



VINUNIVERSITY

OPEN INNOVATION CONFERENCE

Hanoi, Vietnam

OIC CONFERENCE PROCEEDINGS



2024 THEME: INNOVATION FOR A GREEN FUTURE

SCIENCE AND TECHNICS PUBLISHING HOUSE





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PREFACE

The 1st Open Innovation Conference (OIC), held on December 6-7, 2024, in Hanoi, Vietnam, marked a significant milestone in the collective international effort to foster innovation for a sustainable future. With its theme, “*Innovation For a Green Future*”, the conference brought together over 250 authors and experts from 12 countries to present cutting-edge research and innovative solutions across diverse sectors, including tourism, healthcare, education, urban development, transportation, and agriculture. It provided a unique opportunity for global collaboration in addressing the environmental challenges of our time.

Founded by VinUniversity in collaboration with the Ministry of Science and Technology of Vietnam, Saïd Business School at Oxford University, the SC Johnson College of Business at Cornell University, and the Center for International Development at Duke University, OIC 2024 emphasized the importance of global cooperation and knowledge exchange in advancing sustainable development.

The conference focused on green transformation strategies, from policy to practice, highlighting the critical role of innovation in mitigating climate change and promoting sustainable economic growth. The papers presented at the conference addressed national policy deployment at industry, provincial, and corporate levels, contributing to green development at local, national, and global scales.

This year’s conference received 96 submissions, with 56 papers passing the double-blind review process. Of these, 31 papers were selected for publication in the proceedings, representing some of the most forward-thinking research and innovations in green technologies, policies, and practices. These proceedings reflect the latest advancements in green innovation and sustainability across multiple disciplines.

The proceedings are organized into five sections:

1. **Institutional Environments and Government Policies** (4 papers) - Examining policies and reforms necessary to support green transformation, including national strategies and regional energy-saving initiatives, with a focus on industry, provincial, and corporate-level policy deployment.
2. **People & Education for Innovation and Green Growth** (4 papers) - Exploring the role of education, digital leadership, and AI in driving sustainable growth and innovation, and how these initiatives can support green transformation at various levels.
3. **Technology for Innovation and Green Transformation** (17 papers) - Highlighting breakthroughs in electric vehicles, renewable energy, and AI-driven solutions for industries like aquaculture and transportation, showcasing technological advancements that drive green growth.
4. **Business Perspective of Innovation and Green Consumption** (3 papers) - Discussing the challenges and opportunities industries face in adopting green technologies and practices, particularly in real estate, pharmaceuticals, and energy, and how corporate policies contribute to green innovation.

5. **Innovation in Healthcare and Well-Being** (3 papers) - Exploring how sustainability intersects with healthcare innovation, from digital health platforms to eco-friendly medical solutions, addressing the evolving needs of the healthcare sector in a sustainable manner.

As we move toward a future defined by green technologies and sustainable practices, this collection of research serves as both a resource and a call to action. We hope these contributions will inspire further collaboration and the development of solutions that benefit both business and the environment.

We extend our sincere thanks to all the authors, speakers, reviewers, and organizations who contributed to the success of OIC 2024. The knowledge shared at this event will help drive meaningful progress in the green transformation efforts worldwide.

Sincerely,

The Conference Organizing Committee

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SESSION I

INSTITUTIONAL ENVIRONMENT & GOVERNMENT POLICIES FOR A GREEN FUTURE



NAVIGATING INNOVATION POLICY: CHALLENGES AND REFORMS IN VIETNAM'S JOURNEY TOWARD A HIGH INCOME FUTURE

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Abstract: *Innovation is a topic of growing interest in both academic and policy circles across various countries. It is widely regarded as the key to addressing challenges related to productivity, growth, and achieving breakthrough and sustainable development at both national and enterprise levels. However, the nature, scope, and degree of innovation remain subjects of debate, with no unified understanding from either a research or policy perspective. This leads to challenges in managing innovation effectively at various government levels. As a result, institutionalizing innovation within laws and related policies has faced numerous challenges.*

This paper argues that the institutionalization of innovation within the legal framework is essential not only for effective state management of innovation but also for supporting and implementing innovation across relevant stakeholders. Vietnam serves as an intriguing case study as it is undergoing a transition with the aim of becoming a high-income country by 2045. In this context, the authors provide a comprehensive review of Vietnam's innovation-related policies and an evaluation of the current problems and challenges associated with the state management of innovation since the Doi Moi reforms of 1986. Drawing on international experiences, this paper offers recommendations for future institutional reforms aimed at promoting innovation and enhancing the effectiveness of state management of innovation in Vietnam.

Keywords: *Innovation; innovation policy; state management.*

CHARGING FORWARD: POLICY OPTIONS TO ELECTRIFY SOUTHEAST ASIA'S TWO-WHEELERS

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Abstract: Many countries aim to electrify their transportation sectors, focusing on passenger cars, to achieve environmental and energy security benefits. This paper examines how policies can influence the electrification of personal vehicles in Southeast Asian countries, where two-wheelers are the predominant choice. By combining vehicle sales data from the largest two-wheeler markets in the world with a random coefficients discrete choice model, I find that introducing existing electric two-wheelers from Southeast Asian countries into neighboring markets can triple the market share of electric two-wheelers, an effect much larger than a 20% subsidy on the purchase price. When these two policy tools are combined, the share of electric two-wheelers can increase more than fivefold, and average carbon emissions per 100 kilometers traveled can be reduced by close to 13%.

