serve to strengthen relationships between actors. In terms of the network aspect, the occurrence indicates the involvement of various inclusive groups, including people with disabilities. This collaboration not only provides practical solutions to transportation accessibility

issues but also transforms the societal paradigm regarding people with disabilities from objects of assistance to productive and contributing subjects. This institutional model can serve as a blueprint for developing inclusive transportation in other regions, with adaptations to suit their respective local characteristics.

72. The Influence of Entrepreneurial Orientation, Leadership, and Opportunity Recognition on Innovation and Sustainable Growth in Digital F&B SMEs – *Rava Attala Putra Pratista, Muhammad Narmada Diantha, Stefanus Martinus, Shelvy Kurniawan*

The swift expansion of digital Food & Beverage (F&B) SMEs in devel-oping nations such as Indonesia need a deeper comprehension of the el-ements that propel innovation and long-term expansion. The impact of Entrepreneurial Leadership (EL), Entrepreneurial Orientation (EO), and Entrepreneurial Opportunity Recognition (EOR) on innovation is ex-amined in this study, as is the relationship between innovation and sus-tainable growth in digital F&B SMEs. The study employed a quantita-tive research methodology, employing structural equation modeling (SEM) to examine the correlations between variables using survey data gathered from digital F&B SMEs in Indonesia. According to the find-ings, EO, EL, and EOR all significantly boost innovation, which is a key mediator in fostering sustainable growth. The results show that SMEs are more likely to innovate successfully and experience sustained growth if they cultivate entrepreneurial attitudes, leadership skills, and opportunity recognition abilities. By incorporating these constructs in-to a comprehensive model within the context of digital SMEs, especially in emerging markets, this research theoretically adds to the literature on entrepreneurship and innovation.

73. An Analytical Study on the Determinant Evolution of Art Deco Architectural Styles in Kuala Lumpur - *Rafidah Meor Mostafa, Nurul Aishah Ghazali, Mainur Sofiyah*

This study investigates the determinant evolution of Art Deco architectural styles in Kuala Lumpur, focusing on the socio-cultural, economic, and technological factors that shaped its development from the 1920s to the post- independence era. Through a qualitative analytical approach, selected Art Deco buildings within the city's heritage zones are examined to identify stylistic characteristics, material applications, and contextual influences. Archival records, architectural drawings, and field observations are analyzed to trace the adaptation of global Art Deco trends into a localized design language that reflects Malaysia's multicultural identity and emerging modernity. The findings reveal that Kuala Lumpur's Art Deco architecture style demonstrates a transitional evolution from classical geometric motifs to streamlined modernism influenced by industrial progress, colonial governance, and local craftsmanship. This research enhances understanding of

the unique architectural heritage embedded in Kuala Lumpur's urban fabric and emphasizes the importance of conservation efforts to safeguard these cultural assets for future generations.

74. Digital Test Database Design Based on Backward Chaining as a Measuring Tool for Students' Critical Thinking in a Differentiated Learning Environment - *I Putu Wisna Ariawan, Luh Putu Eka Damayanthi, P. Wayan Arta Suyasa, I Nyoman Indhi Wiradika, Ni Made Sri Mertasari and Dewa Gede Hendra Divayana*

The objective of this investigation is to present a database design for digital tests. The design utilizes the backward chaining methodology. It serves as an instrument for evaluating students' critical thinking in a differentiated learning environment as an instrument for evaluating students' critical thinking within differentiated learning environment. The development model employed in this research follows the Borg and Gall framework. For the 2025 research period, the development phases specifically concentrate on database design creation, preliminary testing procedures, and refinement activities based on preliminary test outcomes. Forty-two respondents participated in obtaining data through preliminary trials of the backward chaining-based digital test database design. The forty-two respondents included two specialists: one in informatics and one in education. The final composition was completed with evaluations from ten educators and thirty learners. Questionnaires served as the data collection instrument for preliminary trials. he study results were processed using a comparative analytical technique. This involved assessing the preliminary trial outcomes of the backward chaining-based digital test database design. The assessment was done against quality benchmarks derived from a five-level measurement scale. Study outcomes revealed that the backward chaining-based digital test database design quality falls within the satisfactory category. The implications of these findings involve transforming digital tests from mere scoring mechanisms into intelligent partners capable of diagnosis and prescription, with inference procedures executed by machines following expert-validated rules, consequently minimizing subjective biases that humans might introduce.

