Advances in Energy Research, Materials Science and Built Environment (EMBE) - 1st Edition

A Book of Abstracts

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Advances in Energy Research, Materials Science & Built Environment

A Book of Abstracts submitted to the 1st edition of the international conference on **Advances in Energy Research, Materials Science & Built Environment (EMBE)** 03 – 04 Oct 2023

Acknowledgements

IEREK would like to express its appreciation to all members of the staff and scientific committee for their tremendous efforts and contribution to the growth of this institution and for making the first edition of the international conference on Advances in Energy Research, Materials Science & Built Environment (EMBE). IEREK takes pride in being an institution that amasses a highly qualified and competent team who restlessly worked for months to make this conference what it is today in hopes of creating a well-rounded society. Last but not least, we cannot neglect the prominent role undertaken by our editors and reviewers who made it their duty to help this institution in spreading knowledge to the masses.

Foreword

With technology advancing, helping humanity to discover, create and innovate, advancements in technology became a focal point for research, ignoring the rising costs and the lack of sustainable approaches. With extreme reliance on non-renewable sources of energy to power our cities and communities, we are contributing to the increase in greenhouse gases emissions and to the significant changes in our cities caused by climate change. These rising changes, forces us to discover alternative sources of renewable, efficient and affordable forms of energy, where it will promote sustainable, healthy and diverse ecosystems through enabling technologies that can offer promising solutions.

An overhaul is needed to our approach to designing cities, for a sustainable, resilient and eco-friendly future. In this abstract book, we discover the impact of more innovative approaches towards materials, that emphasize sustainable construction, smart energy, and more durable designs for our cities will be thoroughly investigated, while additionally exploring multiple disciplines where applying innovation can better help advancing with energy research, material science, and built environment.

In this abstracts book, which is an assortment of the highest quality research which was submitted to the 1st edition of the international conference on Advances in Energy Research, Materials Science & Built Environment (EMBE), from the 3rd of October, 2023 – 4th of October, 2023, we investigate research on sustainability and development, green urbanism, modern construction management practices, and material efficacy in climate change mitigation.

This abstracts book Addresses many challenges and approaches, such as climate change, green urbanism’s role in resilient communities and environmental efficiency, opportunities and challenges in coastal areas, evolving architecture and rethinking cities, materials for renewable and sustainable energy, the role of advanced technologies in sustainable architecture, and studies & practical applications. It will also provide an opportunity for exploration where not only new technologies in the Architecture, Engineering, and Construction (AEC) industry are highlighted, but also a guide to practical application is made available. It offers a comprehensive approach covering fundamentals, technologies, and applications through real-world examples.

Word from the Chairman of the Board of IEREK

In this book of abstracts, we are reminded of the urgent need to address the critical challenges facing our cities and the environment. I am deeply grateful for the opportunity to bring together some of the world's brightest minds to explore solutions that can make a meaningful difference at the 1st edition of the Advances in Energy Research, Materials Science & Built Environment (EMBE) conference. It has been an absolute honor to arrange this event, and host the brilliant minds and passionate experts who have come together to tackle some of the most pressing issues facing our world today.

When I first launched IEREK – International Experts for Research Enrichment and Knowledge Exchange – in 2013, I had ambitions of establishing an institution that pursues excellence in the field of research, and connects the world’s scholars, providing them with platforms that advance their academic endeavors. To see my ambition come to life, is quite an honor indeed. Ever since its conception, IEREK has remained committed to its goal of scientific dissemination by building international relationships with prestigious universities and academic institutions around the world. Our journey has been one of great privilege, for we do not walk it alone. The contribution that we attain from our partners is invaluable to us, whether it be the book editors, publishers, hosting universities, conference chairs, keynote speakers, authors, or attendees, I would like to personally thank you for contributing to the furtherance of knowledge and research.

Like with every conference that we organize here at IEREK, we hope that everyone involved in the 1st edition of the *EMBE* conference has gleaned something valuable from the experience, and walked away with a positive and memorable experience. We hope that the conference left a good impression on the scholars, who aim to deliberate upon challenges and opportunities for the issues at hand. I am confident that the message conveyed at this conference will aid in leading the world toward becoming a more sustainable, and livable place.

Mourad S. Amer

Architect, BSc, DSc, MSc, PhD

IEREK CEO

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Materials for Renewable and Sustainable Energy

Regeneration, Resilience and Metamorphosis of the Building Envelope: Analysis of The High-Rise and Skyscraper Types

Massimiliano Nastri

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Abstract:

The study contemplates the resilience characteristics of buildings with vertical development in the current context, according to the processes of "self-adjustment" and as a capacity for performance "re/production", "absorption" and "reaction" towards the "perturbative pressures" caused by the incidence of degradation phenomena, obsolescence or accidental and catastrophic events. The analysis considers the "adaptive", "selective" and "mediation" methodologies, acquired and expressed by vertical architectures, to metabolize and "mitigate" the stresses and conditions of physical, environmental and technical-economic stress, in a combined manner with the processes of innovation (design, executive and functional) and the "eco-efficient" use of energy resources.

