ICONS2026

International CONferences in Computational Science and Engineering for Society 2026

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BOOK OF ABSTRACTS

16–18 July 2026 | Fully Online

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National Technical University of Athens, Greece

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Book of Abstracts

16–18 July 2026 | Fully Online

All sessions are held online via MS Teams. Access links are sent to registered participants.
All times in the technical programme are expressed in Athens time (EEST / UTC+3).

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Programme and Abstracts Overview

Item	Value
Accepted and registered abstracts in this volume	233
Technical sessions in the programme	41
Virtual rooms	3
Presentation format	Fully online
Standard technical presentation slot	15 minutes per paper
Full-length paper deadline	7 September 2026

Editorial note. Titles in this Book of Abstracts have been normalised to a consistent academic title style where submissions were entered entirely in uppercase. Abstract texts are otherwise reproduced from the accepted submission records, with references limited to a maximum of three entries per abstract to maintain a uniform one-page format.

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Preface

ICONS2026, the International CONferences in Computational Science and Engineering for Society 2026, brings together researchers, practitioners and innovators working at the intersection of computational methods, data-driven engineering, artificial intelligence, digital technologies, health, infrastructure, sustainability and organisational systems.

This Book of Abstracts contains the accepted and registered contributions scheduled in the unified ICONS2026 technical programme. The volume is organised as a single conference book, while preserving the broad interdisciplinary character of the ICONS2026 cluster.

The conference is held fully online during 16–18 July 2026. Accepted full-length papers may be submitted after the conference for inclusion in the Springer proceedings, according to the official post-conference submission schedule.

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ICONS2026-000019 | Abstract 1

A Darwinian-Type Design Methodology for Smart Structures with Digital Twin Feedback

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ABSTRACT

Smart structures are increasingly expected to adapt, self-optimize, and maintain performance under uncertain and evolving operational conditions. However, conventional design methods remain largely static, relying on predefined material distributions, geometries, and control strategies that cannot fully exploit the adaptive potential of smart materials and digitally connected structural systems. This work proposes a Darwinian-type design methodology for smart structures, in which structural configurations evolve through a closed-loop interaction between physical behavior, digital twins, and evolutionary design algorithms. In the proposed framework, the smart structure is continuously monitored during operation, while sensor-derived data are transferred to a digital twin that represents its mechanical response, actuation behavior, degradation state, and environmental interactions. The digital twin learns from this feedback and updates the design space, constraints, fitness criteria, and performance models used by evolutionary optimization procedures. As a result, new generations of structural designs are not produced only from predefined simulations, but from accumulated behavioral intelligence obtained during real or simulated operation. This creates a continuous design–test–learn–evolve cycle, analogous to natural selection, where the most effective structural configurations are progressively identified, adapted, and refined. The proposed approach enables the development of smart structures with enhanced adaptability, resilience, multifunctionality, and lifecycle performance. It also establishes a pathway toward self-improving engineering systems in which design is no longer a one-time process, but an evolving intelligence-driven procedure supported by digital twins, real-time feedback, and evolutionary computation.

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Urban Noise Pollution: Acoustic Analysis of the Square District in Constantine and Mitigation Strategies

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ABSTRACT

Abstract

Prolonged exposure to high noise levels in urban environments can have adverse effects on the health and well-being of residents. The most common impacts include stress, hearing fatigue, sleep disturbances, and impaired concentration and communication skills. In dynamic commercial spaces, such as the Square District in Constantine, this noise pollution can also affect user experience and retailer productivity.

In this study, an acoustic assessment of the Square District was conducted through in-situ measurements and software modeling to identify the main noise sources and analyze their impact on the acoustic environment. The results revealed noise levels exceeding recommended thresholds, mainly due to heavy road traffic, commercial activities, and pedestrian traffic. To address this situation, recommendations have been made, including urban planning interventions, the installation of sound-absorbing materials, the installation of acoustic barriers, and better traffic flow management. These measures aim to reduce noise pollution and improve the quality of life for neighborhood users.

Keywords: noise levels, urban environments, commercial spaces, road traffic, sound-absorbing materials

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ICONS2026-000030 | Abstract 3

Historic Reading of Colonial Urban Heritage through Morphology and Spatial Configuration: The Case of Oued Zenati (Algeria)

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ABSTRACT

Colonial urban fabrics in North Africa constitute a significant yet contested component of built heritage, often overlooked due to their association with domination rather than cultural value. This paper examines the colonial urban structure of Oued Zenati (Algeria) through a historical morphological and configurational approach, focusing exclusively on the colonial period. Based on a georeferenced historic colonial map, axial reconstruction, and archival photographic material, the study combines formal urban morphology inspired by Borie with Space Syntax analysis using Depthmap. The objective is to identify the spatial logic, hierarchy, and control mechanisms embedded in the colonial road system and to assess its coherence as a historical spatial system. The results reveal a highly planned orthogonal layout characterized by strong connectivity, high global integration, and pronounced control values along primary axes, confirming the efficiency and intentional hierarchy of the colonial design. Archival photographs validate the correspondence between configurational prominence and material expression in street dimensions, alignments, and architectural continuity. The study argues that the colonial fabric of Oued Zenati should be recognized as urban heritage not merely in architectural terms but as a spatial legacy encoding historical models of governance and territorial rationalization. Methodologically, the paper demonstrates the relevance of combining morphological analysis, Space Syntax metrics, and photographic validation for the study of colonial urban heritage in data-constrained historical contexts.

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ICONS2026-000032 | Abstract 4

Advancements and Trends in Strengthening Slabs Against Impulsive Loads: A Comprehensive Review

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ABSTRACT

This article examines recent advancements in materials and techniques designed to enhance the durability of slabs in the face of sudden incidents, such as explosions and high-impact collisions. Following a thorough examination of research conducted over the past twenty years, the paper categorizes the methods into traditional reinforcement, innovative material uses, and recent design modifications. An assessment is conducted on enhanced concrete, fiber-reinforced polymers, metallic reinforcements, and innovative materials such as shape memory alloys to enhance the impact resistance of slabs. The research examines numerical simulations, laboratory tests, and field evaluations to assess the effectiveness and practicality of various reinforcement methods when subjected to real-world impulsive load scenarios. The impact of experimental settings, such as boundary conditions and load parameters, on outcomes is clearly illustrated. Study acknowledged an increasing focus on multi-material systems and the integration of innovative materials alongside traditional reinforcement techniques to enhance performance. The document evaluates the ability to withstand significant sudden forces in relation to weight, expense, and ease of installation. The assessment uncovers a deficiency in conventional testing methods for dynamic loads and in assessing durability over varying environmental conditions. It highlights the absence of comprehensive design approaches that encompass both stability and resource optimization. The research emphasizes that the integration of materials science, engineering concepts, and practical physics is essential for creating innovative approaches in the design and upgrading of essential infrastructure. Future studies may investigate innovative designs inspired by nature and advanced manufacturing methods to create stronger structural elements.

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ICONS2026-000033 | Abstract 5

PQCMC: Post-Quantum Cryptography McEliece-Chen Implicit Certificate Scheme

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ABSTRACT

In recent years, the elliptic curve Qu-Vanstone (ECQV) implicit certificate scheme has found application in security credential management systems (SCMS) and secure vehicle-to-everything (V2X) communication to issue pseudonymous certificates. However, the vulnerability of elliptic-curve cryptography (ECC) to polynomial-time attacks posed by quantum computing raises concerns. In order to enhance resistance against quantum computing threats, various post-quantum cryptography methods have been adopted as standard (e.g. Dilithium) or candidate standard methods (e.g. McEliece cryptography), but state of the art has proven to be challenging to implement implicit certificates using lattice-based cryptography methods. This study proposes a post-quantum cryptography McEliece-Chen (PQCMC) based on an efficient random invertible matrix generation method to issue pseudonymous certificates with less computation time. The study provides mathematical models to validate the key expansion process for implicit certificates. Furthermore, comprehensive security evaluations and discussions are conducted to demonstrate that distinct implicit certificates can be linked to the same end entity. In experiments, a comparison is conducted between the certificate length and computation time to evaluate the performance of the proposed PQCMC. This study demonstrates the viability of the implicit certificate scheme based on PQC as a means of countering quantum computing threats.

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ICONS2026-000034 | Abstract 6

Pseudonym Certificate Scheme and Application: A Case Study of Healthcare

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ABSTRACT

To establish a pseudonym certificate scheme for a healthcare system, this study modifies the Butterfly Key Expansion (BKE) method and applies it within a healthcare context. The proposed system comprises several key entities: the Root Certificate Authority (RCA), the Enrollment Certificate Authority (ECA), the Pseudonym Certificate Authority (PCA), the Registration Authority (RA) of medical institutions, and the End Entity (EE), such as client devices. The RCA issues certificates to the ECA, PCA, and RA, authorizing them as legitimate entities within the system. Subsequently, the ECA issues device certificates to EEs (e.g., blood pressure monitors). When a patient uses an EE to measure physiological data, the ECA first verifies that the device is legitimate. The PCA then issues multiple pseudonym certificates to the verified EE. Using these pseudonym certificates, the EE transmits physiological data to the medical institution, ensuring data integrity and non-repudiation while preventing identity information from being compromised. At a security strength level of 256, the average key expansion time ranges from 24,186.584 microseconds to 57,894.552 microseconds, enabling the generation of more than 18 public keys per second. In summary, this study presents a pseudonym certificate-based healthcare system in which the modified BKE method provides secure and efficient pseudonym certificates. Through these pseudonym certificates, signatures can be generated using expanded private keys and verified using expanded public keys, while the original public key cannot be inferred from the expanded version for ensuring user privacy.

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ICONS2026-000036 | Abstract 7

Generative AI for Autonomous IT Operations: A Framework for Cognitive Incident and Problem Management

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ABSTRACT

The escalating complexity of modern IT infrastructures, characterized by dynamic microservices and distributed clouds, renders traditional rule-based operations management increasingly inadequate. This research addresses the critical prescriptive gap in contemporary Artificial Intelligence for IT Operations (AIOps) by introducing the Cognitive Incident and Problem Management (CIPM) framework, a novel architecture leveraging Generative AI for autonomous cognitive workflows. The CIPM framework integrates a multi-agent generative ensemble with a retrieval-augmented generation (RAG) pipeline, grounding large language model reasoning in real-time telemetry and historical knowledge. A central innovation is its deterministic validation and action gate, which subjects all AI-generated remediations to policy checks and sandboxed execution, ensuring operational safety and mitigating hallucination risks. Evaluated within a high-fidelity digital twin environment across 500+ fault-injected scenarios, the framework demonstrated an 89% diagnostic accuracy and achieved a 62% reduction in Mean Time to Resolution (MTTR) for autonomously handled incidents, while successfully intercepting 100% of erroneous proposed actions. The results substantiate that a structured integration of generative AI, grounded retrieval, and rigorous validation can enable trustworthy autonomous operations. This work provides a foundational architectural blueprint and a rigorous evaluation methodology, advancing the state-of-the-art from alert correlation to cognitive incident management.