Construction Science

75. A Comparative Analysis of Construction Tendering Practices in Indonesia Under Presidential Regulation No. 1of 201and Presidential Regulation No. 1of 2021 – *Ratih Dewi Shima, Assyfa Indah Larasati*

Construction works constitute a crucial sector in Indonesia's economicdevelop-ment. The realization of infrastructure projects is financed through the State Budget (APBN),

necessitating strict oversight of public procurement. To ensure transparency, accountability, and good governance, procurement activities are regulated under Presidential Regulation No. 16 of 2018 and subsequently amend-ed by Presidential Regulation No. 12 of 2021. This study employs a descriptive quantitative method with purposive non-probability sampling. Data were ana-lyzed using the Likert scale, with validity tests conducted through Pearson Corre-lation and reliability assessed by Cronbach's Alpha. Hypothesis testing utilized linear regression analysis. The analysis emphasizes three legal dimensions of construction tendering: efficiency of procurement implementation, prevention of fraudulent practices, and adherence to binding regulatory frame works, examined comparatively between the 2018 and 2021 regulations. The findings reveal that the regulatory framework under both Presidential Regulations demonstrates no substantial difference in mitigating fraudulent practices. However, significant changes are evident concerning compliance with applicable legal provisions, where the enactment of Presidential Regulation No. 12 of 2021 reinforces adher-ence to procurement laws compared with its predecessor. This highlights the evolving normative framework of public procurement law in Indonesia, strengthening governance in the construction tender process.

76. Optimization of Reinforced Concrete Column Sections Using Python – *Kamaludin, Bernat Ahmad Patria Syafiuddin*

Efficient and safe reinforced concrete column design requires calculations capable of optimizing dimensions and reinforcement quantities without compromising structural strength. This research develops a Python based application with a graphical user interface (GUI) using the Flet library to automatically analyze and optimize reinforced concrete column cross-sections. The application is equipped with nominal capacity and design calculation features, interaction diagram visualization, and reinforcement layout visualization. Optimization is performed iteratively based on strain compatibility analysis and SNI 2847:2019 provisions. Testing was conducted through five loading case studies, including variations in the number of full water tanks, column dimensions, and loading configurations. Research results show that the application produces column designs with symmetrical reinforcement distribution, minimum cross-sectional area, and load ratios approaching 1. Result validation using SpColumn software shows good agreement. This application can beused as a practical tool in reinforced concrete column planning.

77. Modelling of Reinforced Slope Stability Analysis With Sustainable Material Recycled Plastic Pin Using 3D Modeling Approach - *Indra Noer Hamdhan, Rahma Welan Ulfaida, Aurora Dwipantara, Tasya Kamila Rachman*

Unstable slopes frequently occur under diverse geological and geotechnical conditions and may develop into landslide hazards when not properly addressed. To

mitigate such risks, appropriate reinforcement measures are essential to enhance overall slope stability. In line with sustainable engineering principles, the use of Sustainable Material Recycled Plastic Pin has emerged as an environmentally responsible reinforcement option, utilizing recycled plastic waste while supporting sustainable geotechnical practices. This study investigates the improvement in slope stability achieved through the application of Sustainable Material Recycled Plastic Pin on an existing slope exhibiting a factor of safety ≤ 1.5. The stability assessment is performed using a three-dimensional finite element modeling approach.

The modeling results demonstrate that the application of Sustainable Material Recycled Plastic Pin effectively increases slope stability across various reinforcement lengths, installation configurations, and inclination angles. The most effective arrangement for slope ratios of 1:1, 1:1.5, and 1:2 consists of 15-m-long reinforcement pins installed in a rectangular pattern comprising eight elements inclined at 30°, resulting in an increase in the safety factor of approximately 27%–45%. These findings confirm that the use of Sustainable Material Recycled Plastic Pin not only provides significant technical benefits but also advances sustainable geotechnical engineering through the reutilization of recycled materials and the reduction of environmental impact.