Keywords:

*Resilience method and thinking processes****;*** *Regeneration of architecture****;*** *High-rise and skyscraper buildings****;*** *Advanced building envelope technologies and systems*

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Localized heat generation for de-icing applications by 3D printing of smart nanocomposites

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Abstract:

This paper presents an innovative strategy to manipulate heat flow within smart polymeric nanocomposites processed through 3D printing. The heating performance of these materials is heavily influenced by their electrical properties, impacting the heat generated via the Joule effect. By leveraging fused deposition modeling, a widely used thermoplastic polymer printing technology, we successfully modified the electrical properties of ABS filled with MWCNTs by controlling the orientation of printed filaments. The alignment of carbon nanotubes along the printing direction facilitated the creation of preferential nanometric paths for current flow. Combining different printing directions within the same specimen allowed us to design a heating map with distinct temperature zones, all subject to the same electrical stimulus. The resultant temperature gradient, maintaining a nearly stationary state for an extended period, presents numerous practical applications, particularly in the fields of building and transportation, where de-icing solutions are in high demand. This tailorable peculiarity in the design phase opens new possibilities for smart nanocomposites, offering promising advancements in de-icing technology.

Keywords

3D printing technology; Smart polymers; Electrical properties; Localized heating; De-icing application.

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Evaluation of the Photocatalytic Activity of g-C_3N_4 Nanorods/SiO_2@TiO_2 Mixed by Methanol

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Abstract

In recent years, water pollution caused by industrial development associated with population growth has become one of the problems that threaten the health of humans and animals. To solve this problem, photocatalytic decomposition of organic pollutants using solar energy as a wastewater treatment technology is expected. g-C_3N_4 shows excellent performance in decomposing pollutants under visible light irradiation due to its narrow band gap. However, the high electron-hole recombination rate and small surface area of g-C_3N_4 greatly limit its application. To solve this problem, heterostructure composite materials with wide bandgap semiconductors are expected to not only increase the surface area but also decrease the electron-hole recombination rate. As a wide bandgap semiconductor, TiO_2 has attracted much attention due to its low cost, high chemical stability, and excellent photocatalytic activity. However, TiO_2 is less responsive to visible light, and its specific surface area can be increased for more efficient use of solar energy. In this study, g-C_3N_4 nanorods/SiO_2@TiO_2 hetero-bonded structure photocatalysts were prepared, and their photocatalytic activity was evaluated using methylene blue. In the preparation of mesoporous SiO_2@TiO_2, a porous structure of SiO_2 is generated by the Stover method and coated with TiO_2, which is expected to improve adsorption properties and efficient light scattering due to increased surface area. The g-C_3N_4 nanorods were also fabricated using the molten salt method. g-C_3N_4 in nanorod form provides a charge transfer pathway and a higher specific surface area. The mixing method of g-C_3N_4 nanorods with methanol for 3 h resulted in the formation of shortened g-C_3N_4 nanorods around mesoporous SiO_2@TiO_2 spheres, which resulted in higher specific surface area, improved adsorption properties and light utilization efficiency of methylene blue due to the heterostructure, and enhanced decomposition ability. Thus, g-C_3N_4nanorod/SiO_2@TiO_2 showed effectiveness in organic matter degradation.

keywords:

g-C_3N_4nanorods; Mesoporous SiO_2@TiO_2;Photocatalytic; Methylene blue; Methanol mixing method

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Electrode Material Optimization for Microbial Fuel Cells Using Bamboo Charcoal Powder and Bokuju

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Abstract

Bamboo is a fast-growing plant in Southeast Asia, Africa, and Latin America. Due to its rapid growth, bamboo is considered a problem because it rapidly invades forested areas and alters the original ecosystem. On the other hand, it is regarded as a material that is readily available and very accessible in many countries and has great potential for both ecological and social purposes. Therefore, bamboo was employed as one of the materials for the electrodes of microbial fuel cells in this study. Typically, biochar used for electrodes in microbial fuel cells is chemically activated to remove impurities and increase its surface area. However, chemical treatment of biochar can have a negative impact on the activity of microorganisms in microbial fuel cells. The Bamboo charcoal powder, prepared by heat-treating powdered bamboo for one hour under air at 500°C, contained about 75% carbon and had a porous structure. Therefore, the material could be used as an electrode material for microbial fuel cells without complicated and time-consuming treatment processes. Bokuju, which is a common kind of drawing ink in Japan and mainly composed of carbon black, was used as a binder for the prepared bamboo charcoal. The reason for using powdered bamboo charcoal with Bokuju is that it is easier to obtain a solid electrode shape by a drying process. We used this electrode in a floating microbial fuel cell and optimized the ratio of Bamboo charcoal powder and Bokuju in the electrode. By evaluating the performance of the microbial fuel cell using the Bamboo charcoal Bokuju electrode, we were able to improve the effectiveness of the electrode material.