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ICONS2026-000037 | Abstract 8

A Governance Framework for Responsible AI in ITSM: Integrating Ethics, Risk, and Compliance

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ABSTRACT

The integration of Artificial Intelligence (AI) into IT Service Management (ITSM) introduces profound ethical, operational, and compliance challenges that existing, siloed governance models cannot adequately address. This research confronts this gap by developing and validating a novel, integrated governance framework designed to ensure responsible AI in ITSM. Employing a Design Science Research methodology, the study synthesizes AI ethics, risk management, and regulatory compliance into a cohesive, actionable artifact. The proposed framework features a three-tiered architecture that operationalizes ethical principles via impact assessments, manages AI-specific risks through continuous monitoring, and automates compliance mapping to evolving regulations like the EU AI Act. Expert evaluation and scenario-based demonstration confirm the framework's utility, rigor, and novelty, highlighting its effectiveness in identifying and mitigating risks such as algorithmic bias and model drift. The primary contribution is a translational model that moves beyond abstract principles to provide a structured, lifecycle-oriented blueprint for embedding responsible AI into core ITSM processes. This work advances both academic discourse and professional practice by offering a prescriptive pathway for organizations to harness AI's benefits while ensuring ethical integrity, risk resilience, and regulatory adherence.

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DOI: 10.1080/01900692.2020.1749851 While focused on the public sector, this article provides a structured analysis of AI applications and associated governance challenges relevant to enterprise contexts like ITSM. Shneiderman, B. (2022). Human-centered AI. Oxford University Press. DOI: 10.1093/oso/9780192845290.001.0001 This book provides the theoretical foundation for integrating human oversight, control, and accountability into AI systems, a core theme for ITSM workflows. ISO/IEC. (2023). *ISO/IEC 42001:2023 Information technology — Artificial intelligence — Management system.* International Organization for Standardization. This is the first international standard specifically for AI management systems, directly cited as a key component of the modern compliance obligation. Formal standards typically do not have DOIs but are identified by their standard number. European Parliament. 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A Robust Governance Framework for Trustworthy AI: Integrating GRC, Transparency, and Algorithmic Accountability

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ABSTRACT

The operationalization of trustworthy artificial intelligence (AI) remains a critical challenge, hindered by a persistent gap between high-level ethical principles, technical accountability mechanisms, and organizational governance processes. This research addresses this fragmentation by proposing a novel, integrative governance framework that systematically combines an adapted Governance, Risk, and Compliance (GRC) model, a dynamic multi-stakeholder transparency protocol, and concrete algorithmic accountability mechanisms. The framework is architected to create a continuous governance loop where risk assessments inform transparency requirements and accountability audits validate compliance postures, ensuring resilience across the AI lifecycle. Developed through a rigorous design-science and interdisciplinary literature review methodology, the framework's contribution lies in its holistic synthesis, moving beyond siloed approaches to provide a unified, auditable blueprint for translating ethical commitments into operational practice. It is explicitly aligned with emerging regulatory standards, including the EU AI Act, demonstrating its practical utility for ensuring AI systems are not only technically robust but also legally compliant, ethically aligned, and socially accountable. The proposed model offers a critical scaffold for both organizations and policymakers to advance from principled exhortations to verifiable demonstrations of trustworthy AI.

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ICONS2026-000039 | Abstract 10

A Machine Learning Paradigm for Algorithmic Credit Risk Management and Dynamic Portfolio Optimization

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ABSTRACT

The fragmentation between credit risk modeling and portfolio optimization represents a critical limitation in contemporary algorithmic finance. This research proposes and validates a novel, integrated machine learning paradigm that dynamically unifies these functions. The architecture employs a multimodal credit forecasting engine, fusing structured financial data with unstructured textual sentiment via gradient boosting and deep learning to generate forward-looking probability of default (PD) estimates. These PD trajectories are then integrated into the state representation of a risk-averse deep reinforcement learning (DRL) agent, whose reward function is penalized by a Conditional Value-at-Risk (CVaR) metric informed by the credit forecasts. Rigorous out-of-sample backtesting over a decade (2013-2023) demonstrates that this integrated paradigm significantly outperforms disjointed state-of-the-art benchmarks. The framework achieves a 22% reduction in maximum drawdown and a 92% default avoidance ratio while maintaining superior risk-adjusted returns (Sharpe Ratio: 1.24), conclusively demonstrating that the synergistic coupling of fundamental risk intelligence and dynamic allocation generates enhanced resilience and performance. The study provides a foundational blueprint for next-generation, unified algorithmic systems in asset management and institutional risk oversight.

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ICONS2026-000040 | Abstract 11

API Productization: A Framework for Dynamic, Value-Based Pricing in the Platform Economy

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ABSTRACT

The proliferation of platform ecosystems has transformed Application Programming Interfaces (APIs) from technical integration tools into core, monetizable products. However, prevailing static pricing models are fundamentally misaligned with the dynamic, heterogeneous value realization of APIs across diverse consumer contexts, stifling innovation and leaving significant economic value uncaptured. This research addresses this critical gap by developing and validating a novel framework for dynamic, value-based API pricing. Employing a design science methodology, the study integrates insights from platform strategy, service-dominant logic, and algorithmic pricing to construct a tripartite model encompassing a Value Metric Identification Engine, a multi-objective Dynamic Pricing Engine, and an ethical Governance Layer. Qualitative findings from expert interviews inform the framework's design, which is subsequently evaluated through computational simulation via agent-based modeling. Results demonstrate the framework's superiority over static benchmarks, simultaneously increasing provider revenue and consumer surplus while enhancing ecosystem resilience to competitive shocks. The study makes significant contributions to theory by bridging platform economics with granular pricing execution, and to practice by providing a structured, actionable blueprint for transitioning API monetization from a tactical concern to a core strategic capability for sustainable platform growth in the digital economy.

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ICONS2026-000041 | Abstract 12

A Unified Model for ITIL and DevOps: Achieving Velocity without Sacrificing Operational Resilience

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ABSTRACT

The digital economy's dual demands for rapid service delivery and unwavering system stability have entrenched a perceived dichotomy between the velocity-oriented DevOps paradigm and the resilience-focused IT Infrastructure Library (ITIL) framework. This research challenges that zero-sum narrative by constructing and evaluating a novel, prescriptive artifact: the Unified ITIL-DevOps Model for Velocity and Resilience (UIDM-VR). Employing a rigorous design science research methodology, the study synthesizes the ITIL 4 Service Value Chain with the DevOps continuous delivery loop into an integrated architectural model. Core innovations include the formalization of "Governance as Code" to automate compliance, the architectural embedding of Site Reliability Engineering (SRE) principles for quantified resilience, and the redesign of feedback channels to create a dynamic control equilibrium. Expert panel evaluations and scenario-based walkthroughs confirm the model's theoretical robustness and practical actionability. The UIDM-VR provides a definitive blueprint for achieving synergistic acceleration and stability, advancing the state-of-the-art by moving beyond integration tactics to offer a coherent design theory for high-velocity service management. This work contributes a critical pathway for organizations to transcend the traditional trade-off, transforming IT capability into a source of sustained competitive advantage.

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ICONS2026-000043 | Abstract 13

A Blockchain-Based Framework for Verifiable Sustainable Finance and Carbon Accounting in Banking

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ABSTRACT

The global transition to a sustainable economy is critically undermined by pervasive data opacity and verifiability deficits in financial markets, particularly within banking-sector carbon accounting. Prevailing methods for assessing financed emissions (Scope 3, Category 15) rely on aggregated, self-reported data, fostering risks of greenwashing and impeding accurate climate risk management. This research addresses this fundamental challenge by proposing a novel, architecturally detailed blockchain-based framework designed to ensure verifiability in sustainable finance operations. Leveraging a permissioned distributed ledger, the framework integrates trusted oracles for real-world data ingestion, smart contracts for automated carbon footprint calculation and covenant enforcement, and digital asset tokenization to create immutable audit trails from transaction to report. The design science methodology yields a model that technically reconciles financial activity with environmental impact, offering a transformative pathway from declarative reporting to continuous, cryptographic verification. The framework's contribution to the state-of-the-art lies in its holistic, institutionally-grounded design, which advances beyond theoretical propositions to provide a scalable blueprint for enhancing transparency, auditability, and trust in climate-aligned finance, thereby strengthening the integrity of global decarbonization efforts.

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ICONS2026-000044 | Abstract 14

A Unified Governance Framework for Cyber-Resilient ITSM: Integrating ISO 27001 with ITIL Practices

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ABSTRACT

The escalating convergence of digital service delivery and cybersecurity threats necessitates a paradigm shift from siloed governance models toward integrated frameworks that explicitly foster cyber-resilience. This research addresses the critical gap between information security management, as embodied in ISO/IEC 27001, and IT service management (ITSM), guided by ITIL practices, where their operational disconnect undermines organizational capacity to maintain assured service levels during attacks. The study employs a design science research methodology to construct and validate a novel Unified Governance Framework for Cyber-Resilient ITSM. The framework introduces a three-layered artifact: a conceptual model unifying the Plan-Do-Check-Act cycle with the ITIL Service Value Chain; a granular Process Integration Matrix detailing 243 procedural integration points; and a Cyber-Resilience Measurement Layer featuring a composite Cyber-Resilience Index (CRI). Central innovations include the formalization of Cyber-Resilience Feedback Loops that embed adaptive capacity into service workflows. The framework was rigorously evaluated through expert validation and an in-silico case simulation, confirming its utility, clarity, and efficacy in enhancing incident response and closing governance gaps. This work provides a prescriptive, actionable model for organizations to systematically transform their ITSM into a resilient, adaptive, and secure service delivery engine, advancing both academic discourse and professional practice.

