Advancing Green Growth through Innovative Engineering Solutions

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In some countries, the rules about how to grow their economy are changing. They are focusing more on green economic growth to develop despite global uncertainties. Green growth means changing current industries and creating new eco-friendly ones. Figuring out how to do this well is a big question, like a billion-dollar question. The answers depend on each country's economy, industries, location, people, resources, technologies, relationships with other countries, money, and politics.

We're shifting towards materials that are low in carbon and can be recycled in various products, such as plastics, packaging, and textiles. Achieving this requires innovative methods for manufacturing, designing products, and running businesses smartly. This involves developing new items with low-carbon materials like steel, aluminium, and concrete. When constructing highly energy-efficient buildings with no net emissions, we must use materials that can be recycled, effectively manage temperature, and employ digital technology to reduce both the initial and ongoing carbon footprint.

More and more people moving to cities means there's a good chance for new and smart ideas in engineering and design to grow. These ideas are important because they help make cities sustainable and build important things like data centers and the latest tech. The many different digital technologies we use today are a big part of making green growth happen. They help with ideas that recycle and are good for the environment in our tech stuff.

Human activities, urbanization, and climate change contribute to biodiversity loss. Engineering approaches, such as habitat restoration, conservation planning, and sustainable land use practices, are crucial for preserving and restoring ecosystems. The increasing frequency and intensity of extreme weather events require innovative

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engineering solutions for disaster preparedness, early warning systems, and resilient infrastructure to minimize the impact of natural calamities on communities.

Degraded land and deforestation can be addressed through reforestation, afforestation, and sustainable land management practices. Engineering solutions may involve soil conservation, watershed management, and the restoration of degraded landscapes.

Overfishing, pollution, and climate change threaten marine ecosystems. Engineering interventions, such as marine protected areas, sustainable fishing practices, and the restoration of coral reefs, contribute to the preservation and rehabilitation of marine environments. Urbanization often disrupts natural ecosystems. Sustainable urban planning, green infrastructure, and smart city technologies are examples of engineering solutions that can help restore and enhance urban ecosystems while fostering a balance between urban development and environmental conservation.

Transforming food and farm waste into valuable materials presents an eco-friendly growth opportunity. This aligns with the concept of a circular economy, where waste is considered a resource that can be repurposed. Recycling and repurposing waste contribute to resource efficiency by reducing the environmental impact associated with disposal. It can also lead to the development of new industries and markets for recycled materials. Converting waste into valuable materials supports environmental sustainability by minimizing the generation of pollution and reducing the pressure on natural resources.

The concept of a circular economy involves minimizing waste and maximizing the reuse and recycling of materials. Digital technologies play a crucial role in enabling circular economy practices for electronic waste (e-waste) by improving the efficiency of collection, sorting, and recycling processes. Advanced sorting and segregation technologies contribute to resource recovery from e-waste. Precious metals, rare earth elements, and other valuable materials can be extracted and reused in the production of new electronic devices, reducing the need for virgin materials.

Digital technologies can be employed to create labelling systems that provide information about the components and materials used in electronic devices. This facilitates efficient sorting and recycling by providing essential details for automated processes. These machines allow users to return used electronic devices for recycling in exchange for incentives or discounts. By incorporating digital technology, these machines can identify and sort different types of devices, ensuring that each component is properly handled during the recycling process. Automated robotic systems equipped with artificial intelligence and computer vision capabilities can efficiently sort and segregate various components of e-waste. This not only improves the accuracy and speed of the recycling process but also reduces the manual labour required.

The adoption of digital technologies in e-waste management creates opportunities for skilled jobs related to the development, implementation, and maintenance of these technologies. This includes roles in robotics, artificial intelligence, data analysis, and software development. As e-waste recycling processes become more sophisticated and automated, new jobs are likely to emerge in the recycling industry. These jobs may include positions related to the operation and maintenance of recycling facilities, as well as roles in research and development for innovative recycling technologies. The emphasis on sustainable practices in e-waste management contributes to the growth of the green technology sector. This sector can generate employment in various fields, including renewable energy, waste management, and environmental consulting.

Green growth starts with using certain technologies. To make it happen, we need to come up with better engineering ideas, use eco-friendly infrastructure, invest in sustainable practices, make the market encourage green choices, improve our workforce skills, try new

business approaches, and get people to make greener choices. When a country does all these things, it can grow in a green way and not fall behind others in the world who are also trying to be environmentally friendly.