Keywords

Microbial fuel cell; Bamboo charcoal powder; Bokuju

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Fast and Reliable Power System Marginal States Assessment for Emergency Control Systems

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Abstract

The robust and secure operation of power systems has become a challenging task, as the operating state evolves rapidly due to uncertainties associated with increasing renewable generation, less predictable loads, and various forms of contingencies. This paper reviews the recently proposed Transversality Enforced Newton-Raphson method for steady-state security and stability margin assessment. This method was improved by introducing the bus sensitivity analysis based on singular value decomposition. The impact of bus sensitivity analysis is demonstrated using IEEE 9 and 14-bus test cases.

Keywords

Power system security assessment; Loadability limits; Stability margin; Bus sensitivity analysis.

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Molecules vs Electrons, where are we headed?

Leon Stille,
Director Education and partnerships Impact Hydrogen

Abstract:

Deep and intensive decarbonisation of the energy system is needed to meet the goals set out in the Paris agreement and move towards a circular and carbon free world. Since access to clean, reliable and affordable energy is one of the main drivers for human development it is key to make this shift as efficiently and cost effective as possible in order not to lose societal support and avoid significant economic drawbacks. Current energy systems can be divided in two key forms; electricity and molecules (liquids and gasses). In most systems around the world electricity is only a small component and fossil liquid and gaseous fuels make up the largest part of the total energy system. Current technologies to decarbonize the energy system favour electricity generation and therefore the trend is towards further electrification of sectors like transport, households and industry. However, is this feasible? Will electrons indeed be the majority energy carrier or will we require significant amounts of gaseous and liquid molecules as well. If so, how will we decarbonize those molecules? During this talk several scenario's will be shown and discussed. Giving an overview of the challenges and potential solutions for cost effective decarbonisation of the energy system.

Keywords:
Energy transition, molecules, electricity, decarbonization, industry

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Improving the Energy Performance for Tower Design by Using Innovative Façade Systems and Intelligent Skins: The Case of Amman City.

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Abstract

Nowadays, there is a worldwide need for sustainable buildings because of the dramatic increase in building energy consumption. Due to the spread of building towers, and since they are a huge energy consumer, it is urgent now to consider a sustainable strategy in designing tall buildings. Building facades are the key aspect of improving the energy performance of the building in general and specifically in towers, by decreasing the heating and cooling loads. This research investigates the role of innovative building facades and intelligent skins in reducing heat gain and heat losses, which promote the energy performance of buildings, and how much energy can be saved. It shows different sustainable rating systems such as the Jordanian Green Building Codes (JGBC), and Leadership in Energy and Environmental Design (LEED), to evaluate the energy performance of the building and tries to figure out the potential of getting prerequisites points and define its role in enhancing the building performance.

The research studies the Rotana Tower Hotel in Amman City, it is based on a combination of descriptive, analytical, and empirical approaches to understand and achieve the research goals and objectives and formulate the research questions. Weather Consultant Program, Revit software, and Green Building Studio Insight 360 for simulation are used to study and analyze three different case scenarios, by applying different façade systems, then evaluate each scenario and compare them in terms of energy and CO2 emissions saving aspects.

The results and findings show a distinctive improvement in the energy performance of Rotana Tower after applying the efficient glass façade; 47% reduction in energy and a 46% decrease in carbon emissions, on the other hand, 74% in energy savings after integrating photovoltaic glass on the façade.

Keywords:

Building Energy Performance, Highly Efficient Glass, Innovative Façade Systems, Intelligent Skins, Photovoltaic Systems.

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Optimization of Hydrothermal Synthesis Time of g-C3N4 Microtubes for High Photocatalytic Degradation of Methylene Blue

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Abstract

In this study, g-C3N4 was prepared by calcining melamine. g-C3N4 microtubes were obtained by performing the hydrothermal method on g-C_3N_4 at 200°C for various reaction times ranging from 4 h to 24 h, followed by calcination. As the hydrothermal synthesis time increased, the morphology changed from particles to microtubes. In addition, the crystal structures of various synthesized g-C_3N_4 microtubes were evaluated using X-ray diffraction, scanning electron microscopy, and transmission electron microscopy. The results showed that g-C_3N_4 synthesized for 4 and 8 h was particulate, while g-C_3N_4 synthesized for 12 and 16 h had a tubular form. The tubular g-C_3N_4 was found to have numerous holes on its surface. When the powder was put into water, only the powder that had been synthesized for 16 h and more could float because the density of g-C_3N_4 microtubes with 16 h and more hydrothermal synthesis was smaller than that of water. The photocatalytic activity of g-C_3N_4 microtubes was evaluated by the degradation of methylene blue experiment. The results showed that g-C_3N_4 microtubes with 12 h hydrothermal synthesis showed the highest degradation rate. This result may be because the g-C_3N_4 microtubes have a large surface area due to their tube structure, and they also sink into the liquid, allowing them to come in more contact with the methylene blue solution. The g-C_3N_4 microtubes with 16 h hydrothermal synthesis showed the second-highest degradation efficiency while floating on the surface of methylene blue solution; these g-C_3N_4 microtubes are attractive because they can receive more light energy, and they can be collected easily after the experiment because the ability of float on the liquid surface.