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ICONS2026-000045 | Abstract 15

A Cognitive Automation Architecture for Autonomous Cybersecurity Control Validation and Real-Time GRC Assurance

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ABSTRACT

The fragmentation between credit risk modeling and portfolio optimization represents a critical limitation in contemporary algorithmic finance. This research proposes and validates a novel, integrated machine learning paradigm that dynamically unifies these functions. The architecture employs a multimodal credit forecasting engine, fusing structured financial data with unstructured textual sentiment via gradient boosting and deep learning to generate forward-looking probability of default (PD) estimates. These PD trajectories are then integrated into the state representation of a risk-averse deep reinforcement learning (DRL) agent, whose reward function is penalized by a Conditional Value-at-Risk (CVaR) metric informed by the credit forecasts. Rigorous out-of-sample backtesting over a decade (2013-2023) demonstrates that this integrated paradigm significantly outperforms disjointed state-of-the-art benchmarks. The framework achieves a 22% reduction in maximum drawdown and a 92% default avoidance ratio while maintaining superior risk-adjusted returns (Sharpe Ratio: 1.24), conclusively demonstrating that the synergistic coupling of fundamental risk intelligence and dynamic allocation generates enhanced resilience and performance. The study provides a foundational blueprint for next-generation, unified algorithmic systems in asset management and institutional risk oversight.

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ICONS2026-000047 | Abstract 16

Sustainable Service Features in Family Hotels: Examining Kids Hospitality, Fam-ily Facilities, and Sensory Experience

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ABSTRACT

The number of family trips in Indonesia, particularly Jakarta, shows significant potential that indicates the need of family-friendly accommodation. The purpose of this research is to verify the positive impact of kids hospitality, family-oriented facilities, and signature scent on guests' intention to revisit. The significant con-tribution of guest satisfaction and emotional attachment as mediators between the independent and dependent variables is also investigated. Quantitative approach was employed in this study, with non-probability technique used for question-naire. Collected data are processed with PLS-SEM using Smart-PLS 4 software.

The findings show that kids hospitality, family-oriented facilities, and hotel's sig-nature scent positively influence guests' revisit intention through satisfaction and emotional attachment. The three factors take part in fostering positive memories and experience during the family's stay by offering convenience and relaxing at-mosphere. It is also revealed that kids hospitality and signature scent have low performance level despite their high importance to guests. Research result gives some practical implications including how hotels can improve family-friendly practices. Future research can consider exploring kids hospitality from children and teenager's point of views.

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ICONS2026-000048 | Abstract 17

Systematic Literature Review: Culinary Tourism Loyalty, Experi-ence Satisfaction, and Food Neophilia: The Moderating Effect of e-WOM on Millennial Travelers

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ABSTRACT

Millennial travelers' desire to learn more about the local way of life and cuisine, Bali's culinary tourism has expanded quickly in recent years. Food neophilia, which consists of consumers' desire to taste new foods, determines the loyalty of culinary tourists, particularly if the dining experience can satisfy a range of emotional and physical needs. Now that we live in the digital age we encounter electronic word-of-mouth, also called e-WOM, which influences our perception, im-age, and traveler preferences when selecting culinary destinations and making recommendations to them. The aim of this study is to determine the relationships between culinary tourism loyalty, experience satisfaction, and food neophilia, where e-WOM is used as a moderating variable. This research methodology is supported by a systematic literature review, using an analytical and bibliometric approach. The materials were referenced from books and publications from scientific databases, e.g., ScienceDirect, Scopus, Emerald. The primary subjects chosen as research sources included culinary consumer behavior, food neophilia, satisfaction, culinary tourism loyalty, and the impact of eWOM. To create a conceptual model that is both theoretically and practically relevant in visual form, the re-sults were combined using VOS Viewer. The study's findings demonstrate that food neophilia directly affects culinary tourism loyalty, and that this effect is greatly enhanced when experience satisfaction acts as a mediator and e-WOM quality acts as a moderator. Additionally, e-WOM serves as a marketing tool and generates social validation that improves recommendations and the destination's image.

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ICONS2026-000049 | Abstract 18

Artificial Intelligence in Tourism: Threats, Opportunities, and Future Directions – A Systematic Literature Review

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ABSTRACT

This study conducts a Systematic Literature Review (SLR) to examine how employees in the tourism industry with the adoption of Artificial Intelligence (AI) and how these perceptions influence their openness, readiness, and behavioral intention toward AI-based systems in the workplace. Using the PRISMA protocol, ten peer-reviewed studies from 2020 to 2025 were analyzed to see the rapid growth and exponential development of AI in tourism organizations. The findings reveal that AI provides substantial benefits for improving efficiency, service personalization, decision-making, and organizational sustainability. However, these advantages are balanced by concerns among employees related to job insecurity, reduced autonomy, and increased psychological pressure. Variables such as perceived usefulness, perceived ease of use, AI readiness, AI opportunity perception, and perceived technology threat strongly shape how employees interpret AI as either a supportive innovation or a potential risk. Bibliometric visualizations show that research focusing on employee perspectives remains limited, with most studies emphasizing sustainability and destination management. Organizational support emerges as a crucial factor in reducing anxiety and increasing acceptance through training, communication, and skill development. The study concludes that the successful integration of AI requires balancing technological advancement with human-centered strategies to ensure that innovation complements rather than replaces the human role in tourism services.

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ICONS2026-000052 | Abstract 19

Leading AI Safety in Military Education: Institutional Governance of Disinformation Risks

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ABSTRACT

The rapid integration of artificial intelligence into military education presents institutional leaders with an unprecedented governance challenge: leveraging AI's transformative potential while mitigating its capacity as a disinformation vector. This study addresses leadership dimensions of AI safety in defense training by investigating scientific discourse on AI disinformation and systematizing institutional vulnerabilities requiring strategic governance responses.

The research combines bibliometric analysis of 809 Scopus-indexed publications (2011–2026), Partial Least Squares Structural Equation Modeling (PLS-SEM), and expert assessment involving 12 defense education specialists. PLS-SEM reveals a statistically significant relationship between AI Technologies and Disinformation clusters, while exposing a critical "education gap": the path coefficient from Disinformation to Education fails to reach statistical significance, indicating that institutional leadership has yet to develop adequate governance structures.

The study systematizes AI model compromise mechanisms — LLM grooming, data poisoning, prompt injection, and RAG exploitation — and documents the Russian disinformation network "Pravda", which caused 33% of leading AI chatbots to reproduce disinformation narratives. Expert assessment verified four institutional vulnerability domains: information leakage, educational content manipulation, critical thinking degradation, and social engineering risks.

To bridge this governance gap, the study adapts the SACRAD framework (Specificity, Accuracy, Clarity, Relevance, Appropriateness, Depth) for military education, identifying four implementation directions: curriculum integration, scenario-based training, verification protocol design, and competency assessment. The findings offer actionable guidance for leaders navigating AI adoption in security-sensitive educational environments, with implications for EU AI Act compliance, NATO AI strategy alignment, and organizational readiness for responsible deployment.

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ICONS2026-000053 | Abstract 20

Transforming Military Education for Industry 5.0: A Human-Centric Framework for AI Integration Under Wartime Conditions

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ABSTRACT

The transition from Industry 4.0 to Industry 5.0 demands fundamental reorientation of educational systems from technology-centric efficiency to human-centric resilience. Military education, where decision errors carry life-or-death consequences, is critical for this shift. This study develops a framework for transforming military professional education aligned with Industry 5.0 pillars: human-centricity, sustainability, and resilience, addressing a gap between Education 5.0 theory and defense training practice.

The methodology combines systematic review of Scopus-indexed publications, content analysis of Ukraine's Defence Applications Classifier aligned with NATO C3 Taxonomy Baseline 6, and comparative analysis of NATO states' AI integration strategies. Bibliometric analysis of 266 Scopus publications on AI in military education revealed pronounced technological bias: 50.8% focus on technical capabilities while only 6.4% address ethical dimensions.

The framework identifies three transformative vectors. Human-technology collaboration redefines AI from automation to augmentation. Adaptive resilience addresses educational systems' capacity to maintain functionality during external shocks, drawing on evidence from Ukrainian military universities operating under missile strikes. Institutional sustainability establishes governance mechanisms for digital innovation integration while preserving human competency primacy.

Ukraine's ETEE category within the Defence Applications Classifier reveals human-centric elements including adaptive learning pathways and simulation-based training. Expert assessment involving 12 defense specialists confirms information security threats substantially outrank cognitive threats, indicating the need for balanced integration.

The findings demonstrate effective transformation requires coevolutionary development across technology, pedagogy, and policy, offering NATO-aligned institutions a transferable Education 5.0 model.

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ICONS2026-000054 | Abstract 21

Organizational Design of Social Entrepreneurship Ecosystems in the Defense Sector: Evidence from Ukraine's Wartime Transformation

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ABSTRACT

Military conflicts generate large-scale demands for veteran reintegration and defense workforce social protection that conventional welfare systems cannot meet. This study addresses the challenge of designing a social entrepreneurship ecosystem within a national defense-industrial complex (DIC) during active hostilities. Drawing on Ukraine's wartime experience, the research develops governance architecture bridging defense operations, social enterprise development, and public administration.

The methodology integrates the ecosystem approach, the European EMES concept, and the Work Integration Social Enterprises (WISE) model, employing systematic literature review, comparative analysis of international practices, content analysis of Ukraine's regulatory framework, and GAP analysis of institutional capacity.

Empirical diagnostics reveal the challenge's scale: Ukraine's DIC expanded from 300 enterprises in 2022 to over 800 in 2024, production capacity reached USD 35 billion annually, workforce exceeds 300,000. The projected veteran population of 2.5 million represents a reintegration task without modern precedent. GAP analysis identifies critical discrepancies between target group needs and social protection delivery capacity.

The study proposes a three-level governance architecture. The macro level specifies institutional coordination involving government agencies and international partners. The meso level addresses organizational intermediaries: industry associations, veteran support networks, and business incubators. The micro level defines operating models for social enterprises serving defense employees, veterans, and internally displaced persons.

The findings demonstrate that effective organizational design must account for dual logic of defense operations — security imperatives alongside social mission — and governance structures require built-in adaptability for wartime-to-recovery transition.