Keywords: Electrification, Developing Countries, Transportation.

CAN COMMAND-AND-CONTROL POLICY BE EFFICIENT THROUGH ACCURATE TARGETING? EVIDENCE FROM AN ENERGY-SAVING PROGRAM IN CHINA

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Abstract: *This paper studies how the effectiveness and efficiency of command-and-control policies can be achieved through accurate targeting by taking into account heterogeneous compliance costs among regulated entities. We study this question by exploiting China's "TOP 10K" energy-saving program as a quasi-experiment, which mandates major energy consuming firms to meet firm-specific caps by 2015, and the energy caps varies by local government discretion based on firm-and industry-specific characteristics. We empirically estimate firms' compliance and find varied compliance strategies on firms' output and employment. We build a structural model to back out firms' compliance costs. The structural estimates show that the shadow cost of energy-saving regulation is a function of energy regulation stringency, a firm's output elasticity with respect to inputs and capital, energy price, and the market price. With estimated model, we simulate the total welfare loss or improvement under alternative policy scenarios where policymakers trade-off market surplus and environmental externalities.*

Keywords: *Command-and-control; Policy targeting; Energy regulation.*

EVALUATING THE SUSTAINABLE DEVELOPMENT OF MARINE AND ISLAND TOURISM IN KHANH HOA PROVINCE: A SWOT ANALYSIS AND POLICY RECOMMENDATIONS

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Abstract: Khanh Hoa Province possesses significant potential and advantages for tourism development, particularly in sustainable marine and island tourism. Over the past decade, the province has become an increasingly popular destination for both domestic and international travelers. However, its tourism growth has yet to fully capitalize on its inherent strengths and opportunities. This article aims to clarify key theoretical aspects of green tourism and assess the current conditions for the development of eco-friendly marine and island tourism in Khanh Hoa. Drawing on data provided by the Department of Tourism of Khanh Hoa and a survey of 37 tour agencies and 100 hotel facilities operating within the province, this study conducts a SWOT analysis and proposes a strategic vision, along with innovative ideas and recommendations, to advance the sustainable development of the province's marine and island tourism sector.

Keywords: Marine and Island Tourism, Green Tourism; Sustainable Development; Khanh Hoa province.

SESSION II

PEOPLE & EDUCATION FOR INNOVATION AND GREEN GROWTH



REVOLUTIONIZING GREEN FINANCE EDUCATION WITH AI: A VINUNIVERSITY INITIATIVE

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Abstract: As environmental sustainability becomes a critical focus for economies worldwide, integrating green finance into education is increasingly important. This paper explores how VinUniversity, in collaboration with the German Sparkassenstiftung for International Cooperation (DSIK), is leveraging Artificial Intelligence (AI), Near Field Communication (NFC), and augmented reality (AR) to transform green finance education. The initiative utilizes AI-driven eBooks and interactive tools to create personalized and engaging learning experiences, making complex topics more accessible to students, small and medium-sized enterprises (SMEs), and policymakers. By examining this innovative approach, the paper illustrates how AI-enhanced educational methods can mainstream green finance principles, offering a scalable model for global institutions. Through a combination of digital tools and immersive learning environments, this case study highlights the significant role of technology in fostering a deeper understanding of sustainable finance and shaping future leaders in this field.

Keywords: Green Finance Education, AI in learning, VinUniversity.

DRIVING INNOVATIVE WORK BEHAVIOR OF EMPLOYEES THROUGH DIGITAL LEADERSHIP: MEDIATING ROLES OF EMPLOYEE'S DIGITAL LITERACY AND DIGITAL CULTURE IN VIETNAMESE ENTERPRISES

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Abstract: *In the context of the digital economy, innovative work behavior (IWB) is essential for maintaining competitiveness across industries. This study examines the influence of digital leadership (DL), employee's digital literacy (EDL), and digital culture (DC) on IWB in Vietnamese enterprises, with a focus on the differences across three industries: information and communications technology (ICT), manufacturing, and consumer services. A mixed-method approach was used, starting with qualitative interviews with 11 professionals to refine authors' research model and measurements, followed by quantitative surveys of 323 respondents mostly in Northern Vietnam. Survey results show that: DL directly enhances IWB and has a significant positive impact on both EDL and DC; EDL and DC both significantly contribute to increasing IWB, with DL exerting indirect influence on IWB through the mediating roles of DC and EDL; both ICT and manufacturing industries report significantly higher levels of DL compared to the services industry; EDL and DC in manufacturing industry exhibits significantly higher levels than both ICT and services industries, and no significant differences in IWB were found among the industries. Arguably, the study made a significant contribution to the literature of DL by exploring its impact on IWB in the context of Vietnamese enterprises, particularly highlighting the mediating roles of EDL and DC across industries. These findings highlight the need for investing in DL in specially in customer service industry, improving digital skills of employees, and fostering a strong DC to drive innovation in Vietnamese enterprises.*

Keywords: *Consumer services, digital culture, digital leadership, employee's digital literacy, ICT, innovative work behavior, manufacturing, Vietnamese enterprises.*

AI, INNOVATION & ENTREPRENEURSHIP EDUCATION FOR A GREENER FUTURE

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Abstract: *This case study describes a technology innovation and entrepreneurship programme that takes students from technical backgrounds (engineering, computer science, and IT) and teaches them innovation and entrepreneurial skills. Students are engaged through a practical approach, working in teams and applying skills, as they learn them, to create a pseudo-venture. Teams are guided through the process of identifying opportunities and a target market, engaging with the market to design a product, developing a product prototype, and creating a business plan.*

Students work in multi-cultural teams, enriching their learning experience. Team members come from at least two different cultural backgrounds. This not only develops cultural awareness and sensitivity, but also provides a richer range of experiences that teams can leverage when identifying opportunities and designing a product.