Keywords

g-C_3N_4 microtubes, Hydrothermal synthesis method, Photocatalytic degradation

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Improvement of Dye Adsorption Rate by Ozone Treatment on Rutile TiO_2 Hollow Spheres in the Scattering Layer of Dye-sensitized Solar Cells

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Abstract

This study used mesoporous TiO_2 hollow spheres (MP-THS) to make the scattering layer in the dye-sensitized solar cell (DSSC) photoanode. Although TiO_2 in the anatase is widely used in DSSCs, TiO_2 in the rutile has a higher refractive index and better scattering performance. However, rutile TiO_2 has a low dye adsorption rate due to its small surface area, making it challenging to absorb light. In this study, rutile MP-THS were treated with ozone to increase the amount of dye adsorption and further improve the output. Ozone treatment improves the hydrophilicity of the scattering layer surface, increasing the amount of dye adsorbed. The MP-THS were found to have a particle diameter of about 400 nm and a hollow wall thickness of about 40 nm. Different crystal structures of anatase and rutile were prepared by changing the firing temperature of MP-THS, and the effect of the difference in refractive index on the power output was investigated. In this study, the performance of DSSC was evaluated by power density. The results displayed that the power density was higher when rutile MP-THS was used compared to anatase MP-THS, and the power density was improved by 11% by ozone treatment. It was confirmed that rutile MP-THS improved the scattering layer performance, and ozone treatment improved the power density.

Keywords:

DSSC; scattering layer; rutile; MP-TiO2 hollow spheres; ozone treatment

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Effect of Light Intensities in Triple Co-culture

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Abstract:

High-value bioproducts derived from microalgae including proteins, chlorophyll, carotenoids, and lipids have seen major interest in the recent years. It is possible to utilize microalgae bioproducts in various industries, such as feed for animals, fertilization in agriculture, natural ingredients for cosmetics, bioactive compounds for pharmaceutical, renewable sources of fuel in bioenergy, and dietary supplements for food. Following extensive research on the production of high-value bioproducts from microalgae, performing co-culture systems for microalgae cultivation is a promising approach to increase the applicability of microalgal biorefineries on a large scale. In this research, multiple bioactive compound production have been studied in a tripleco-culture of *Haematococcus pluvalis, Chlorella vulgaris* and *Spirulina platensis*. The main aim was to investigate the effects of three different light intensities (200, 400, and 600 µE.m^{-2}.s^{-1}) by microalgae triple co-culture in 2 L airlift photobioreactors for 8 days to produce high-value bioproducts. In this period, total phycobiliprotein (phycocyanin, allophycocyanin, and phycoerythrin), chlorophyll (chlorophyll a and b), carotenoid, astaxanthin, total protein, and reactive oxygen species values have been monitored. Additionally, amount of lipid content has been detected upon harvest. As a result, the maximum overall bioproduct yield was determined for microalgae triple co-culture under the light intensity of 600 µE.m^{-2}.s^{-1}compared to the other two systems.

***Keywords**:*

Microalgae; Airlift photobioreactor; Secondary metabolite; Co-culture

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Design and characterization of biodegradable self-healing nanocomposites

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Abstract:

The main reason for the growing interest in self-healing materials is closely linked to the possibility of developing products with an extended life span, thereby enabling energy savings and a reduction in the waste of resources. Among the strategies employed for producing self-healing materials, a relevant role is played by those using biodegradable materials. In this context, this research proposes the development of materials with auto-repair functionality based on a fully biodegradable commercial polymer, namely the highly amorphous vinyl alcohol polymer (HAVOH). The formulated samples have been obtained by mixing the HAVOH matrix with a masterbatch (also biodegradable) composed of carboxyl methyl cellulose (CMC) modified with Multiwall Carbon Nanotubes (MWCNTs), which make the samples electrically conductive and improve their mechanical performance. Furthermore, Murexide (M) salts have been added to the formulation to enhance the self-healing ability of the materials. The evaluation of the electrical properties has attested that using 5% by weight of MWCNTs allows obtaining samples with an electrical conductivity value of around 10^{-4} S/m. The self-healing efficiency has been evaluated by monitoring the recovery of the "Storage Modulus" determined by dynamic-mechanical analysis (DMA) of healed samples. The self-healing behavior is temperature-dependent, with the materials exhibiting the highest values of healing efficiency between 30 and 80°C. The obtained results attest to a significant step forward in the design of self-healing green nanocomposites by employing natural resources.