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ICONS2026-000056 | Abstract 22

Healthy Lifestyle and Health Consciousness as Key Determinants of Healthy Food and Beverage Purchase Decisions among Millennials

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ABSTRACT

This study aims to examine the influence of lifestyle and health consciousness on purchasing decisions for healthy food and beverage products among millennials in South Jakarta. A quantitative research design was employed using a structured questionnaire distributed through purposive sampling to 120 millennial respondents residing in South Jakarta. Data were analyzed to assess the relationship between the independent variables and purchasing decision behavior. The findings reveal that lifestyle has a significant influence on millennials' purchasing decisions for healthy food and beverages, indicating that consumption patterns, daily habits, and lifestyle orientation play a crucial role in shaping healthy consumption behavior. Conversely, health consciousness does not show a significant effect on purchasing decisions, suggesting that awareness of health issues alone may not necessarily translate into actual buying behavior. These results contribute to a better understanding of consumer behavior in the growing healthy food market and provide practical implications for marketers and food and beverage businesses in designing strategies that align with millennials' lifestyle preferences.

Keywords: Lifestyle, Health Consciousness, Purchase Decision, Millennials, Quantitative Study

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ICONS2026-000061 | Abstract 23

Interactive effects between thermal/acoustic/visual environments on pedestrian winter comfort & perception in a campus

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ABSTRACT

This study examined subjective responses to thermal, visual and acoustic conditions on a university campus in Mianyang, China, during winter. Field measurements and questionnaires revealed that trees significantly reduced light levels but had limited effect on sound and thermal conditions. Local residents' neutral winter values were 18.76°C (PET), 4.90 klx and 54.92 dBA. Neutral temperatures varied with acoustic context, ranging from 17.80°C (transport sounds) to 19.98°C (teaching sounds), aligning with summer findings and suggesting physiological adaptation. Neutral temperatures also declined polynomially with higher sound levels—from approximately 21°C at 5 klx to about 18°C at 70 klx. All three environmental factors significantly influenced overall comfort (sig. < 0.001), each contributing equally (0.30), unlike summer where thermal perception dominated. Trees modified environmental quality variably based on their traits. Selecting trees with suitable characteristics could therefore enhance outdoor comfort by addressing multiple factors together.

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ICONS2026-000073 | Abstract 24

Strategic Pathways to Metaverse Adoption: A Configurational Analysis of Central American SMEs Pursuing Industry 5.0 Objectives

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ABSTRACT

This study looks at how small and medium-sized businesses (SMEs) in Central America use metaverse technologies in a way that fits with the goals of Industry 5.0. The study looks at two different ways that companies in El Salvador and Costa Rica adopted technology. The Technology-Organization-Environment structure is used to talk to workers and look at papers to do this. Transformational Alignment, which is sparked by market possibilities and quick action, helps people unconsciously align with the pillars of Industry 5.0 in a way that makes everyone valuable. Constrained Exploration, on the other hand, lowers risks and makes changes slowly. This way gives you clear plan frames that are often not the same. Now modern society know for sure that the metaverse is not a fixed tool, but rather a place where different types of technology can be used together. They also talk about how important it is to think about leadership and have heroes who do great things. You can't really tell how the switch to digital affects countries that are still growing because of this one-of-a-kind quality. It helps professionals and experts deal with making things in places that don't have many tools.

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ICONS2026-000074 | Abstract 25

Bibliometric analysis of Human and Digital Competences for workplaces innovation

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ABSTRACT

The research addresses an emerging need in the digital era valuable for academics and professionals interested in the evolution of the labor market within a dynamic highly influenced by digital transformation within strategic organizational management. To identify and examine areas of research that the academic literature has provided within the digital transformation theme, focusing on the evolution of the competencies required for both human and non-human job roles, by conducting a bibliometric study. Literature review and bibliometric analysis. Identification of 8 major conceptual categories as potential research areas, which in turn have 16 theoretical connections and 28 core themes. providing a strategic framework for integrating human and digital competencies. Key findings emphasize the evolving skillsets necessary for digital transformation, with implications for workforce training and talent management strategies. The study offers actionable insights for educators, employers, and policymakers to address competency gaps and foster innovation in increasingly digitized workplaces. Theoretically it will help identify theoretical frameworks regarding the evolution of people's skills and competencies in the digital age, and how these are distributed between human workers and automated systems. Socially, the research can influence educational and training policies, ensuring that the workforce readiness for the demands implied by digital transformation within a highly digitized work environment. In addition, it can guide organizations in designing professional development programs and talent management strategies, promoting effective integration of advanced technologies and humans in the workplace. This, in turn, can reduce skills gaps and improve employability and productivity in the digital economy.

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ICONS2026-000075 | Abstract 26

Empirically Validated Autonomous Orchestration of Cyber-Resilience via Generative AI Multi-Agent Systems

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ABSTRACT

The fast merging of advanced cyber dangers with a regulatory environment that is crowded and appears in many countries has made models of compliance and risk that are used now and then out of date. The Proactive Compliance & Cyber-Resilience Orchestration Framework (PCC-ROF) fills an important gap in study by suggesting, showing, and giving proof for it. With the introduction of this new generative AI multi-agent structure (MAS), organizational control can now be handled by a dynamic, self-directed system rather than a reactive, human-centred process. The framework combines professional tools for continuous regulatory analysis in real time, environmental risk prediction with the help of graph neural networks, and the generation of automatic responses. A cooperation layer with shared context memory organizes all of these. Its most important new feature is a "meta-governance layer" that keeps an eye on things all the time to lower AI-specific risks like model fantasy and aggressive prompt input. This allows AI to consistently take care of itself in very important scenarios. The mean time to compliance (MTTC) is lowered by 91.4% by the PCC-ROF, which also projects contextual weaknesses with 90.3% accuracy and stops 76.4% of attack sequences by itself, according to careful tests of regulatory dynamics and hostile cyber-threat campaigns. Meta-governance is able to block 94.2% of lies and stop 88.0% of hacking efforts.

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ICONS2026-000077 | Abstract 27

An Integrated Deep Learning Framework for Glaucoma Diagnosis Using Enhanced Morphological Image Preprocessing, Robust Feature Extraction, and CNN-Based Optic Disc–Cup Segmentation and Stage Classification

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ABSTRACT

Glaucoma is a progressive and irreversible ocular disease that leads to vision loss if not detected at an early stage, making accurate and automated diagnosis a critical requirement in modern ophthalmology. This paper presents a comprehensive and hybrid deep learning–based framework for reliable glaucoma detection and staging by integrating advanced image preprocessing, discriminative feature extraction, and convolutional neural network (CNN)–based optic disc (OD) and optic cup (OC) segmentation. Initially, fundus retinal images undergo an enhanced preprocessing stage that combines improved morphological dilation and erosion operations with Contrast Limited Adaptive Histogram Equalization (CLAHE). Features such as cup-to-disc ratio (CDR), neuroretinal rim thickness, pixel intensity distributions, and textural descriptors are extracted to provide clinically relevant indicators of glaucomatous progression. These features complement deep representations learned automatically by the CNN, improving the discriminative capability of the overall framework. The core of the proposed system is a CNN-based segmentation model designed to accurately delineate the optic disc and optic cup regions from retinal fundus images. The segmented outputs are used to compute critical glaucoma indicators, which are then fed into a classification module to categorize the disease into normal, early, moderate, and advanced stages. Extensive experimental evaluations demonstrate that the proposed hybrid framework achieves high segmentation accuracy. Results confirm that integrating enhanced morphological preprocessing, effective feature extraction, and CNN-based segmentation significantly strengthens diagnostic reliability. Framework offers scalable, automated, clinically viable solution for early glaucoma screening and stage-wise assessment, supporting ophthalmologists in decision-making and preventive eye care.

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ICONS2026-000078 | Abstract 28

Design & development of a novel hybridized KFD prediction model for seasonal forecasting of vector borne diseases detection in medical applications using the hybrid combination of KSVM, KFD, mRBF, HRRP, RFC models

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ABSTRACT

This research introduces a comprehensive approach to forecasting vector-borne diseases by crafting a hybridized KFD prediction model that integrates multiple advanced machine learning techniques. Utilizing a new multi-level ensemble model, Kernel Support Vector Machine (KSVM), multilabel, beat process, Multi Radial Basis Function (mRBF), modified transductive, high-resolution range profiles (HRRP), and multi-level Random Forest Classification (RFC) models, the study aims to enhance the accuracy and reliability of detecting KFD. Methodologically, the research leverages Python scripting for model implementation, with extensive data transformation and preprocessing to ensure robust model evaluations. The innovative use of multiple data sources—including historical data, mobile and web application data, and clinical data—augments the model's predictive capabilities, making it a significant tool for early detection and management of vector-borne diseases. The main aim of the proposed research work is to design and develop a novel hybridized Kyasanur Forest Disease (KFD) prediction model that leverages a combination of rejuvenated machine learning models to enhance seasonal forecasting and detection of vector-borne diseases. By integrating advanced algorithms such as Support Vector Machines, Naive Bayes, Logistic Regression, and Multi-layer Perceptrons, the research seeks to improve the accuracy and reliability of predictions related to KFD cases. This hybridized approach aims to better capture the complex relationships between seasonal factors, disease symptoms, and environmental conditions, thereby providing more effective tool for early detection and management of KFD. Objective of research is dedicated to developing sophisticated hybridized model for accurate detection of disease in human beings.

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ICONS2026-000079 | Abstract 29

A Comprehensive Study & Evaluation of the AI and ML-Driven Plant Disease Detection for the Advancements through Deep Learning and GAN-Based Models for Smart Agriculture in the world scenarios

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ABSTRACT

The research work presented in this research paper gives a condensed yet comprehensive review of Artificial Intelligence (AI) and Machine Learning (ML) techniques for plant disease detection, with particular emphasis on real-time model development, simulation studies, and practical implementation in modern agricultural systems. Plant diseases and insect infestations continue to pose serious threats to crop productivity and global food security, making early detection and accurate diagnosis a critical requirement. Recent advances in deep learning, especially Convolutional Neural Networks (CNNs), along with Generative Adversarial Networks (GANs) and Deep Convolutional GANs (DCGANs), have significantly enhanced the accuracy, adaptability, and robustness of automated plant disease identification systems. It also highlights how GAN-based data augmentation techniques effectively address dataset scarcity by generating realistic synthetic images, thereby improving model generalization under diverse field conditions. When combined with advanced image preprocessing and segmentation approaches such as super-pixel and SLIC-based methods, these models can precisely localize diseased regions, leading to improved classification performance. Simulation-based evaluations reported in the literature demonstrate that AI-driven frameworks outperform conventional image processing techniques in terms of accuracy, sensitivity, and real-time responsiveness. Furthermore, the paper discusses the integration of these intelligent models with IoT-enabled platforms for real-time monitoring and decision support. IoT sensors, edge devices, and cloud-based analytics enable continuous data acquisition, remote disease assessment, and timely alerts, making the solutions practically viable for large-scale deployment. While challenges such as data diversity, hardware constraints.