Keywords: *Innovation, Entrepreneurship, Education, Environment, Artificial intelligence, Machine learning.*

SESSION III

TECHNOLOGY FOR INNOVATION AND GREEN TRANSFORMATION



DIFFERENT SHADES OF GREEN ARTIFICIAL INTELLIGENCE: ESTIMATING ENERGY CONSUMPTION AND CARBON EMISSION

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Abstract: Artificial Intelligence (AI) is rapidly becoming an integral component of modern information and business systems. The capabilities of generative AI and large language models are driving digital transformation in business and services at an unprecedented pace. While the benefits of AI integration are undeniable, the resource consumption associated with these technologies is often underreported, poorly quantified, or even hidden. This paper investigates resource utilization in three research studies employing AI methodologies: a virtual educational agent utilizing AI-supported voice and video generation, a natural language processing approach for deception detection in textual corpora, and a machine learning and natural language processing technique for automated literature reviews. The study introduces and applies resource metrics specific to these approaches, providing a clearer understanding of energy consumption and carbon emission across the studies. The findings highlight the necessity for a more systematic approach to AI resource estimation and emphasize the importance of sustainable, environmentally-conscious AI practices.

Keywords: Code Energy Consumption Metrics, Code Carbon Emission Metrics, Artificial Intelligence; Generative Artificial Intelligence; Large Language Models; Computing Resource Utilization.

APPLICATION OF INNOVATIVE TECHNOLOGY TO THE SUSTAINABLE MINING VALUE CHAIN: AN EXPLORATORY CASE STUDY OF THE EMDT PROJECT

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Abstract: Critical minerals are the backbone of the green economy, e.g., renewable energy, electric vehicles, aerospace, medicine, and agriculture. However, the mining industry has high entry barriers, a complex and under-explored value chain, stakeholders with conflicting interests and agendas, and a high level of conservativeness due to governmental involvement and regulation. Subsequently, the diverse stakeholders in the mining value chains have experienced a multitude of information coordination issues, resulting in cost inefficiency and excessive resource consumption. Exploring solutions for these issues is critical since a sustainable mining industry is vital for a healthy and green economy. This study uses case study method to explore the Energy & Mines Digital Trust (EMDT) project, an initiative of the British Columbia government of Canada. The EMDT project applies innovative technologies, including distributed ledger technologies and verifiable credentials, to facilitate a trustworthy, frictionless, and secure digital data exchange between mining and energy operators. Grounded on communication and control theory, this study finds that the EMDT has effectively communicated at the micro, the meso, and the macro levels and enabled timely, reliable, and actionable information exchange. The findings suggest that by coupling advanced technologies with exemplary leadership, an ecosystem mindset, and sharing culture, the government can become a critical trust anchor in the digital ecosystem and steer the industry toward sustainable goals. These lessons are crucial for innovative projects globally, particularly in developing countries with untapped mineral potential and economic challenges. By applying these insights, they can accelerate their integration into the sustainable global minerals value chain.

Keywords: Digital trust, Mining value chain, Blockchain, Information governance, Innovative technology, Communication and control, Distributed ledger technology.

ESTIMATION OF THE NUMBER OF PEOPLE WAITING AT BUS STOPS USING DRIVE RECORDER IMAGES

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Abstract: In recent years, a shortage of bus drivers has led to the reduction or elimination of bus routes, resulting in a decline in service quality. To improve service levels, proper bus operation is essential. In order to operate additional services and create effective schedules on overcrowded bus routes where passengers cannot board due to overcrowding, it is essential to measure actual demand, specifically the number of passengers waiting at bus stops. Previous studies have proposed methods for estimating the number of people waiting at bus stops using cameras or Wi-Fi capture sensors installed at the stops. However, due to the challenges of installation and costs, it is difficult to equip all bus stops with these sensors. Consequently, such sensors are often not installed at bus stops where the number of users temporarily increases, such as during rush hours or in rainy weather, leading to the issue of failing to fully capture passengers who cannot board. In this study, considering ease of equipment installation and data acquisition, we developed an algorithm to estimate the number of passengers waiting at bus stops using two types of deep learning: object detection and monocular depth estimation from drive recorder images captured by onboard bus cameras. First, we estimated the distance and speed of pedestrians using the inference results from these two deep learning models on the in-vehicle video. Then, combining these estimates with GNSS data, we estimated the number of people waiting at the bus stops. We evaluated the estimation accuracy of the algorithm, demonstrating the effectiveness of integrating both object detection and monocular depth estimation. The evaluation results suggest potential applications in presenting estimated passenger numbers at bus stops.

Keywords: Demand estimation, Public transport, Image processing.