Keywords

Self-healing Nanocomposites, Smart Materials, Biodegradable Polymer

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Electro-curing: saving energy for the manufacturing of structural resins is possible

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Abstract:

The development of structural thermosetting composites is now widely exploited in the transport field, allowing for simultaneously having structural properties and mass reduction. Their applicability presents several advantages, including a lower temperature for processing the materials than other structural materials (i.e., metals). For the transport sector, weight saving allows reducing CO_2 emissions and energy consumption during the in-service vehicles. Different research papers have highlighted that the manufacturing process is one of the most critical phases for the environmental impact of composite production. Currently, the primary process for producing epoxy composites (curing in an autoclave) is energy, time-consuming, and hardly tunable. Moreover, it often causes, during the curing cycle, gradients of temperatures in the components that may lead to the generation of microcracks or stress concentration. In light of these premises, the present research aims to present an energy-saving and highly tunable alternative process realized through electro-curing. The fluid epoxy resin is filled with carbonaceous electrically conductive nanofillers (multi-wall carbon nanotubes) to obtain a conductive mixture to be electrically cured via the Joule effect. Following this approach, the energy necessary for curing the samples is directly generated inside the resin. Compared to the traditional curing processes, the electro-curing is highly and rapidly tunable since the energy generated in the sample is strictly related to the applied voltage. These results make electro-curing a promising process to solidify thermosetting composites due to the substantial reduction of the environmental impact.

Nanocomposites, Electrical Properties, Cure Behavior, Joule effect, Electro-curing

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Analysis of traditional construction materials and techniques: A Case study of Guthu Mane in Coastal region of Karnataka

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Abstract:

Architecture can be described based on the function, construction materials and traditional knowledge specific and distinctive to its location. It is ethnic to a specific time, place and integrates the skills and proficiency of local builders. The focus of this paper is to analyse the traditional construction materials and techniques with the case study of a 350-year-old "Hirebettu House", which are traditional homes of bunt community of coastal Karnataka. These houses are developed over generations with the locally available building materials, their craftsmanship and response to climatic conditions. For instances, some examples of such type of houses are still found in Hirebettu Grama. These traditional houses provided with various passive solar techniques including natural cooling systems which is more comfortable compared to the contemporary buildings in today's context. Field data gathered by a range of methods such as history, observation, documentation, and simulation.

The findings of this research paper are to analyse the traditional construction materials and techniques which helps to achieve the adequate cooling comfort to users in coastal region having hot and humid climatic condition. It also explores on how these techniques can be interpreted in today's context, so that it can be used effectively in the future residential designs.

Keywords:

Traditional houses, Sustainable construction materials and techniques, Coastal region, passive cooling techniques.

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Part II:
Innovative Technologies for Smart Futures

Artificial intelligence and crowd-sourced social media data for biodiversity monitoring and conservation

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Abstract:

Environmental resilience is intrinsically tied to the conservation and promotion of biodiversity at multiple scales, spanning from local ecosystems to the global biosphere. Biodiversity assumes a pivotal role in the capacity of ecosystems to endure and recuperate from diverse perturbations. However, due to human-induced stressors, we are facing unprecedented losses to biodiversity. Preventing and reversing the global biodiversity crisis necessitates targeted conservation endeavors, yet monitoring efforts are expensive, and conservation resources are limited. This lack of information on biodiversity statuses and trends may obscure population declines and potential extinctions. As a result, there is a pressing need for cost-effective and scalable solutions to monitor biodiversity. Here, we highlight significant recent developments in computer vision and natural language programming and discuss their exciting applications to big data from social media for biodiversity monitoring, which hitherto have been underexplored. First, we assess how computer vision can be applied to social media images for species identification, assessment of human-nature interactions, and understanding of animal behavior, and how natural language programming can provide insights into public interest, sentiment, attitudes, and biodiversity-related behaviors from textual metadata. Second, we highlight the novelty social media provides by allowing us to combine multiple data types, such as audio, video, and text, through multimodal approaches, for innovative conservation research. Compared to previous ecological research harnessing AI, this multimodal approach to biodiversity monitoring can be applied to innovative approaches to biodiversity monitoring, including tracking the changes in timing and distribution patterns of biodiversity events and identifying areas affected by invasive species. By harnessing the capabilities of computer vision, natural language processing, and spatial-temporal analysis, we can unlock valuable insights from social media posts and guide conservation strategies for enhancing environmental resilience in an efficient and scalable manner.

***Keywords*:**
Artificial Intelligence, Biodiversity, social media, Environmental Resilience

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Unveiling the Complexities of Purchaser Retention in Non-Fungible Token (NFT) Platforms: Investigating Direct, Strengthening, and Constraining Moderating Factors for Single and Multiple NFT Purchasers

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Abstract:

The market for NFTs, which stands for non-fungible tokens, has been experiencing significant growth recently, leading to an increase in the number of platforms offering NFT services and intensifying competition among them. Despite the rapid adoption of NFTs and their importance for purchaser retention, there has been little empirical investigation or understanding of NFT purchaser retention in the literature. To address this research gap, our study aimed to develop a comprehensive research framework that encompasses the direct effects of satisfaction, trust, perceived usefulness, switching costs, and lack of alternative attractiveness on the retention of NFT purchasers towards their main NFT platforms. We also examined the moderating role of two strengthening moderators (trust and perceived usefulness) and two constraining moderators (switching costs and lack of alternative attractiveness) on the satisfaction-retention link. Furthermore, we aimed to identify purchaser groups (single and multiple NFT platform purchasers) and examine heterogeneity on the satisfaction-retention link in these two purchaser groups. We believe that our approach will reveal previously neglected effects on the retention of NFT purchasers towards their main NFT platforms. We conducted a large-scale online survey of NFT retail purchasers in Hong Kong. We found that the five direct effects of satisfaction, trust, perceived usefulness, switching costs, and lack of alternative attractiveness have a significant and positive effect on retention. Additionally, the two strengthening and two constraining moderators have significant moderating effects on the satisfaction-retention link. Regarding the examination of heterogeneity between single and multiple NFT platform purchasers, we found that the two strengthening moderators only play a significant moderating role in the satisfaction-loyalty link for single NFT platform purchasers, while the two constraining moderators only play a significant moderating role in the satisfaction-loyalty link for multiple NFT platform purchasers. The paper concludes with a discussion of the practical and theoretical implications of the findings.

***Keywords*:**
Non-Fungible Tokens (NFTs), Strengthening moderators, Constraining moderators, Purchaser Satisfaction, Purchaser Retention

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Lost wax casting: from 3D printing to functional parts

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Abstract

The lost wax production process is an intermediate step in converting a design idea that has been 3D printed from PLA plastic into a functional part via metal casting processes. The metal in this case is aluminum obtained from recycled products, such as beverage cans, out-of-service heat exchangers, appliances, etc. With the increase in raw material prices, recycling saves funds and emissions during material processing, and this is especially true in the case of aluminum. Obtaining aluminum from its bauxite ore requires at least 70% more energy and results in carbon dioxide emission that accompanies the carbothermic reduction process. The combination of 3D printing for part design, lost wax for fabrication and recycling for material feedstock allows controlled production, reduced emission as well as lower costs and enhanced eco-consciousness. In this work, the design, mold preparation, casting and postprocessing of an aluminum part is introduced. The process economics, emissions and customizability are highlighted and discussed.

Keywords:

lost-wax casting; recycling; 3D printing; aluminum casting

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Into the Secret Garden or a Dark Pool? An Exploration of whether DeFi Gardens/Pools Provide a viable democratic alternative to Principal-agent Investment Products

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Abstract:

In this paper I apply the principles of game theory to investment gardens, pools or sets. These are ebay-style websites which allow anybody to create an investment product, and for it to be run on democratic principles rather than a principal-agent relationship. Gardens contain two inherent weaknesses: (1) no barriers to entry for the creators; and (2) retail customers being exposed to a highly niche and confusing area. This paper sources the limited research around financial fraud, which notes the opportunities for abuse that producer-managers of complex financial products can exploit against the unsuspecting public. This is considered against the background highlighted by Belaşcu et al (2022), namely the complexity in DeFi products.

This paper is a specific consideration of the underlying dialectic in the DeFi debate. How dare access to the riches of the finance sector be denied to anyone? Or is there an indisputable obligation for regulators to restrict DeFi access to protect vulnerable investors?

I compare and contrast eight garden products to the S&P 500, and Bitcoin and Ethereum prices. Additionally, I compare six garden products to fifty-five traditional investment fund products investing in DeFi.

This leads to my proposing an extension of Pouryousefi and Frooman's (2019) work on consumer scams from an agency-theoretic approach. The propensity in a garden product (and its circumstances) for adverse selection should determine whether retail investors should be able to access sets, pools and gardens.

***Keywords*:**
adverse selection – DeFi – game theory – adverse selection – investment gardens

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Exploring Determining Factors for SMEs' Access to Alternative Financing Through the Technology-Organization-Environment (TOE) Framework

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Abstract:

Small and medium-sized enterprises (SMEs) are vital for country's economic growth. However, they often struggle with a persistent issue: a funding gap. Alternative finance presents a solution to this problem but remains underutilized due to limited SME understanding and access.

This paper aims to explore factors influencing SMEs to access innovative alternative financing models. This research addresses the literature review and conceptual model to identify the influential factors affecting SMEs access to alternative financing. The research adopts the Technology-Organization-Environment (TOE) model as a theoretical framework to understand the factors influencing SMEs' access to alternative financing options. The TOE framework explains technology adoption in organizations and describes how the process of adopting and implementing technological innovations are influenced by the technological context, organizational context, and environmental context (Tornatzky and Fleischer 1990). This conceptual paper not only testing the TOE framework for SMEs but extending the framework by adding individual context, financial literacy of SME owner/manager, as one of the determining factors. Addition of individual context to the TOE theory is an original contribution from the researcher. This paper presents a comprehensive conceptual model that offers a holistic perspective on the determining factors influencing SMEs access to alternative finance, while also clearly delineating the dimensions of these factors. Furthermore, it opens avenues for future research to test and further enhance the model.