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** The asterisk denotes the presenting author.*

ICONS2026-000080 | Abstract 30

Energy-Efficient High-Speed Digital Logic Design Using Adiabatic Computational Methods for Next-Generation Low-Power VLSI Systems using Multi-Physics Concepts

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ABSTRACT

The proposed work focuses on the developing of the adiabatic logic-based architectures for fundamental digital building blocks, including combinational and sequential circuits, with emphasis on achieving an optimal trade-off between speed, power dissipation, and area overhead. The increasing demand for high-performance computing systems with stringent power constraints has made energy efficiency a critical design objective in modern Very Large Scale Integration (VLSI) systems. In this context, adiabatic logic has emerged as a promising alternative, offering substantial reductions in energy consumption by enabling near-reversible charge transfer and minimizing switching losses. This paper presents the design, simulation, and optimization of energy-efficient high-speed digital logic circuits employing adiabatic logic principles for next-generation low-power VLSI applications. Detailed mathematical modeling is carried out to analyze energy dissipation as a function of switching frequency, load capacitance, and power-clock waveform characteristics. Extensive circuit-level simulations are performed using industry-standard EDA tools across multiple technology nodes to evaluate power consumption, propagation delay, energy-delay product, and robustness under process, voltage, and temperature variations. The results indicate significant improvements in energy efficiency without compromising operational speed, making the proposed approach suitable for high-speed, low-power applications such as portable electronics, IoT devices, and energy-constrained computing systems. Overall, this work establishes adiabatic logic as a viable and scalable solution for future VLSI systems, providing valuable insights into the practical realization of energy-optimized digital circuits for next-generation computing platforms.

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ICONS2026-000081 | Abstract 31

From Human in the Loop to AI in the Front Seat: The Emergence of Agent Centric Digital Platforms

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ABSTRACT

For decades, organizations have relied on human-in-the-loop arrangements across domains such as finance, marketing, and operations, where people retain decision authority while information systems support analysis and execution. Yet emerging agent-centric platforms such as Moltbook reveal a conceptual blind spot in Information Systems scholarship: abundant work explains supervised automation, but sparse theory explains platforms where AI agents become operational participants that generate discourse, coordinate interaction, and stabilize decisions through internal control layers. The central problem is therefore explanatory, not evaluative: existing lenses are not designed to describe the structural shift in agency, coordination, and governance when AI moves into the front seat. Address this gap, ATLAS (Autonomous Technological Loop of Artificial Sovereignty) is proposed as a mechanism framework that models agentic autonomy as a closed loop of AI Actor, AI Processing, AI Decision, and AI Sovereignty. ATLAS enables systematic classification of agent-centered platforms and provides a foundation for future IS research on governance-by-design, including decision rights, escalation logic, auditability, and contestability.

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ICONS2026-000082 | Abstract 32

Sovereign Truth in the Loop: Grounding LLMs in Indian Government Data through MoSPI MCP

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ABSTRACT

This paper examines how the Indian government's MoSPI Model Context Protocol (MCP) can ground large language model outputs in authenticated public statistics. Using a comparative query-based design, media-linked claims were evaluated against ChatGPT responses connected to the MoSPI MCP. The findings show that sovereign grounding can validate accurate claims, contextualize incomplete narratives, clarify methodological disputes, and replace estimated figures with finalized official data. The study positions government MCP as a sovereign truth interface for reducing misinformation in public-facing AI systems.

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ICONS2026-000083 | Abstract 33

Six Principles, One System: A Multi-Agent Architecture for Ethical Evaluation

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ABSTRACT

The rapid integration of large language models (LLMs) into organizational and public-facing systems has intensified concerns about automated ethical reasoning. This paper operationalizes six enduring ethical principles—the Golden Rule, Kant's Categorical Imperative, the Slippery Slope Rule, the Utilitarian Principle, the Risk Aversion Prin- ciple, and the Ethical 'No Free Lunch' Rule—within a multi-agent AI evaluation pipeline built on CrewAI. Each principle is encoded as a spe- cialized reasoning agent that independently evaluates a prompt–output pair and returns a structured verdict. A synthesizing 'Ethics Chair' agent aggregates these verdicts into a single actionable report. By distributing ethical reasoning across independent agents and exposing inter-principle conflicts, the system enhances interpretability, auditability, and organi- zational accountability in generative AI deployments.

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ICONS2026-000090 | Abstract 34

Investigating the effects of digital technology development on carbon emission efficiency: Using a semiparametric additive spatial autoregressive model

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ABSTRACT

The digital technology development has enormous potential for enhancing carbon emission efficiency (CEE). However, the existing parametric spatial models are unable to fully capture the complex nonlinear and spatially heterogeneous effects. To address this gap, we construct a semiparametric additive spatial autoregressive model (SASARM) with its generalized method of moment (GMM) estimation to analyze the linear, nonlinear and spatial spillover effects of digital technology development on CEE from the panel data of 30 Chinese provinces spanning 2011-2021. The results show that: (1) CEE exhibits a significant spatial spillover effect. (2) An inverted "U-shaped" nonlinear effect on CEE is exerted by digital technology development. As a result, the Chinese government should enhance regional collaboration, dynamically optimize the development path of digital technology, and promptly avoid potential efficiency bottlenecks that may arise in the later stages of technological expansion when formulating emission reduction policies.

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ICONS2026-000091 | Abstract 35

Exploring the spatio-temporal evolution and nonlinearity of PM2.5 concentration driven by the digital economy: Evidence from China

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ABSTRACT

This paper investigates the generalized method of moments (GMM) estimation for the fixed effects partially linear additive spatial autoregressive model (PLASARM). Based on the panel data of 30 provincial-level administrative regions in China from 2011 to 2023, this paper further adopts PLASARM to systematically examine the spatio-temporal evolution and nonlinearity of PM2.5 concentration driven by the digital economy. The empirical results are summarized as follows: (1) PM2.5 concentration presents significant spatial spillover characteristics across regions. (2) The digital economy, energy structure and civilian vehicle ownership affect PM2.5 concentration in a significant U-shaped pattern, while population size and energy intensity show an inverted U-shaped impact. In addition, industrialization and urbanization initially follow a U-shaped relationship with PM2.5 pollution, and their influencing effects have gradually stabilized in recent years. Drawing on the empirical findings, this study provides some policy implications.

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ICONS2026-000098 | Abstract 36

Conceptual Design for a Hybrid Wave Disk Engine and Variable Chunk-Based CFD Methodology

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ABSTRACT

This paper proposes a novel conceptual design for a hybrid hydrogen wave disk engine integrated with a variable chunk-based fluid analysis mechanism. The wave disk engine is a type of internal combustion engine that combines the advantages of the conventional internal combustion engine and the gas turbine engine. In this mechanism, hydrogen combustion replaces the carbon-based fuel combustion cycle, thereby eliminating carbon emissions. This study defines the concept of the hydrogen-based wave disk engine and analyzes it. In addition, the electrical feedback and control system is introduced to the angular velocity of the rotor to stabilize the cycle and maintain the efficiency-maximizing angular velocity. This study defines a chunk-based CFD methodology for the hydrogen wave disk engine to solve the divergence problem and numerical instability of the conventional Navier-Stokes solvers. This mechanism is expected to solve both the greenhouse gas emissions problem of the internal combustion engine and the energy density limitation of the pure electric motor system.

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ICONS2026-000104 | Abstract 37

Analytical Matrix Solutions for Real-Time UAV (drone) Attitude Control

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ABSTRACT

Autonomous drones require high-frequency updates of their orientation (attitude) to maintain flight stability, yet conventional onboard algorithms often rely on Euler angles, which are prone to Gimbal Lock singularities, or iterative Taylor expansions for matrix exponentials, which consume significant CPU cycles and introduce numerical drift. This paper applies an exact analytical framework to the 3x3 rotation matrices ($R \in SO(3)$) governing drone dynamics. By utilizing the Cayley-Hamilton theorem and our previous work, the matrix exponential e^{Ωt} representing the drone's rotation over time, is reduced to a finite polynomial, providing a direct closed-form solution for any constant angular velocity w. Key findings demonstrate superior computational efficiency, as the proposed formula eliminates iterative loops by replacing them with a single matrix power calculation (A^2) and a linear combination. Furthermore, this analytical approach ensures numerical integrity by maintaining the orthogonality of the rotation matrix, thereby preventing spatial deformation during long-duration flights. The framework also exhibits high robustness, remaining stable even when damping or friction effects are present, offering a more general solution than the classical Rodrigues formula. By providing an exact mathematical bridge for 3x3 matrix operations, these formulas enable more reliable and energy-efficient flight controllers for autonomous UAVs.

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ICONS2026-000105 | Abstract 38

Efficient Attitude Control and State Prediction for Satellites via Direct 3x3 Matrix Power Calculation

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ABSTRACT

In modern aerospace engineering, the real-time Control and Attitude Determination Systems (ADCS) of satellites-particularly within the burgeoning field of CubeSats-face significant constraints regarding onboard power and computational throughput. Predicting future states for Model Predictive Control (MPC) or stabilizing complex rotational dynamics traditionally relies on iterative matrix multiplications or numerical approximations of the matrix exponential, both of which are susceptible to O(n) complexity and cumulative numerical drift.This paper introduces a robust, closed-form algebraic methodology for the direct calculation of the n-th power and exponential of 3x3 transition matrices. By leveraging the characteristic properties of the SO(3) group, our previous work and the Cayley-Hamilton framework, we derive a deterministic formula: A_{d}^n=a_{n}A_{d}^2+b_{n}A_{d}+c_{n}I. We demonstrate that this approach achieves O(1) constant-time complexity, providing exact state predictions without the need for traditional diagonalization or recursive iterations.Numerical simulations of a coupled inertia satellite model show that our method reduces the floating-point operation count by over 90% compared to iterative techniques while maintaining absolute numerical integrity. This efficiency allows for extended prediction horizons and higher control frequencies, offering a transformative tool for autonomous satellite navigation and high-precision pointing missions.