Disaster Triangle Analysis

78. Comparison Spatial Models of Flood Potential in the Citarum (West Java) and Poso (Central Sulawesi) Watersheds – *Dian Noor Handiani, Aide Heriati, Eka Wardhani*

Mitigation and flood management in a watershed (DAS) require a spatial model of flood potential that matches field conditions. In the first year of our research, two flood potential models were studied in the Citarum River Basin (West Java) and the Poso River Basin (Central Sulawesi). Flood potential was mapped using seven parameters: elevation, slope, precipitation, geology, soil type, land use, and distance to streams. Each parameter was weighted using the Analytical Hierarchy Process (AHP) method, and pairwise comparisons for weighting were derived from historical flood occurrences in high- and very-high-vulnerability areas within each DAS. Preliminary results indicate that flood potential in the Poso River Basin is concen-trated in lowland areas near Lake Poso in the north, including Paloma and Lore Villages, as well as in several locations around the downstream area, such as Poso City. By contrast, in the Citarum River Basin, flood potential is mainly near built-up areas along the river, including Bandung and Karawang Regencies. Field observations in the downstream Citarum, specifically in Karawang Regency, show a high erosion process along the coast. Overall, the interaction between inland (upstream) and coastal (downstream) areas contributes to the complexity of flood disaster management in the Citarum River Basin. These findings underscore the need for integrated flood mitiga-tion

strategies that consider both spatial variability and upstream-downstream dynamics across different watersheds.

79. Monitoring of Volcanic Deformation Using DInSAR Case Study: Mount Merapi, Mount Sinabung, Mount Ijen, and Mount Awu) – *Soni Darmawan, Rika Hernawati, Nadya Luthfiyah Amalia*

Indonesia hosts 127 active volcanoes and is geographically positioned along the Pa cific Ocean Plate within the Pacific Ring of Fire. While volcanic presence brings environmental benefits, it also poses significant eruption hazards. Monitoring volcanic activity is essential for determining status levels from normal to alert, enabling authorities to implement preventive measures or evacuations. This study aims to employ Differential Interferometric Synthetic Aperture Radar (DInSAR), a remote sensing technology utilizing satellite radar imagery, to monitor volcanic deformation. Sentinel-1 imagery was processed through cloud-based DInSAR processing via the ASF Alaska platform. Deformation monitoring was conducted on Mount Merapi, Mount Sinabung, Mount Ijen, and Mount Awu during 2019-2024. The results of this study were that Mount Merapi exhibited inflation (ground uplift) averaging 0.00548 m (2019), 0.02110 m (2020), 0.03404 m (2023), and 0.03215 m (2024), with deflation (ground subsidence) of -0.02478 m (2021) and -0.05256 m (2022). Mount Sinabung showed inflation of 0.00159 m (2019), 0.02261 m (2020), 0.01156 m (2023), and 0.01825 m (2024), with deflation of -0.03046 m (2021) and 0.04550 m (2022). Mount Ijen experienced inflation in 2020 (0.01262 m), 2022-2023 (0.00122 m), and 2024 (0.01106 m), with deflation in 2019 (-0.02246 m) and 2021 (-0.03786 m). Mount Awu demonstrated inflation across 2019-2021 and 2023-2024, with deflation in 2022 (-0.05255 m). These deformation patterns correlate with recorded volcanic activity data, demonstrating DInSAR's effectiveness for volcano monitoring.

80. Local Community and Tourist Awareness of Rip Current Hazard in Pangandaran Beach – *Yessi Nirwana Kurniadi, Fitri Suciaty,Dr.Eng,*

This research was conducted to gain understanding of awareness, atti -tudes, and actions of local community and tourists regarding rip currents hazard at the Pangandaran Beach. Regional Board for Disaster Management presents a high risk of drowning at coastal area and the number increasing during holiday. The research method uses a quantitative approach with the distribution of question naires to 100 respondents consisting of local com-munity and tourists. The research results show that over 80% of local com-munity are aware of the dangers of rip currents, with 90% answer that rip currents are dangerous. However, only about 60% of respondents truly un-derstand the characteristics of rip currents and know how to save themselves when caught in this current. From behaviour and action perspective, both local communities and tourists show positive tendencies, with more tourists in terms of numbers being concerned about safety, while local communities

are more consistent percentagewise due to their proximity to the coastal en-vironment. The findings of this study show a clear difference in the levels of knowledge, attitude, and action related to rip current hazard awareness. This pattern highlights the need for strengthening community education, improv-ing access to rip current hazard-related information, and providing more hands-on preparedness activities such as drills, simulations, and step-by-step training by stakeholder. Enhancing knowledge is likely to increase the com-munity's and also tourist confidence and practical ability to perform preparedness actions.