This research makes substantial contributions, both in theory and practice, by delving into the realm of emerging business models empowered by disruptive technology. It underscores the pivotal role of alternative finance in fostering the growth of small and medium-sized enterprises (SMEs). The study's relevance extends to policymakers, regulators, and SME leaders, as it provides valuable insights into harnessing disruptive technology to create innovative business models. These insights can serve as a catalyst for SME development and ultimately economic prosperity.

Keywords:
Alternative Financing; Determining factors; SMEs; Disruptive Technologies; TOE framework; Conceptual model.

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The Nature Smart Future – In Search for the Next Gen Innovation

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Abstract:

When talking about innovation, it is important to define what we mean with the term. Originally, the term innovation (as we know it today) was first coined in the 1980's to describe new, emerging technologies. The first generation, Innovation 1.0, was the era of techno-optimism that built the foundation for technologies we use today, such as personal computers, compact discs, the space shuttle, and the artificial heart. The second generation, Innovation 2.0, was an era marked by all things digital: the World Wide Web, Text Message SMS, and Google, among other things.

In the turn of the millennium, design started to play a bigger role within leading technologies such as the iPhone and the iPad, as user experience (UX) became the mantra of the first decade of the millennium. The next phase was open innovation and platform innovation, and the breakthrough of Artificial Intelligence AI as well as robotics and self-driving cars.

In the next generation, Innovation 3.0, we are talking about systems innovation and quantum computing, but also circular economy and biomimicry. In the coming decade, the focus will be on social and sustainable innovations and nature smart solutions rather than technological innovation alone.

The 50-year history of innovation, 1980–2030, has seen radical changes from technological to human- driven innovation, and will move still further towards human-planetary well-being as the future goal. In our current world of multiple crises, we have only one way out: Nature Smart Design, based on systems thinking and creative thinking and supported by human-like AI, geodesign, circular design, biophilic design and the regenerative approach. Through these multiple perspectives and collective wisdom, it is possible to create all things artificial: cities, technologies, transportation, urban food production, culture, and societies that are more resilient, sustainable, equal, innovative, and creative than before.

***Keywords*:**

Creative Thinking, Circular Design, Nature Smart Design, Planetary Wellbeing

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Shaping disruptive solutions for sustainable futures: zooming in on the social in socio-technical transformation

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Abstract:

Creating sustainable futures is one of the grand challenges of our time and one that requires a suit of disruptive solutions to act in concert towards the shared goal. For too long now, businesses have focused disproportionately on maintaining the status quo through sustaining innovations. Our current technologies, with their interest in existing users' needs and product-market fit, miss opportunities to disrupt at scale. What is needed are disruptive solutions which tackle the sustainability deficiency. In the Science and Technology Studies field, it is well established that technology and society mutually shape each other. Thus focusing on collective social needs, businesses can shape technologies such that they become fit for tackling sustainability issues. Today, businesses have opportunities to develop economically viable sustainable solutions. Based on signals from both industry and academia, we believe the time is ripe for disruptive solutions that incorporate social actors as active agents in the sustainability transformation.

We propose a conceptual study that addresses the following research question: How might social interactions shape and drive disruptive solution development in businesses?

To operationalize our research question, Christensen's theory of disruptive innovation sheds some light into the social aspects of technologies, for instance by focusing on the process rather than the product or service. Additional perspectives are needed to grasp the complex and systemic phenomenon of purposefully crafting disruptive solutions in the digital age, in particular around how technologies can be co-created among social actors with competing interests but united by the drive of solving grand challenges. By combining disruptive innovation theory (Christensen & Ryanor, 2003) with social shaping of technology (MacKenzie & Wajcman, 1998) and social construction of technology (Pinch & Bijker, 1984; 1987), we seek to understand how businesses might initiate, craft and shape disruptive technologies together with social actors rather than just adopt otherwise sustaining innovations.

***Keywords*:**
disruptive solution; social construction of technologies; social interaction; sustainability disruption

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Analysis of the impact of new singular ventilation technologies on enhancing indoor air quality in schools

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Abstract:

Concern about indoor air quality (IAQ) in schools has grown in recent years, especially after the effects of COVID-19 pandemic highlighted its impact on children's health. Existing educational buildings presents limitations for conducting extensive interventions to incorporate ventilation solutions. As a result, simple strategies such as opening windows are employed. While this approach achieves the goal of air renewal, it undermines energy consumption and user comfort.

In this context, it is required to address ventilation in schools from a new perspective, providing innovative technologies that allow quick and simple installation while guaranteeing high standards of air quality, energy efficiency and user comfort. In response to this challenge, a new solution has been developed consisting of autonomous equipment installed inside each classroom and featuring independent intelligent control.

The objective of present study is to evaluate the applicability and the social and economic impact that the widespread implementation of this alternative technology could have compared to conventional methods.

To achieve this, a study was conducted to determine the general characteristics and the specific peculiarities and needs of schools in the Basque Country. The study first approached the topic theoretically through bibliographic references and statistical analysis, and subsequently, fieldwork to assess the reality of existing buildings. Additionally, an air quality monitoring campaign was carried out in pilot schools, conducted in two stages: first without ventilation and later with the new solution.