ADVANCING ELECTRIC VEHICLE SMART CHARGING FOR ENHANCED RENEWABLE ENERGY UTILIZATION AND SUSTAINABLE MOBILITY SOLUTIONS

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Abstract: *The global transition to electric vehicles (EVs) and renewable energy sources presents a crucial opportunity to reshape the future of mobility and energy management. This study explores the advancement of EV smart charging systems, integrating renewable energy (solar, wind) and battery energy storage solutions to optimize energy usage, reduce costs, and support sustainable mobility. Our approach leverages an Internet of Things (IoT) platform combined with advanced computational models to create a dynamic digital twin of the charging network, enabling real-time monitoring, predictive analytics, and load balancing.*

Key focus areas include the integration of solar and wind energy, optimal placement of charging stations, battery energy storage management, and user demand forecasting. Additionally, the role of AI/ML algorithms in optimizing energy flows and enhancing grid stability is explored, aiming to minimize reliance on conventional energy sources. Preliminary results indicate significant improvements in renewable energy utilization, reduction in peak grid loads, and overall system efficiency. This research demonstrates the potential of EV smart charging to foster sustainable transportation and energy ecosystems, laying the foundation for more resilient and eco-friendly urban infrastructure, specifically addressing the needs of Nha Trang as it transitions to a low-carbon future.

Keywords: *Electric vehicles, Smart charging, Renewable energy, Battery energy storage, IoT, Sustainable mobility, Grid optimization, Digital twin.*

OPTIMIZING ELECTRIC VEHICLE CHARGING WITH RENEWABLE ENERGY AND BATTERY STORAGE FOR INCREASED PROFITABILITY AND GRID EFFICIENCY

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Abstract: As the levelized cost of energy for renewable energy decreases, using renewable sources to charge electric vehicles benefits both electric vehicles charging station owners and the power grid. However, inefficient distribution of renewable energy for electric vehicles charging can lead to increased reliance on grid power. This paper compares the performance of a standard RE distribution approach from previous studies with the consensus distributed algorithm. Additionally, it explores the optimization of renewable energy and battery energy storage systems to maximize electric vehicles charging station owners' profits and examines the impact of the number of electric vehicles on these profits.

Keywords: Electric Vehicle; Photovoltaic; Small Wind Turbine; Battery Energy Storage System; Electric Vehicle Charging Station Owner.

ANALYZING THE TECHNO-ECONOMIC EFFECTS OF BESS IN PUBLIC EV CHARGING STATION WITH RENEWABLE ENERGY SOURCES INTEGRATED

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Abstract: Electrification of transportation is one of the most accessible and feasible solutions on a broad scale to green the transportation sector and it requires a large amount of electricity to meet both the travel needs and normal functions of the vehicles. Besides private charging, public charging should receive more attention to support the development of the EV market. However, public chargers mainly draw electricity from the national grid, potentially causing grid instability or reducing profits for station stakeholders. Therefore, we propose a mathematical model to analyze the impact of battery energy storage system (BESS) in charging station (EVCS) with renewable sources (RES) in both technical and economic terms, evaluating the project's viability and efficiency throughout its lifespan. The model is then solved in Python using the GLPK solver to find optimal solutions for various scenarios. The results show that grid-connected EVCSs are generally 5 times more profitable (around 2.5 million compared to 500 thousands), but environmental factors and grid stability were not considered. Due to current technological limitations, a hybrid charging station is not yet a viable investment. However, as BESS price decline by 67%, the system will become more attractive, when zero BESS integrated into standalone configuration drops from the most profitable size of BESS to the least.

Keywords: Electric Vehicle Charging Station (EVCS), Photovoltaic (PV), Small Wind Turbine, Battery Energy Storage System (BESS).

A ROBUST OPTIMIZATION MODEL FOR COST-EFFICIENT AND FAST ELECTRIC VEHICLE CHARGING WITH L2-NORM UNCERTAINTY

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Abstract: *In this paper, we propose a robust optimization model that addresses both the cost-efficiency and fast charging requirements for electric vehicles (EVs) at charging stations. By combining elements from traditional cost-minimization models and a fast charging objective, we construct an optimization model that balances user costs with rapid power allocation. Additionally, we incorporate L2-norm uncertainty into the charging cost, ensuring that the model remains resilient under cost fluctuations. The proposed model is tested under real-world scenarios and demonstrates its potential for efficient and flexible EV charging solutions.*

Keywords: *Electric Vehicles, Cost Minimization, Fast Charging, Robust Optimization, L2-norm Uncertainty.*

DIGITAL TWIN PLATFORM FOR GREEN AND SMART TRANSPORTATION

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Abstract: The global transition towards a greener and more sustainable transportation system has become a priority in addressing climate change and reducing carbon emissions. This shift brings with it an urgent need for optimized management systems capable of handling the increasing complexity of transportation networks, energy consumption, and public mobility. In this context, Digital Twin technology emerges as a promising solution, offering real-time data integration and predictive modeling to enhance the efficiency and sustainability of smart transportation infrastructures. This paper provides a comprehensive review of the applications, key technologies, and implementation strategies of Digital Twin in the Green and Smart Transportation domain. Furthermore, it highlights the challenges associated with platform selection, system modeling, data integration, and lifecycle management, emphasizing the importance of addressing these limitations for future research and development. Through this review, the authors aim to contribute to a clearer understanding of how Digital Twin can be applied to optimize transportation systems towards a sustainable and eco-friendly future.