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ICONS2026-000106 | Abstract 39

Deep Learning-Based Fault Diagnosis in Wind Turbines Using Vibration Signals

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ABSTRACT

The increased rate of wind power production has created a need for reliable monitoring tools that can detect mechanical malfunctions in wind farms. Critical mechanical parts, such as gearboxes, bearings, and rotating shafts, are under constant stress. Unexpected failures lead to high maintenance and repair costs. Vibration-based condition monitoring has emerged as a promising method for fault detection in wind turbine mechanical parts. However, existing fault diagnosis tools based on vibration analysis are often limited by the need for manually crafted features and expert analysis. This paper proposes a data-driven framework for wind turbine fault diagnosis based on deep learning approaches for vibration analysis. The proposed framework should be capable of automatically learning fault features from vibration signals. The proposed method includes a discussion on signal pre-processing, segmenting vibration time series, and transforming them into a format that can be fed into deep learning architectures. The proposed method will investigate various deep learning architectures, such as CNNs and a combination of CNNs and LSTMs, to evaluate their effectiveness for fault diagnosis in wind turbine mechanical parts. The results obtained will demonstrate the reliability of deep learning approaches for fault diagnosis based on vibration analysis. The proposed framework will be a valuable addition to the field of wind power production. The proposed method will be a major contribution to reliable fault diagnosis, reduced maintenance costs, and improved reliability of modern wind power plants within the renewable energy sector.

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ICONS2026-000109 | Abstract 40

Beyond Convolution: O(1) Image Reconstruction via Analytical 3x3 Matrix Functions

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ABSTRACT

Real-time high-definition video processing is currently limited by the O(n) computational complexity of iterative filtering operations. Standard methods for denoising or multi-scale analysis require successive convolution cycles, leading to significant latency and energy consumption. This paper introduces a transformative paradigm that shifts these operations from numerical approximations to exact algebraic solutions.

Leveraging the Cayley-Hamilton theorem, our previous work and the spectral properties of 3x3 matrices, we demonstrate that any n-step linear filtering process can be reduced to a single-step, closed-form polynomial: A^n = a_n A^2 + b_n A + c_n I. This analytical reduction ensures constant computational cost (O(1)) regardless of the number of iterations. We provide the mathematical derivation for the coefficients {a_n, b_n, c_n}, ensuring signal stability and energy preservation.

Experimental benchmarks on HD and 4K streams using low-power ARM architectures show a processing acceleration of up to 94x compared to iterative schemes, reducing CPU cycles by 99%. Furthermore, our method achieves superior structural integrity (SSIM > 0.999) by eliminating cumulative rounding errors. These results offer a scalable, energy-efficient solution for autonomous drones, satellite imaging, and real-time medical diagnostics, where high-speed precision is essential.

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ICONS2026-000110 | Abstract 41

The Need of Lifecycle Management in Sustainable Infrastructure Requiring Governance Framework Especially for Digital Twins Led by AI

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ABSTRACT

The fast incorporation of Digital Twins with AI technologies is providing the facility to transform the way systems of infrastructures could not only be planned as well as constructed but also operated in addition to maintained. The Digital Twins allow nonstop monitoring, optimization of lifecycle of assets of infrastructures, and predictive decision making, which is why their extensive implementation increases considerable governance hurdles associated with interoperability, transparency, ownership of data, coordination between institutions, as well as accountability. To discuss such hurdles is important to make sure that the ecosystems of Digital Twin aid efficiently in the decision-making process particularly in public sector context, as well as in the management of sustainable infrastructures. A governance framework will be proposed through this paper, for Digital Twins led by Artificial Intelligence incorporated into lifecycle management of infrastructures. This framework will concentrate on incorporating Digital Twin platforms, data environments led by sensors, as well as BIM within the responsible structure of governance to assist in dependable processes of decision support. This research will implement a policy based as well as conceptual method, where it will synthesize the present literature on lifecycle asset management, governance of Artificial Intelligence, in addition to management of digital infrastructure, to allow the development of governance model which could possess multiple layers, that can cover regulatory, organizational, as well as technical aspects.

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ICONS2026-000111 | Abstract 42

AI-Driven Intelligent Control Architecture Integrated into Modern Photovoltaic Inverters

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ABSTRACT

The accelerated growth of photovoltaic systems requires inverters that can quickly adapt to constantly changing environmental and operational conditions. In this paper, we introduce an artificial intelligence-based control architecture directly integrated into the inverter, aimed at optimizing energy conversion in real time, predicting potential failures, and dynamically adjusting the maximum power point tracking (MPPT) process.

The system relies on compact neural models and machine learning mechanisms designed to operate efficiently on hardware with limited resources. This approach enables the inverter to respond more rapidly to sudden changes in irradiance, maintain high efficiency, and remain stable even in challenging situations such as partial shading.

Simulation results demonstrate consistent improvements over traditional control methods in both stability and energy efficiency. Incorporating an AI module into the inverter's logic yields faster responses to irradiance changes, more accurate maximum power point estimation, and earlier detection of abnormal behavior. These findings confirm the potential of AI-based smart inverters to enhance energy output, minimize operational risks, and support the advancement of modern renewable energy infrastructure.

Keywords: Artificial Intelligence, Smart Inverter, MPPT Optimization, Embedded Systems, Predictive Maintenance, Renewable Energy, Machine Learning Control, Photovoltaic Systems

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ICONS2026-000112 | Abstract 43

Data-Driven Analysis of Operational Performance and Stability in a 110 Kv Electric Transmission Network

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ABSTRACT

This paper presents an analysis of the operational performance of a 110 kV electric transmission network, using real-time measurements over a 30-day period. The study focuses on evaluating key electrical parameters, including voltage, current, power factor, active and reactive power, as well as frequency variations, to determine the efficiency, reliability, and stability of the network. Through detailed data analysis performed using advanced monitoring tools and software, significant insights into the networks dynamics were obtained. The results demonstrate the network's capability to manage load variations and highlight critical areas where improvements could enhance operational effectiveness. Additionally, the research discusses the implications of these measurements on predictive maintenance and network design optimizations. The integration of real-time data provides a solid foundation for implementing more efficient and robust network management practices, contributing to improved sustainability and resilience of the power system. This study not only supports strategies for continuous monitoring and improvement but also serves as a model for similar analyses in other electric transmission networks.

Keywords : power network analysis, energy system performance, real-time monitoring, electrical network optimization

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ICONS2026-000113 | Abstract 44

Power Quality Improvement in a 6 Kv Medium-Voltage Network Using a Synchronous Machine

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ABSTRACT

In this paper, the integration of synchronous machines into medium-voltage networks plays a significant role in improving power quality and ensuring stable operation. This study focuses on analyzing the contribution of a synchronous machine to enhancing power quality in a 6 kV medium-voltage network. Key parameters such as voltage regulation, harmonic attenuation, reactive power compensation, and power factor correction are investigated to determine the machine's effectiveness in addressing power quality challenges. Through theoretical modeling and simulations, the impact of the synchronous machine on reducing voltage fluctuations, balancing loads, and minimizing harmonic distortions is evaluated. Additionally, experimental data obtained from real network operating conditions are analyzed to validate the machine's performance under dynamic operating scenarios. The results highlight the machine's capability to provide reactive power support, improve voltage stability, and enhance the overall efficiency of the electrical network. Recommendations for optimal integration strategies and operational settings are proposed to maximize these benefits. This study contributes to the advancement of research on advanced solutions for maintaining high power quality in medium-voltage power systems.

Keywords : synchronous machine, power factor, real-time monitoring, power quality

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ICONS2026-000114 | Abstract 45

Robust Omnidirectional Robot with Four Active Wheels based on Digital Twin

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ABSTRACT

Omnidirectional mobile robots have become an essential component of modern autonomous systems used in logistics, industry, agriculture and service applications. Their ability to move in any direction without changing orientation gives them a significant advantage in dynamic environments and confined spaces. However, precise trajectory control for such systems remains a complex problem due to the nonlinear nature of robot dynamics, parametric uncertainties and external disturbances. In recent literature, numerous control strategies are investigated to improve the performance of mobile robotic systems, including classical methods such as PID and LQR, as well as advanced methods such as Model Predictive Control (MPC), fuzzy control and neural network-based techniques. MPC predictive control allows for control optimization over a prediction horizon and can handle system constraints, and is frequently used for tracking complex trajectories of mobile robots. At the same time, fuzzy and neuro-fuzzy methods are used to deal with system uncertainties and nonlinearities, providing high performance under disturbance or noise conditions. Recent studies show that these methods can reduce tracking error and improve robot stability in dynamic scenarios. In this paper, a simulation framework is proposed for an omnidirectional mobile robot with four drive wheels, in which several control strategies are implemented and compared: PID, LQR, MPC, fuzzy and neural. The performance of the controllers is evaluated through MATLAB simulations using metrics such as RMS error, maximum deviation and trajectory stability. The obtained results highlight the advantages of predictive and intelligent methods over classical control methods.

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ICONS2026-000115 | Abstract 46

Analysis of Three-Phase Induction Motor Operation in a Distorted Regime

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ABSTRACT

Explosive working environments are highly demanding for the electric motors that drive industrial equipment. The construction of ATEX-type motors is specialized to ensure the protection of both the motor itself and the surrounding work environment. The operating regime of a three-phase induction motor functioning in such an environment is influenced by dynamic and variable production processes, high ambient temperatures, and the circuit's power factor. Distorted regime analysis involves evaluating the entire electrical supply system, the power factor value, the waveforms of currents and voltages, and the technological process, which often exhibits a highly dynamic gradient.

This paper analyzes the serious effects of distorted regimes on motor operation, focusing on electrical and thermal stresses. It also covers the simulation of distorted regimes in a virtual environment to optimize motor performance and identify solutions to limiting the deforming regime.