This Quality in Research (QiR) International Conference aims to be an international meeting to discuss the role of science and technology in the 21st century, with a special focus on human life and a sustainable environment. The main objective of conference is to open a worldwide discussion on the role of sustainable technologies and green policies in achieving Net Zero Emissions, especially in Indonesia.

In this special edition, IJTech's editors-in-charge in the respective fields of study have selected 20 Papers from the International Conference on QiR 2023, 23-24 October 2023, at the Hilton Bali Resorts, Nusa Dua, Bali, Indonesia "Navigating the Pathway to Achieve Net Zero Emission through Green Technologies and Policies".

The first paper, authored by R. Khoirunisa, A. Mushfiroh, and A. Gamal, focuses on identify the lack of synergy among the actors and limited youth participation, thereby worsening challenges in sustaining the funding and the challenges in the innovation ecosystem of West Java, Indonesia. This paper formulate tailored recommendations for each actor in innovation ecosystem. This aimed to enhance innovation productivity emanating from Higher Education Institutions (HEIs) and other important actors.

The second paper, authored by R.T. Dewa, A. Aulia, S.-J. Kim, and R. Akbar, identified Alloy 617 as a potential material for defense applications, particularly in military air platforms. This paper presents the impact of strain rate on Alloy 617 properties during low-cycle fatigue (LCF) at room temperature (RT). LCF resistance of Alloy 617 is found to be time-dependent. It is recommended that the factor of safety must be considered in the designing phase to evaluate the fatigue life.

The third paper by A. Kholil, G. Kiswanto, A.A. Farisi, and J. Istiyanto, argue to optimize lattice structure design by changing the size of unit cell at a constant volume. Finite Element Analysis (FEA) was conducted by applying static loading at one end of the surface from x, y, z-axis, and combination of model, using Inconel 625 additive manufacturing. Deformation and stress behavior were influenced by the smallest cross-sectional area and shape of the unit cell, as shown by the relationships within lattice structure models and the printed part of model showed poor surface quality, particularly on the overhanging part.

The fourth paper by M. Sari, M. A. Berawi, S. P. Larasati, S.I. Susilowati, B. Susantono, and R. Woodhead, argue to develop a predictive machine learning (ML) model using Industry 4.0 technological advancements to optimize HVAC system design that meets IAQ parameters in Indonesia healthy building (HB). The cooling load and the chiller-type prediction models had a relative error of 1.11% and 3.33%. Meanwhile, air handling unit (AHU)-type and filter area predictive model had a relative error of 10% and 1.22%, respectively.

The fifth paper by W. Xu, M. Luis and B. Yuce, present a hybrid method that combined the crow search algorithm for binary optimization (BinCSA) with an exact method to solve a closed-loop supply chain (CLSC) problem, including location allocation, transportation, and supplier selection challenges. This study successfully applied BinCSA to address the facility location problem in the proposed MILP model for the CLSC. However, limitations included BinCSA solving impractical the uncapacitated facility location problem (ULFP) and challenges in tuning parameters at the initial stage.

The sixth paper by B. Ryan, D.N. Bristow, argue to evaluate the significance of hygrothermal analysis and the advancements in assessment methods for climate effects on hygrothermal performance of building envelopes based environmental loads, timber and wood-frame, masonry walls assemblies, as well as performance criteria and assessment

method. An approach based on System Dynamics was proposed to create a structured and integrative tool capable of explicitly capturing factors affecting building system performance under climate change. It enabled the identification of climate impacts on envelopes system and an improved comprehension of desirable hygrothermal responses in building materials through adaptive measures.

The seventh paper by Husnawati, K. Kusmardi, R. Kurniasih, A.E.Z. Hasan, D. Andrianto, H. Julistiono, B.P. Priosoeryanto, I.M. Artika, and M.N. Salleh, argue to identify the active compounds in *Phomopsis* extract and predict anti-breast cancer mechanism through the human epidermal growth factor receptor 2 (HER2) inhibition using Molecular Docking (MD) and Molecular dynamic simulations (MDS). Based on these results, 3-[(4-hydroxyphenyl)methyl]-octahydropyrrolo[1,2-a]pyrazine-1,4-dione was identified as a promising HER2 inhibitor for breast cancer.