Key words: Digital Twin, Green and Smart Transportation, Real-time Data Integration, Predictive Modeling.

HMOPSO-ES: A HYBRID MULTI-OBJECTIVE PARTICLE SWARM OPTIMIZATION AND EVOLUTION STRATEGY FOR EFFICIENT CHARGING ROBOT PATH PLANNING IN ELECTRIC VEHICLE SYSTEMS

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Abstract: Autonomous mobile robots are intelligent agents that play a critical role in various applications, including industry, agriculture, and rescue operations. In the context of electric vehicle systems, mobile robot navigation is a particularly challenging task that must be solved to enable robots to move autonomously and efficiently in working environments. This paper addresses the Multi-objective Charging Robot Path Planning (MOCRPP) problem within electric vehicle systems, aiming to find a path that is short, smooth, and safe. We propose a hybrid algorithm, HMOPSO-ES, which combines Multi-objective Particle Swarm Optimization (MOPSO) and Evolution Strategy (ES) to tackle this problem. MOPSO has good exploration but slow convergence which in turn demands great quantities of computational time as well as resources in multi-objective problems, while ES has strong exploitation. By integrating both methods, HMOPSO-ES balances exploration and exploitation, improving performance for the MOCRPP problem. The algorithm updates particle velocities and positions using ES to refine the global optimum for path planning. A Pareto dominance-based approach is used to select the best particle positions based on collision avoidance and the three optimization objectives. Simulation results demonstrate the effectiveness of HMOPSO-ES in solving the MOCRPP problem within electric vehicle systems.

Keywords: Electric Vehicle - EV, Charging Robot; Multi-objective Particle Swarm Optimization - MOPSO; Evolution Strategy - ES.

BEAMGA-GA: A NOVEL APPROACH TO COLLISION-FREE AUTONOMOUS ELECTRIC VEHICLE RECHARGING FOR ENERGY-LIMITED CHARGING ROBOT

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Abstract: Electric vehicles (EVs) are increasingly utilized for green logistics, meeting the growing demand for sustainable transportation solutions. These vehicles significantly enhance efficiency and reduce carbon footprints across various sectors, including supply chain management and urban deliveries. A promising approach is the automatic charging of these vehicles at charging stations using charging robots, thereby reducing dependence on humans. This paper addresses the problem of Collision-Free Autonomous Electric Vehicle Recharging for Energy-Limited Charging Robot (AEVR), focusing on finding an optimal and collision-free route to recharge the vehicles. We propose a novel algorithm, called BeamGA-GA, which operates in two stages: finding the optimal path between the electric vehicles and optimizing the robot's route for recharging these vehicles with energy constraint. In the first stage, Beam Search technique is used to increase diversity and improve the convergence speed of the Genetic Algorithm (GA). An energy estimation technique is proposed to guide the robot back to the charging pole for self-charging, ensuring continuous operational. Experiments conducted in various simulation environments demonstrate the effectiveness of the proposed algorithm compared to baseline schemes. This research establishes a foundation for future advancements in autonomous robotic charging systems, paving the way for more sophisticated and scalable approaches that could further enhance the efficiency and autonomy of electric vehicle charging infrastructure.

Keywords: Electric Vehicle; Charging Robot; Energy Estimation; Beam Search - BS; Genetic Algorithm - GA.

DIGITAL TWIN PLATFORM FOR BUS OPERATIONS MANAGEMENT IN KHANH HOA PROVINCE

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Abstract: Within the proliferation of big data, Digital Twin is poised to revolutionize public transportation systems, given their promising potential for comprehensive monitoring across operational cycles of the public system. Despite the growing availability of real-time traffic data, its application in bus timing predictions remains underexplored. This research addresses this notable gap by proposing a continuously synchronized digital twin model of bus routes for predictive timing profiles. Firstly, actual traffic data synergy input into the GAMA platform, and subsequently, it enables streaming calibration of running simulation scenarios. A case study in Nha Trang City (Vietnam) illustrates the model's efficiency. It also forms a foundation for future advancements of real-time predictive analytics in the application of digital twins for public transport planning, ultimately supporting more effective decision-making in the city's transport management policies.

Keywords: Digital Twin; Bus Operation Management; Bus Timing Prediction.

SCENARIO-BASED DIGITAL TWIN EVALUATION FOR VISUALIZING BUS PLANNING POLICY MEASURES

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Abstract: The accessibility of real-time traffic data offers digital twins a critical foundation for complementing conventional simulation methods in bus operations. However, there is a notable gap between Digital Twin and bus planning analysis, due to the absence of adequate models and the applicability of real-time data. Thus, this study focuses on scenario-based evaluation of the impact of transport policy in Khanh Hoa (Vietnam). Firstly, actual traffic data synergy is input into the GAMA platform, and subsequently, it enables streaming calibration of running simulation scenarios. These simulations for visualizing policy measures include, for example, expanding the bus network and adjusting bus routes to assess their impact on overall traffic flow and bus efficiency via the proposed GAMA model.

Keywords: Digital Twins, Bus planning, Public transportation, Policy evaluation, Scenario-based evaluation.