81. Tidal Flood Hazard Potential Level in Tanjungpinang City - *Aria Bagiasa Chidmahdjati, Arie Afriadi*

Tidal Flooding occurs annually along the coast of Tanjungpinang City due to rising sea levels. If it continues, it may affect social and economic activities, damage infrastructure, and lead to changes in physiography. This study aims to determine the level of tidal flood hazard potential. The parameters used in this research include distance from the shoreline, land elevation, slope gradient, and land cover. The analysis techniques applied are scoring, weighting, and overlay using Geographic Information System (GIS). The results show that 6.25% of the total area is located within 0–100 meters from the shoreline, 46.77% of the area has a land elevation of 1–7 meters above sea level, 54.43% has a slope of less than 8%, and residential land cover accounts for 27.24% of the total area that is directly susceptible to tidal flood hazards. Furthermore, the sub-district with a very high and high hazard level is West Tanjungpinang, accounting for 68.84% of its total area. Meanwhile, the sub-district categorized as having very low and low hazard levels is East Tanjungpinang, covering 65.72% of its total area. It can thus be concluded that areas within 0–100 meters from the coastline, with a land elevation of 1–7 meters, slope gradient of less than 8%, and residential land cover are regions with a very high potential hazard level of tidal flooding in every sub-district of Tanjungpinang City.

82. Evaluation of Early Release Strategies at the Pamukullu Dam for Peak Flood Discharge Reduction - *Andhika Wicaksono Sasongko*

This study evaluates early release strategies at the Pamukullu Dam to reduce peak flood discharge and enhance downstream flood safety. Design flood hydrographs for retum periods of 2 to 100 years were generated using the HEC-HMS hydrological model, incorporating the SCS Curve Number method for rainfall-runoff transformation. Rainfall inputs were obtained from GPM satellite precipitation data and calibrated with limited available ground observations, demonstrating the feasibility of using satellite-based rainfall products in data-scarce regions. Simulated discharges were further calibrated using observed water level data at the dam to increase the reliability of flood estimation. Several early release scenarios were then assessed using the dam's bottom outlet to create

additional reservoir storage prior to major storm events. The results show that controlled early release significantly reduces peak inflow to the reservoir, allowing the 50-year flood (Q50) to be attenuated to levels that can be safely conveyed by the downstream river channel. Overall, this study highlights the effectiveness of proactive reservoir operation and provides a practical framework applicable to other watersheds with limited ground-based rainfall data.

83. Flood Peak Reduction Through Early Release at Pamukullu Dam: A Hydrological Modeling Approach for Data-Scarce Regions - *Andhika Wicaksono Sasongko, Djelia Fitirani*

Flood mitigation in regions with limited ground-based rainfall data poses significant challenges for reservoir operators. This study investigates the effectiveness of early release operations at the Pamukullu Dam as a strategy to reduce peak flood discharge under data-scarce conditions. Design flood hydrographs for return periods of 2 to 100 years were generated using the HEC-HMS hydrological model with the SCS Curve Number method, supported by GPM satellite rainfall data that were calibrated against the available ground observations. Modelled discharges were further calibrated using observed reservoir water level records, ensuring reliable representation of flood events. Several early release scenarios through the dam's bottom outlet were evaluated to increase reservoir storage prior to incoming storms. Results indicate that controlled early release can substantially attenuate peak inflows, enabling the 50-year flood (Q50) to be safely conveyed by the downstream river channel. The findings demonstrate that satellite-driven hydrological modeling, combined with proactive reservoir operations, can provide an effective flood reduction framework for watersheds with limited hydrometeorological data.