The eighth paper by R.A. Machfudiyanto, L.S. Riantini, T.S.N. Rachmawati, A.D. Rarasati, M.D.A. Rachman, focuses to analyze the effectiveness of different insulation types and roof covering in improving the energy-saving performance of office building. The results showed that the addition of insulation to roof through Insight 360 and the replacement of roof covering layers produced an energy reduction of 19.5% to 20.2% and 19.5% and 23.5%, respectively. The implementation of green roof in scenario B3 with criteria implementing green roof was selected as the most promising renovation option, achieving 23.5% reduction in energy consumption.

The ninth paper by A.T. Bilqis, A. Abdillah, S. Jahroh, A. Abdullah, F. Dewi, B. Tjahjono, I. Rakhmani, and C.R. Priadi, focus to measure waste generation and implement anaerobic digestion with a TORBI rector in traditional boarding school *at Al Hikam Boarding School*. This produced biogas volume and methane yield of 805±219 L/day and 292±130 L.CH$_4$/kg.VS, with an initial potential reduction factor of 54%. The gas was composed of methane and carbon dioxide, with a concentration of 59±0.035% and 41±0.035%.

The tenth paper by J.M. Santos, E. Anit, C.M. Ramos, N. Bugtai, A. Sy, N. Roxas, and F. Munsayac III, focus to present a sequential model based on feedforward neural network as this is arguably the simplest algorithm developed and requires minimal computing power. The results showed that training the algorithm for 1000 epochs yielded the best results. The developed model successfully distinguished between Atrial Fibrillation (AFib) and non-AFib patients with a 96.67% sensitivity, 94.61% specificity, and 95.64% accuracy.

The eleventh paper, authored by H.A. Nugroho, A. Subiantoro, and B. Kusumoputro. This paper reported the performance of Ensemble Deep Learning Nonlinear AutoRegressive (NARX) system, regarding earthquake occurrences estimation in the subduction zone (Sunda Strait, Southern Java, and Bali Regions). The Ensemble Deep Learning NARX system outperforms individual model and traditional method, yielding a significantly improved estimation performance. The valuable insights for seismic hazard assessment, facilitating the development of proactive measures for earthquake mitigation and preparedness in regions were obtained.

The twelfth paper, authored by N.A. Madani, R.W. Purnamaningsih, N.R. Poespawati, M. Hamidah, S. Rahardjo, and D.K. Wibowo. This paper reported the detection of low hydrostatic pressure, serving as the foundation for developing an underwater pressure sensor. The experimental results showed a consistent linear relationship between low hydrostatic pressure and Bragg wavelength, implying a sensitivity of 0.8092 pm/Pa, according to theoretical expectations. Meanwhile, the simulation results showed as the temperature rose, there was a corresponding increase in the reflected wavelength difference by 5.3754 $\times 10^{-9}$ nm/Pa for every 1°C increase in seawater temperature.

The thirteenth paper, authored by I.N. Hartono, A.D. Setiawan, A. Hidayatno, and M.P. Dewi. This paper present to analyze uncertainty factors to provide knowledge and information regarding significant obstacles in developing geothermal energy in Indonesia using Exploratory System Dynamics Modelling and Analysis (ESDMA) method. The results showed that four uncertainty factors have significant influence on the achievement of geothermal development in terms of total installed capacity, total revenue, and profit. Delay due to bureaucracy, social acceptance, exploration duration, and exploration permit processing time had 68% influence on total installed capacity and profit. Meanwhile, electricity price had 44% impact on total revenue.

The fourteenth paper, authored by M.A. Puspasari, S.T. Madani, B.M. Iqbal, E. Muslim, B.P. Sanjaya, C.Y.P. Pribadyo, K.N. Junistya, A. Ghanny, D.H. Syaifullah, and S.A. Arista. This paper designed a model to assess the effect of road distraction, driving behaviour, and perception of risk on self-reported crashes by private car drivers in Jakarta, Indonesia, as well as formulate strategies to improve safety. A combination of quantitative methods, such as Partial Least Squares Structural Equation Modelling (PLS-SEM) and Pearson's Chi-square tests, complemented by questionnaire instruments such as the Driving behaviour Questionnaire (DBQ), Road Distractions Scale (RDS), and Risk Perception and Regulation Scale (RPRS) were used. This study offered strategic recommendations with the potential to lower accident rates and improve driving safety overall.

The fifteenth paper, authored by R. Ardi, S. Nurkamila, D.L. Citraningrum, and T.N. Zahari. This paper presented a robust optimization model for the management of plastic waste within the reverse logistics system in Jakarta. The results showed that the model could accurately identify optimal facility locations and determine the exact quantity to transport between facilities while considering social, economic, and environmental factors. The results also showed that the proposed model minimized cost at Rp 5.145.970.048.160,202, reduced gas emissions to 625.556.333,281 m^3 (ca. 1.238.601.540 $kgCO_2$) and maximized labor at 611.155,845 people.