SUSTAINABLE SMART MARICULTURE SYSTEM: IOT-BASED WATER QUALITY MONITORING AND POLLUTION REDUCTION IN AQUACULTURE

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Abstract: *The sustainable development of mariculture, especially in vulnerable coastal areas, faces complex challenges related to environmental sustainability and operational efficiency. This paper introduces a comprehensive research initiative focused on creating a sustainable smart mariculture system aimed at enhancing aquaculture efficiency while reducing environmental impact. The proposed system integrates three critical components: A robust smart mariculture framework, an Internet of Things (IoT)-based water quality monitoring platform, and advanced data analytics to address marine pollution. The study targets three main objectives: Designing a scalable and adaptable mariculture infrastructure, deploying IoT networks for real-time water quality monitoring, and utilizing IoT-generated data to strengthen environmental protection and optimize resource use. Field trials for the platform will be conducted in Nha Trang, Vietnam, with a focus on pomfret and grouper aquaculture. These trials aim to showcase the system's capability to effectively monitor water quality, anticipate operational anomalies, and reduce pollution, fostering more sustainable aquaculture practices. Additionally, we employ the Autoregressive Integrated Moving Average (ARIMA) model to predict key water quality indicators, such as pH, dissolved oxygen, and water temperature, based on an existing dataset, providing further validation of the platform's functionality.*

Key words: *Aquaculture, autoregressive integrated moving average, environmental sustainability, IoT-based monitoring, water quality monitoring, marine pollution reduction.*

AI COMBINING WITH HIGH-THROUGHPUT SYSTEM FOR MATERIALS DISCOVERY

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Abstracts: Growing environmental concerns have fueled significant interest in Green Chemistry, which aims to develop eco-friendly chemical products and processes. Traditionally, discovering new environmentally benign synthetic methods has been a slow and laborious process, relying heavily on trial-and-error experimentation and specialized expertise. This manuscript proposes a novel, streamlined approach that leverages robotic automation and artificial intelligence (AI) to accelerate materials synthesis while adhering to Green Chemistry principles. The proposed workflow begins by employing Large Language Models (LLMs) to analyze published literature and extract relevant information on chemical synthesis. This information is then organized into a structured database, providing valuable insights into experimental conditions, including chemical substances and reaction parameters. This database aids researchers in selecting optimized conditions for subsequent experiments, reducing the reliance on trial-and-error. To further enhance efficiency, a pipetting robot is utilized to prepare multiple reaction mixtures simultaneously, with varying concentrations. This high-throughput experimentation, guided by the AI-derived insights, accelerates the synthesis process. The resulting materials are then analyzed using optical microscopy and X-ray diffraction (XRD) to determine their crystal structure. Finally, AI-based classification methods are used to verify that the synthesized crystals match the expected structure, ensuring the accuracy and reliability of the result.

Keywords: LLM literature synthesis, Metal Organic Frameworks, LLM experimental verification, Green Chemistry, Robotic synthesis.

LOW-COST TRIBOELECTRIC NANOGENERATOR FOR WIND ENERGY HARVESTING IN URBAN AREAS

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Abstract: As the demand for renewable energy in urban environments grows, traditional large-scale wind turbines face challenges related to space, safety, and integration into dense cityscapes. This study presents the design and development of a low-cost Wind-Driven Triboelectric Nanogenerator (Wind TENG) for efficient wind energy harvesting and wind speed monitoring. The Wind TENG utilizes a rotational triboelectric mechanism (R-TENG), where sliding motion between triboelectric layers generates electrical output through contact electrification and electrostatic induction. The device's structure consists of fluorinated ethylene propylene (FEP) as the negative triboelectric layer, paper as the positive triboelectric layer, and aluminum and copper as conductive electrodes. The rotor, driven by a vertical-axis Savonius wind turbine, allows continuous sliding motion, which enhances energy generation in variable wind conditions. The compact design is scalable and can be integrated into urban infrastructure. Performance tests show the Wind TENG generates up to 50V at 9 m/s and 24V at 3.5 m/s with a rectifier. The device achieved a maximum power density of 2.22 mW/m² at 9 m/s and exhibited high sensitivity to wind speed variations, with voltage output responding directly to changes in wind velocity. Additionally, the device charged a 2.2 μ F capacitor from 0V to 23V in 40 seconds, showcasing its capability for small-scale energy storage and environmental monitoring. Future work will focus on optimizing materials and design for enhanced efficiency in urban deployment.

Keywords: TENG, Wind, Low-cost, Compact, Self-powered sensor, Urban Areas.

A PERSPECTIVE: EVALUATING AND MODELLING ELECTROCOAGULATION SYSTEM BY ARTIFICIAL INTELLIGENCE FOR SUSTAINABLE WATER TREATMENT

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Abstract: Climate change and direct human activities such as global urbanization and industrialization have significantly degraded both the quantity and quality of freshwater sources. Excessive contaminants in water harm the safety of freshwater supplies for human health and ecosystems. Consequently, developing highly effective and sustainable water treatment methods is essential to tackle the water crisis. Electrocoagulation (EC) has been demonstrated as a well-known method for removing contaminants from water due to its flexibility, cost-effectiveness, and environmental sustainability. This review paper presents the crucial role of evaluation and optimization in EC systems by artificial models. Response Surface Methodology (RSM) is a valuable mathematical and statistical tool for designing and evaluating the interactions of input factors to output results in the EC system. In addition, Artificial Intelligence (AI) is a powerful tool for forecasting relationships within nonlinear data, enabling data-driven predictions at both pilot and industrial scales in EC systems for water treatment. Finally, remaining challenges and further research to explore the role of AI in optimizing water treatment through the EC process are given. The analysis in this review can provide simple insights for readers in the modeling and predicting EC systems by RSM and AI models.