The study evaluated the benefits in terms of improved air quality achieved, as well as the improvements in the implementation and operational processes. These results were extrapolated to Basque educational buildings park, providing an estimation of the potential impact of this new ventilation approach. Highly positive results were yielded in terms of acceptance, feasibility, and ultimately, addressing the identified challenges.

Keywords

Indoor Air Quality; Schools; Ventilation; Energy Efficiency

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Machine learning-based QSAR classifications for PIM kinases inhibition prediction: Towards the neoplastic insilico drug design

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Abstract:

Promoting the use of strong AI tools in neoplastic computational drug designing is a promising way to avoid the early-stage failures of the drug discovery process for novel cancer treatment solutions in the perspective of targeted therapy approaches. We build an inhibition activity prediction machine learning classifications, aiming to model the structure/activity relationships for PIM 1/2/3 protein kinases inhibitors, using different decision tree-based algorithms, starting from the data curation and analysis of previous experimental measurements. These therapeutic targets are a family of serine/threonine protein kinases directly involved in various cellular processes, they have been implicated in cancer progression and identified as highly oncogenic. The constructed models showed Random Forest performances slightly better than XGBoost for the PIM1 (+1% of difference in the accuracy scores), and XGBoost significant robustness for the PIM2 and 3 datasets (+2% and +4% respectively), whereas the SVM algorithms were found to present a poor predictive ability from our datasets, either with a linear or a radial basis functional kernel. The benchmarking led to the selection of strongest models: 85% of prediction accuracy for PIM1 and PIM2, and 82% for PIM3 dataset. Data modeling along with technical methodology are discussed in details and the predictive strength of both RF and XGBoost algorithms on these data types is examined.

***Keywords*:**
Machine learning, QSAR, Drug design, Targeted therapies

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Design for global challenges.
Communicating emergencies for behavioral change through disruptive technologies.

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Abstract:

The current emergencies such as climate change and sustainable development, are outlining the responsibility we have as researchers and designers to transform disruptive technologies into action/reaction tools able to address and overcome the nowadays challenges.

From this perspective, as designers, we indeed believe that the key for change lies in human behavior, and thus precisely in this direction design can impact using disruptive technologies in raising awareness by resulting into behavioral change.

Specifically, this paper aims to encompass how advanced technologies such as Data Visualization and Immersive Realities can cooperate in order to activate proactive behaviors in contemporary society through a careful analysis of opportunities and limitations.

If on the one hand, Data Visualization has always been used as a tool for analyzing and communicating emergencies (Snow, Nightingale, etc.), on the other hand, immersive realities are more recently beginning to explore this field.

It is indeed at the meeting point between technology and Human Interface that the biggest gaps emerge, sometimes making the deployment of these technologies fail, due to sensory, sociological, psychological and cognitive limitations.

Have we ever wondered, for example, whether the rules of Gestalt and Bertin's theories, belonging to the first half of the 1900s, are sufficient today in making effective Data Visualization?

Are we relying too much on the "astonishing" effect of immersive realities, paying more attention to their use rather than to the conveyance of the content?

This paper attempts to critically analyze – in a multidisciplinary way and through a historical analysis, case studies and personal experimentation – the use of disruptive technologies, such as XR and Data Visualization, trying to clarify their limits, potentialities, and plausible common application fields.

The objective of the study is in fact related to the determination of possible theoretical and practical approaches for the development of validation tests regarding the use of disruptive technologies and their relationship with the Human Interface.

Keywords:
Data Visualization - XR - Human Interface - Emergency - Disruptive technologies

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The Impact of Facilitating Conditions on Innovation Readiness in the Dubai Public Sector

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Abstract:

Purpose- The purpose of this paper is to analyze the level of innovation readiness in Dubai's public sector by taking a critical look at the current facilitating conditions, analyzing the gaps that arise with the lack of various innovations in place, and offering recommendations to remedy the problem.

Methodology- This study uses secondary sources of information by selecting peer-reviewed journal articles. Given that multiple sources had to be used, the study needed to be cross-sectional. The search process for the articles included the use of relevant terms such as "innovation readiness," "facilitating conditions," as well as "Dubai Public Sector." The researcher filtered the results from the potential articles that surfaced and, after filtering, ended up with 15 peer-reviewed journal articles that were now used for the study.

Findings- This study sheds some light on the research gaps captured from the literature review. It highlighted how the literature could be broadened and possible research questions that can be identified from the literature.

Implications- The intention to use innovation readiness is positively impacted by facilitating situations, but the effect is marginal after the initial usage. As a result, the Model suggests that conducive environments have an immediate, considerable impact on user behavior.

Originality/ value- The Unified Theory of Acceptance and Use of Technology discussed in this essay gave us insights into the various forms of technology by comparing prominent technology acceptance theories.

***Keywords*:**
Innovation Readiness, Facilitating Conditions, Theoretical Framework, Conceptual Framework, The Unified Theory of Acceptance.

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