The sixteenth paper, authored by S. Herbirowo, A.H. Yuwono, N. Sofyan, A. Imaduddin, A.W. Pramono, S. Supriyadi, and J.J. Mohamed. This paper investigated the use of the hot working in a sealed tube method for the production of MgB_2 wires from a powder state. The diffraction pattern and microstructure results showed that MgB_2 phase was successfully created using economically advantageous raw materials of crystalline Mg and amorphous B with 60% filling density. The R-T cryogenic magnet assessed the sample of critical temperature, and MgB_2 produced using full amorphous boron had a transition temperature of 39 K.

The seventeenth paper, authored by D. Nauphar, R. Irham M.A., G.S. Brajadenta, and T.M. Pratamawati. This paper examined the association between ADIPOQ gene polymorphism in patients with type 2 diabetes mellitus (DM) and insulin resistance level. The results showed that the genotype frequency of SNP in the case group was GG = 12 (40%), GT = 16 (53.33%), TT = 2 (6.67%). Meanwhile, in the control group, it was observed to be GG = 18 (60%), GT = 11 (36.67%), and TT = 1 (3.33%). Statistical analysis showed a significant association between +276 G/T polymorphism and type 2 DM. This concluded that individuals with polymorphism are at higher risk of developing type 2 DM.

The eighteenth paper, authored by R.W. Hakim, R.C. Putri, W. Fachri, F. Fadilah, D.G.B. Krisnamurti, R. Fitriani, E.H. Hakim, and D. Wulansari. This paper reported a molecular docking was conducted on PD-1 (PDB ID: 57w9) and PPAR-γ (PDB ID: 5two) human proteins. Both Chalcomoracin and Guangsangon E are bound to PD-1 and PPAR-γ, suggesting potential significance in breast cancer pathogenesis. While Morushalunin

exclusively interacted with the PD-1 protein. These indicated the potential of the compound to relate with PD-1 and PPAR-γ, key proteins in breast cancer pathogenesis.

The nineteenth paper, authored by R.W. Nurhayati, A.L. Laksono, A. Salwa, A.I. Pangesty, Y. Whulanza, and W. Mubarok. This paper reported the effect of Human umbilical cord blood serum (UCBS) and platelet-rich plasma (PRP) coatings on the mechanical properties, cytotoxicity, and cell attachment ability of Poly(ε-caprolactone) scaffolds. Coating scaffolds with UCBS generated a significantly lower Young's modulus (0.20 MPa) compared to non-coated counterparts (0.27 MPa), while PRP-coated scaffolds showed no substantial change (0.24 MPa). Both UCBS and PRP coatings significantly increased ($p<0.05$) the viability and attachment of primary human fibroblast cells on scaffolds, showing the potential to enhance PCL cytocompatibility for artificial skin.

The twentieth paper, authored by C. Ratri, T.B. Aguta, A.H. Arundati, R. Rohib, M. Chalid, S. Astutiningsi, and A.F. Nugraha. This paper reported the effect of solvent fraction in an acetone-water system on the membrane morphology. The results showed that the mechanical properties of cellulose acetate (CA) membranes are higher than those of commercial Celgard membranes (1.42 MPa). CA membrane fabricated with 50% acetone content in the coagulation bath possessed the highest ionic conductivity, 4.79×10^{-4} S/cm, which is higher than the ionic conductivity of the Celgard membrane (9.41×10^{-7} S/cm). Considering their superior mechanical properties and electrical performance, CA membranes could potentially substitute Celgard as a more sustainable alternative for Li-ion battery (LIB) separators.

To sum up, the papers from the QiR International Conference 2023 that are featured in this special edition of the International Journal of Technology (IJTech) provide a thorough and perceptive examination of a variety of subjects linked to sustainability, science, and technology. Every submission offers insightful viewpoints and creative solutions that highlight the worldwide efforts to overcome obstacles and find a method to achieve Net Zero Emissions. The conference's facilitation of collaboration and knowledge exchange highlights the significance of international discourse in establishing a sustainable future for human existence and the environment.

With warmest regards from Jakarta,

Prof. Seeram Ramakrishna	Dr. Eny Kusrini	Dr. Retno Wahyu Nurhayati	Prof. Dr. Yudan Whulanza
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