Keywords: Electrocoagulation, Water treatment, Artificial intelligence, Sustainability, System modeling.

COMBATING ANTIMICROBIAL RESISTANCE IN VIETNAM BY SUPPORTING REGIONAL AND REMOTE FARMERS - THE FARM2VET PROJECT

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Abstract: Antimicrobial resistance (AMR), especially the insensitivity of disease-causing pathogenic bacteria to treatment with antibiotics, is an urgent concern to healthcare professionals worldwide. AMR ranks among the top 10 global health threats, potentially causing 10 million annual human deaths and USD 3.4 trillion GDP losses by 2050. In our mission to tackle the extensive misuse of antibiotics in animal food production, particularly in low-and-middle-income countries, we confront the growing crisis of AMR. We aim to build a trustworthy virtual veterinary platform called Farm2 Vet that delivers instant, low-cost access to reliable veterinary knowledge and services for livestock farmers in regional and remote locations. This open-sourced, large-language smart app will be co-created with farmers to enable them to make informed decisions on antibiotic usage in treating their sick animals. Collected citizen-generated data will inform geographical prevention of animal disease outbreaks, identify AMR hotspots, and help target clusters that are suitable for antibiotic-prudent transitions. Initiating our campaign in Vietnam, which has one of the highest AMR rates globally, we recognize the reluctance of farmers to report infectious diseases due to fear and uncertainty. Addressing these concerns is pivotal to empowering farmers and fostering a sustainable, resilient agricultural landscape.

Keywords: Antimicrobial resistance, Antibiotic, Veterinary, Farmer, Livestock, Machine learning, Vietnam.

SESSION IV

BUSINESS PERSPECTIVE OF INNOVATION AND GREEN CONSUMPTION



DRIVERS OF PROPTech ADOPTION IN VIETNAM'S REAL ESTATE SECTOR: OPPORTUNITIES AND CHALLENGES

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Abstract: Vietnam's real industry is currently undergoing a significant transformation fueled by rapid urbanization, industrial growth, and the rising demand for sustainable solutions. This paper examines the driving factors behind the adoption of Property Technology (PropTech) in Vietnam's real estate sector, utilizing the Vietnam Industry Innovation Research framework. Through a mixed-methods approach, which combines secondary data and primary insights from a focus group of industry experts-including policymakers, real estate association leaders, and corporate executives-this study identifies key enablers such as regulatory frameworks, financial markets, human resource challenges, technological advancements, and leadership capacity. The study reveals that challenges to PropTech adoption in Vietnam include regulatory gaps, insufficient skilled labor, and limitations in technological infrastructure, while opportunities lie in forthcoming digital technology laws, a dynamic young workforce, and the growing adoption of technology in the real estate sector. By providing actionable insights, this research contributes to strategic innovation planning aimed at promoting long-term growth and sustainability in Vietnam's real estate industry.

Keywords: Real Estate; PropTech; Digital Transformation.

INNOVATION IN VIETNAM'S PHARMACEUTICAL SECTOR: AN EXPLORATORY ANALYSIS OF KEY DETERMINANTS

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Abstract: *Our study aims at exploring the determinants of innovation in the pharmaceutical industry in Vietnam, focusing on industry-wide factors that drive innovation beyond firm-level strategies. Given the unique challenges of Vietnam's emerging market status, this research seeks to fill the gap in the literature on industry-level innovation in the pharmaceutical field. The study adopts a mixed-method approach, combining qualitative data from talks and panel discussions at innovation conferences and quantitative data from industry reports, market statistics, and academic publications. The study reveals that technological advancements are emerging drivers of innovation. However, human resources constraints, regulatory bottlenecks, and limited R&D investment pose significant challenges. Partnerships with universities and research institutes remain underdeveloped, limiting knowledge transfer and innovation potential. Policymakers and industry leaders should focus on building an innovation ecosystem that supports advanced R&D, technology transfer, and international partnerships to enhance Vietnam's competitive position in the global pharmaceutical market.*

Key words: *innovation, pharmaceutical, industry, Vietnam.*

DETERMINANTS OF CONSUMER WILLINGNESS TO PAY FOR GREEN ELECTRICITY: A VIETNAMESE PERSPECTIVE

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Abstract: This study aims to analyze the determinants of the willingness to pay (WTP) phenomenon in the context of a developing economy, such as Vietnam in particular, and to pay for green electricity in general. Employing a large-scale online survey of 1041 respondents, the research conducts regression analysis of WTP for renewable energy sources on socio-economic and attitudinal variables. Research findings indicate a positive perception of green electricity initiatives by Vietnamese consumers, but the willingness to pay the price level is influenced by income, education, age, electricity bill, level of belief in environmental authority, and knowledge levels on renewable energy. It was revealed that the average additional monthly payment respondents were ready to make in favor of electrifying hearts and making their generation green is about 227,141 VND, or 9.04 USD. Income emerged as one of the significant factors that influenced people's WTP to pay for green power. People with higher incomes had more chances of being willing to pay more advanced prices for green energy supply. Furthermore, knowledge about renewable energy was found to affect factors influencing WTP as well as in an educational context. These insights are useful for energy providers and policymakers in formulating measures to sustain the use of renewable energy in Vietnam. The research adds to the existing literature on the attitudes of consumers in emerging markets towards the use of sustainable energy and provides a basis for future work in green energy implementation in developing countries.