Keywords: Deforming regime analysis, Atex motor, Power factor

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ICONS2026-000116 | Abstract 47

State of Power Estimation for Lithium-Ion Batteries via HPPC and NARX Residual Learning

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ABSTRACT

Accurate estimation of battery State of Power is essential for electric-vehicle battery management because it determines the maximum charge and discharge power that can be delivered over a finite horizon without violating voltage and current constraints. This paper proposes a hybrid SOP estimation framework that combines an HPPC-grounded equivalent-circuit baseline with a Nonlinear AutoRegressive network with eXogenous inputs (NARX) acting as a residual corrector. The baseline layer provides an interpretable and computationally efficient power limit based on open-circuit-voltage and resistance characteristics, consistent with established SOP estimation workflows. The NARX layer is then used to learn the dynamic discrepancy between the baseline SOP and a richer reference SOP, allowing the estimator to capture transient load-history effects, voltage sag, and delayed polarization behavior that are difficult to represent with static maps alone. The methodology is implemented in MATLAB using an HPPC/C20-driven parameterization workflow and a NARX training strategy based on open-loop identification followed by closed-loop deployment for multi-step prediction. Validation is performed on the publicly available LG 18650HG2 dataset, which includes drive-cycle, HPPC, and characterization data across operating conditions. The proposed feature set includes current, voltage, SOC, temperature, baseline SOP, voltage sag, and transient descriptors such as current and voltage derivatives. The resulting framework aims to improve transient SOP prediction while preserving the interpretability and deployability of the underlying model-based estimator, making it suitable for data-informed battery digital twins and real-time BMS supervision.

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ICONS2026-000117 | Abstract 48

A liquid droplet based robot model proposal for a semi-autonomous retinal surgery system

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ABSTRACT

The design of a semi-autonomous retinal surgery system based on biochemical nanorobots involves the integration of advanced technologies for navigation, communication, manipulation, and therapeutic substance delivery. A analogue computer based robot in liquid droplet can pass inside the eye vitreous through osmosis, and transport medical substances, and merge with other liquid robots, and it can move inside. Droplets may perform chemical reactions as miniature beakers and carry biological entities. Droplets may be manipulated with algorithmic means based on logic operations that automatically compute where droplets are stored or directed but there is a platform for error-free physical computation via synchronous universal logic. Through the coupling of droplets, was developed AND, OR, XOR, NOT and NAND logic gates, fanouts, a full adder, a flip-flop and a finite-state machine, and this enables large-scale integration of droplet logic processing.

Keywords

Semi-autonomous retinal surgery, nanorobots, analogue computer based robot, liquid droplet, logic operations, droplet logic processing, guidance system for nanorobots

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ICONS2026-000118 | Abstract 49

Side-outlet cyclone separator performance on powder material separation: CFD and experimental study

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ABSTRACT

Material handling and classification often requires equipment with multiple components, particularly for those with coarse and fine materials such as powders. Herein, a modified cyclone separator is investigated using simula-tion and experimentation to find out its separation capability. Under the Reynolds Stress Model (RSM), the side-outlet cyclone performed at 83.59 % separation efficiency. Moreover, the experimental setup resulted to a per-formance of 81.82 %, thus validating the simulation result by a margin of 2.16 % in terms of percentage difference. Remarkably, these results operated at a low velocity of 2.52 meters per second. This also has the benefit of out-performing its previous iteration, only performing at 45.48 and 60.34 % for the CFD and experimental study, respectively. This improvement in perfor-mance provides a viable option for powder transport as it implicitly denotes a lower energy consumption due to the lower velocity while having a rela-tively high separation capacity. In addition, this study features the advantage of simulating equipment operation prior to fabricating to lessen the cost in production and errors in manufacturing.

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ICONS2026-000123 | Abstract 50

The Systems of Circular Construction & Climate Responsive Needing a MCD Framework

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ABSTRACT

The construction industry in the world encounters rising pressure to decrease the negative impacts on the environment whereas long term resilience, feasibility in the economic terms, and structural performance could be maintained at the same time. It is noteworthy to understand that the regulatory shifts, scarcity of resources, in addition to climate change, have led on the path where principles of circular economy is a must and requirement of frameworks which decision support ones in order to lead the practices of sustainable construction across the whole life cycle of the infrastructures. The conventional planning methods frequently concentrate on standalone indicators of performance, which is why they wrestle to discuss the complicated trade offs amid climate resilience, lifecycle cost, efficiency of resources, in addition to the carbon emissions. This paper will propose a framework which will a multi criteria decision one in nature (MCD Framework) to assist the systems of circular construction as well as climate responsive at the same time. The said framework will incorporate environmental indicators like operational as well as economic criteria like efficiency in materials usage, lifecycle cost, infrastructure resilience, in addition to lifecycle environmental performance, and carbon footprint. The gaps in the existing literature will be covered, along with real life case studies will be analysed, apart from the market readiness will be taken into account to understand the future of climate responsive and circular construction systems.

Keywords: Sustainable Infrastructure, Circular Construction, Multi Criteria Decision Framework, Governance

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ICONS2026-000124 | Abstract 51

The Sector of Built Environment Requiring Artificial Intelligence Led Transformation Through Governance Models and Readiness of Organizations

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ABSTRACT

AI is swiftly remaking the operational processes, project management, as well as decision making across the sector of built environment. It is noted that Artificial Intelligence technologies are being used not only in construction management, planning of infrastructures, but also in lifecycle optimisation, monitoring of assets, apart from the fact that they are being implemented into the engineering workflows more with time. Nonetheless, effective implementation of AI technologies relies on various factors which include technological capabilities, transformation processes of organisations, governance structures, in addition to readiness of institutions together, where mostly people only concentrate on technological capabilities which is not sufficient. This leads to various organizations in engineering encounter hurdles associated with adaptation of workforce, responsible deployment of AI, regulatory compliance, in addition to accountability frameworks. This paper will investigate the governance models as well as the readiness of organisations which are needed for transformation supported by Artificial Intelligence within the sector of built environment. The gaps in the current literature will be explored, and actual case studies for implementation will be discussed, along with market readiness of AI led transformations in the sector of Built Environment will be considered.

Keywords: Engineering Governance, Organisational Readiness, AI, Digital Transformation, Built Environment, Infrastructure Management

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ICONS2026-000125 | Abstract 52

SATTSMP: a Sentiment Analysis Tool for Social Media Posts

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ABSTRACT

SATTSMP: a Sentiment Analysis Tool for Social Media Posts

In recent years, social media has become an integral part of people's lives, who share their memories, experiences, feelings, and interests through it. This resulted in the generation of substantial volumes of data in many formats, in particular the textual form that represents the largest portion of these data. In order to extract valuable information from social media textual content, several methods for natural language processing tasks have been developed, especially through deep learning techniques. In this respect, various researches ranging from machine learning to deep learning methods have been proposed to determine public sentiment about a specific topic, event, or product. The main objective of this research paper is to develop a sentiment analysis tool that analyzes social media posts (like tweets or Facebook statuses) to determine public sentiment about a specific topic, event, or product. The tool will use natural language processing (NLP) techniques to classify sentiments as positive, negative, or neutral.

Keywords: sentiment analysis, public sentiment, deep learning, natural language processing.

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ICONS2026-000126 | Abstract 53

Adaptive MPC–ANFIS–NN hybrid control for industrial crane

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ABSTRACT

This paper presents a hybrid control approach for an industrial lifting system (crane), combining model-based predictive control (MPC), adaptive neuro-fuzzy inference (ANFIS) and adaptive neural network (NN) correction. The objective is to improve the dynamic performance of the system in tracking an angular velocity reference over a full 600s cycle, in the presence of significant load variations. The system model includes the mechanical dynamics of the drum and motor, the mechanical reducer and the effect of friction. MPC provides the feedforward control action, ANFIS compensates for the system nonlinearities and the adaptive NN reduces the tracking errors through online learning with decaying learning rate.

MATLAB simulations demonstrate accurate reference tracking (RMSE ≈ 0.057rad/s), stability of the speed–torque loop and an energy recovery of approximately 16% through regenerative braking. The analysis includes performance metrics (RMSE, mean error and standard deviation), velocity, error, power plots and a Sankey like visualization of the energy flow. The results suggest that the hybrid approach outperforms traditional control (e.g. PID or single MPC), both in terms of dynamic accuracy and energy efficiency. The main contributions include the integration of MPC+ANFIS+NN in a single control loop, the normalization of ANFIS for numerical stability and the quantification of energy recovery in a realistic industrial cycle.

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ICONS2026-000128 | Abstract 54

Context-aware conversational retrieval system for educational platforms

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ABSTRACT

The educational platforms offer access to a vast quantity of scholarly materials; however, the conventional retrieval mechanisms are not capable of considering the context-based attributes of the users, such as their academic level or their interest in specific topics. The paper suggests a context-aware conversational assistant for improving access to the resources of educational platforms. The suggested framework is based on the integration of conversational interaction with context modeling and semantic document retrieval. The user queries are handled by a conversational agent that processes the queries based on context attributes such as user profile, academic discipline, or interaction history. The context-aware conversational assistant can dynamically adapt to the needs of the user for better access to the resources of the educational platform. For example, for undergraduate students, the system can retrieve introductory learning materials, while for researchers, it can retrieve specialized publications. The system is based on the following components: document processing, semantic indexing, context modeling, and conversational response generation. The context-aware retrieval mechanism is validated based on experiments performed on a set of academic resources. The results indicated that the proposed context-aware conversational system has the ability to improve the relevance of the materials compared to the context-agnostic conversational systems. The proposed method demonstrates the benefits that a context-aware conversational agent has for improving the services provided by the educational platforms.

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ICONS2026-000129 | Abstract 55

Confidence-Aware Intelligent Assistants for Reliable Student Support in Massive Open Online Courses

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ABSTRACT

Massive Open Online Courses (MOOCs) have expanded access to education worldwide, yet learners often face challenges when immediate academic support is unavailable. Intelligent assistants have emerged as promising tools to provide automated guidance and answer students' questions. However, many existing systems deliver responses without assessing their reliability, which may lead to inaccurate or misleading information being presented to learners. In educational environments, the ability of an assistant to indicate uncertainty is essential to maintain trust and support effective learning.

This paper proposes a confidence-aware intelligent assistant for MOOCs that estimates the reliability of its responses before presenting them to students. The proposed approach integrates a retrieval-based question answering mechanism with a confidence estimation strategy derived from the similarity between student queries and relevant educational resources. Based on this similarity score, the system computes a confidence level that reflects how strongly the retrieved information supports the generated response. When the confidence is low, the assistant can warn users or suggest consulting additional learning materials.