Keywords: Renewable resources, Green electricity, Willingness to pay, Sustainable development, Vietnam

SESSION V

**INNOVATION IN
HEALTHCARE & WELL-BEING**



LOW-COST, DEGRADABLE, AND RECYCLABLE FLEXIBLE FIBER SENSOR FOR SUSTAINABLE HEALTHCARE APPLICATIONS

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Abstract: *Recent advances in flexible sensing systems have enabled novel wearable sensors for healthcare applications thanks to their compliance nature and comfort for human users. However, the materials involved in creating these systems are often not biodegradable nor recyclable, unintentionally contributing to the growing issue of environmental pollution. Therefore, it is also essential to develop sustainable materials for use in flexible sensing systems. Our work introduces the design and development of a lotus fiber-based flexible fiber sensor (LF-FFS), which is a type of hydraulic-pressure-based tubular sensor filled with incompressible fluid whose inner pressure changes with mechanical deformations. The main constituent materials of the LF-FFS include lotus fiber, a natural and bio-degradable fiber, and recyclable thermoplastic elastomer, rendering the LF-FFS a promising candidate for sustainable flexible sensing systems. Additionally, the LF-FFS employs simple and low-cost processes in its fabrication, which is suitable for low-budget settings. Possessing a tubular form factor, the proposed LF-FFS is highly scalable and can be customized to create a variety of configurations, such as single fiber or wearable textile garments, to suit a wide range of sustainable applications, which is demonstrated by the fabrication and evaluation of a wearable hand-gesture tracking glove prototype. In addition, a wireless data transmission system is also implemented in this work, promoting the potential of developing LF-FFS-based sustainable sensing platforms for telehealth applications.*

Keywords: *Flexible sensor, Soft robotics, Sustainability, Healthcare, Wearable devices.*

A DIGITAL HEALTHCARE PLATFORM FOR CARDIOVASCULAR DISEASE MANAGEMENT: ARCHITECTURE, TECHNOLOGY INTEGRATION AND DEPLOYMENT

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Abstract: Cardiovascular diseases (CVDs) continue to be one of the leading causes of mortality worldwide. Early detection, continuous monitoring, and personalized interventions are crucial in mitigating the global impact of CVDs. This paper introduces a digital platform architecture that integrates advanced technologies, such as wearable devices, telehealth, cloud computing, and artificial intelligence (AI), to enable real-time monitoring and risk assessment for CVD patients. The platform is designed to ensure seamless interoperability with existing healthcare systems, adhere to data protection regulations, and scale to accommodate growing data demands. To verify the platform's functionality, a case study focused on CVD detection is presented. Specifically, the Cleveland heart disease dataset was collected and refined using a Random Forest classifier, followed by density-based spatial clustering of applications with noise (DBSCAN) to detect outliers. To address the class imbalance, the synthetic minority over-sampling technique (SMOTE) and conditional tabular generative adversarial network (CTGAN) are applied, both balancing the dataset and generating synthetic data to improve model generalization. Finally, a light gradient boosting machine (LightGBM) is employed with hyperparameter tuning conducted via Optuna, optimizing the model's performance and demonstrating its robustness and effectiveness in diagnosing heart disease.

Key words: Artificial intelligence (AI), AI-powered healthcare, Cardiovascular disease, Internet of Things, real-time monitoring, and Predictive analytics.

INNOVATION IN VIETNAM'S HEALTHCARE SECTOR: TRANSFORMATIONS, IMPACTS, AND LESSONS LEARNED

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Abstract: *The healthcare industry in Vietnam is undergoing a major transformation fueled by innovation. This research investigates the key areas of innovation in Vietnam's healthcare sector, identifies their primary drivers, and evaluates their economic, social, and environmental impacts. Employing the Vietnam Industry Innovation Framework as a theoretical base, the study uses a mixed-methods approach that combines secondary data analysis with focus group discussions involving 12 healthcare experts, including policymakers, healthcare association leaders, and medical executives. The findings reveal that key innovations include the integration of advanced technologies such as telemedicine, AI-driven diagnostics, and electronic health records, which improve treatment accuracy, patient monitoring, and administrative efficiency. Additionally, the development of new therapies like cell therapy and personalized medicine is broadening treatment options. Patient-centric care models are also crucial, focusing on personalized care, enhanced communication, and effective data management, while ensuring data security and privacy through international standards. The research underscores the need for collaboration among healthcare providers, researchers, and policymakers. Strengthening public-private partnerships and investing in healthcare infrastructure and training are essential for sustaining innovation and enhancing healthcare delivery. Overall, the study offers valuable insights into how innovation is transforming Vietnam's healthcare industry, providing lessons for other countries facing similar challenges. By adopting technological advancements, patient-centered models, and collaborative strategies, Vietnam's healthcare system is positioned to achieve significant improvements in patient care and system efficiency.*

Keywords: *Healthcare innovation, Vietnam, Telemedicine, Patient-Centered Care, Public-Private Partnerships.*

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