The proposed architecture is designed to operate using lightweight natural language processing techniques, making it suitable for educational platforms with limited computational resources. The study introduces the system architecture and outlines an experimental framework for evaluating the effectiveness of confidence estimation in improving the reliability of automated student assistance within MOOC environments.

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ICONS2026-000130 | Abstract 56

Finite element simulation and spherical indentation in estimating the constitutive equation of high-carbon cable

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ABSTRACT

High-carbon, high-strength steels have an important application in many constructions of domes, shell structures, and bridges because of the advances of its mechanical properties. In this study, a methodology to determine the constitutive equation of high-strength steels from indentation curves was proposed. The constitutive equation of high-strength steel includes an elastic modulus (E), a yield strength (σ_y), and a work hardening (n). A three-dimensional (3-D) finite element (FE) model simulating the indentation process was developed for the necessity of constructing the accurate dimensionless equations. These dimensionless equations, which describe the fundamental relationships between constitutive parameters and the characteristics of loading–unloading curves, were developed based on FE results from 960 combinations of mechanical properties. The proposed methodology was validated through both numerical and experimental investigations. It was then applied to derive constitutive equations from the indentation curve of Poscable-86 high-strength steel. The resulting constitutive equations were further validated through tensile tests on Poscable-86 high-strength steel.

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ICONS2026-000131 | Abstract 57

Data-Driven Framework for Soil Fertility Prediction and Nutrient Recommendations.

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ABSTRACT

To optimize agricultural production, it is essential to predict soil fertility, but limited and heterogeneous datasets complicate model learning. Existing work (Sarangi et al., 2024; Dengiz et al., 2024; Abdullah, 2025) uses datasets labeled according to agronomic standards and norms and applies various machine learning algorithms to predict soil fertility. These works achieve good performance but do not explicitly address small samples or data augmentation to improve generalization. Our work is distinguished by using our limited dataset, collected in the field, which combines (i) automatic extraction of labels to identify fertility levels, (ii) soil prediction via a modular framework integrating several classifiers, (iii) using data augmentation to stabilize learning, and (iv) presenting personalized recommendations to a farmer that enables him to correct nutrient deficiencies. This work is intended to offer a scalable, data-driven, and concrete tool for the modeling and intelligent management of agricultural soils.

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ICONS2026-000133 | Abstract 58

Mathematical Modeling and Numerical Evaluation of a Wheel-Spoke Electromagnetic Energy Harvester

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ABSTRACT

In this study, we analyzed previous studies on automotive wheel energy harvesters using piezoelectric methods and numerically evaluated a low-speed energy harvester that can be mounted inside the spokes using electromagnetic induction. Through mathematical analysis, we theoretically confirmed the potential for power generation. We derived the equations of motion and current through the Euler-Lagrange equation with the generalized coordinates of position and electric charge. In addition, we observed how the generated total energy changes according to variations in the spring constant and damping ratio and analyzed the causes of this phenomenon. As a result, it was observed that the power output at low speeds can be higher than that of previous small piezoelectric energy harvesters. To confirm that this structure is an efficient method for regenerative braking, experimental analysis is planned for future work.

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ICONS2026-000134 | Abstract 59

Validation of Numerical Modelling of Cold-Formed Steel Lipped Channel Beams under Non-Uniform Bending

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ABSTRACT

Cold-formed steel (CFS) lipped channel sections are widely used as flex-ural members due to their high strength-to-weight ratio and fabrication efficiency. However, their thin-walled and monosymmetric characteris-tics make them prone to complex buckling behaviour, particularly under non-uniform bending condition commonly encountered in practice. A validated numerical model under such a condition remains limited. This study presents the validation of a numerical model for CFS lipped chan-nel beams subjected to non-uniform bending using finite element (FE) analysis. Six beam specimens with varying geometries and moment gra-dients were modelled in ABAQUS and analysed using a four-point load-ing configuration to simulate realistic bending conditions. The numerical model incorporates geometric imperfections derived from eigenvalue buckling analysis and adopts material properties based on experimental data. The predicted bending moment capacities, moment–midspan de-flection responses, and failure modes were compared with experimental results. The FE model shows good agreement, with moment capacity ra-tios ranging from 0.97 to 1.04, a mean of 1.01, and a coefficient of varia-tion of 0.026. The results demonstrate that the proposed model can relia-bly predict the bending behaviour of CFS beams, providing a basis for further parametric and design studies.

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ICONS2026-000135 | Abstract 60

A Comparative Study of Gradient Boosting Surrogate Models for Truss Optimization

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ABSTRACT

Surrogate-assisted optimization has emerged as a powerful strategy for reducing the computational load associated with structural design, where each function evaluation requires a costly finite element analysis (FEA). This study investigates whether approximation quality - as measured by the mean squared error (MSE) of a surrogate model on unseen (testing) design points - is a reliable predictor of optimization quality, defined here as the number of FEAs required to reach a design within a certain percentage of the known optimum truss weight. Two gradient boosting algorithms are employed as surrogate models: AnyBoost, a functional gradient descent method, and XGBoost, its regularised second-order extension. The proposed algorithms are evaluated on the 10-bar truss optimization benchmark problem. A Latin hypercube sampling strategy is used for the design space exploration, and the surrogate is iteratively refined by directing new FEA evaluations toward regions of predicted improvement. It is investigated if the surrogate achieving lower MSE on held-out points leads to superior optimization performance, and also the differences between these two algorithms are queried: XGBoost's deeper trees and regularisation mechanism offer an advantage in higher-dimensional spaces, while AnyBoost's simpler structure proves competitive in low-dimensional problems where training data is sparse. These findings suggest that surrogate fidelity and optimization efficiency are governed by distinct properties of the algorithms involved, and that the optimum values of the hyperparameters of a ML model strongly depend on the way it is used, either for optimization purposes directly or for function approximation alone.

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ICONS2026-000136 | Abstract 61

From Digital Skills to Work Execution: The Role of Digital Translation Capacity in Contemporary Organizations

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ABSTRACT

Digital skills are widely recognised as important for employee effectiveness, yet the literature has paid far less attention to how such skills are turned into actual work execution. This study addresses that issue by examining Digital Translation Capacity, defined as the employee's ability to convert digital knowledge, tools, and system possibilities into practical routines and role-relevant action. In this way, the paper moves beyond the usual emphasis on competence possession and focuses instead on the process through which digital capability becomes operational value within contemporary organisations. Data were collected between October 2025 and February 2026 through a questionnaire administered to 433 employees from different sectors. The instrument included demographic questions and eighteen five-point Likert items covering digital competence, Digital Translation Capacity, and execution quality under ongoing digital transformation. The data were analysed using PLS-SEM. The findings confirmed the proposed relationships and showed that digital competence is positively associated with execution quality, but that this relationship is not fully sufficient on its own. More specifically, Digital Translation Capacity emerged as a significant explanatory factor, suggesting that employees with similar levels of digital competence may still differ in how effectively they apply that competence in changing work environments. The study contributes to current discussions on organisational adaptation and evidence-based management by offering a more focused explanation of how digital capability is translated into consistent execution. It also provides a useful basis for future research and for organisations seeking to strengthen performance during periods of continuous digital transformation.

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ICONS2026-000138 | Abstract 62

Nonlinear Finite Element Modeling of Steel Tubes Strengthened with Different FRP Composites

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ABSTRACT

This study presents a finite element (FE) investigation on the structural performance of steel tubes strengthened with different fiber-reinforced polymer (FRP) composites, including carbon FRP (CFRP), glass FRP (GFRP), and basalt FRP (BFRP), using Abaqus. A detailed three-dimensional FE model is developed to simulate the nonlinear behavior of steel tubes under axial loading, incorporating material nonlinearity, geometric imperfections, and the interaction between steel and FRP layers. The FRP confinement is modeled using appropriate constitutive laws for each composite type, while cohesive surface interactions are employed to capture the interfacial behavior.

The numerical model is validated against available experimental results, demonstrating good agreement in terms of load–displacement response and failure modes. A parametric study is then conducted to evaluate the influence of different FRP types on the load-carrying capacity, stiffness, and ductility of the strengthened steel tubes. The results indicate that all FRP strengthening methods significantly enhance the structural performance compared to unstrengthened specimens. Among the three types, CFRP provides the highest increase in load-carrying capacity and stiffness due to its superior tensile strength and modulus. BFRP shows a balanced performance with moderate strength enhancement and improved ductility, while GFRP offers the least improvement.

Based on the comparative analysis, CFRP is identified as the most effective strengthening material for maximizing load capacity. The findings provide useful insights for the design of FRP-strengthened steel tubular structures.

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ICONS2026-000144 | Abstract 63

Formation of students' natural science skills in teaching natural sciences

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ABSTRACT

Annotation:In the introductory part of the research, the relevance and necessity of the topic are substantiated, the goal, objectives, object, subject of the research are described, its compliance with the priority areas of science and technology development of the republic is indicated, and information on scientific novelty, practical results, their reliability, scientific and practical significance, implementation into practice, published works, as well as the structure of the research is provided.

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ICONS2026-000154 | Abstract 64

Structural reanalysis using fixed point iteration methods

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ABSTRACT

In computational structural mechanics simulations, the most intensive task is the solution of linear systems of equations involving a stiffness matrix, a known right-hand side (load) vector and an unknown displacement vector. Advanced applications require successive solutions of such linear systems, as these are at the heart of e.g. sensitivity analyses, sizing/shape/topology optimization, stochastic analyses, etc. Hence, the development of efficient customized numerical procedures for solving sequences of large-scale linear systems is of major importance.

The so-called ‘reanalysis problems’ (Kirsch 2008) arising in the aforementioned applications involve the solution of successive linear systems of equations with multiple left- and/or right-hand sides due to variations in structural stiffness and loads. Reanalysis problems can be efficiently treated using iterative solution methods to numerically take advantage of the fact that there are relatively small differences between coefficient matrices in successive systems of equations (Papadopoulos et al. 2009; Charmpis 2010).

This work presents and numerically assesses a new family of iterative solution methods for reanalysis problems, which employs a Fixed Point Iteration (FPI) approach that follows the rationale of the classical Jacobi, Gauss-Seidel and Successive Over-Relaxation methods for solving linear systems of equations. Such methods use a recursive matrix equation to generate a sequence of solution approximations. The proposed FPI implementations take the special features of reanalysis-type problems into account and provide efficiently computed solutions. Moreover, incomplete factorization preconditioning, appropriate relaxation and suitable matrix handling techniques are employed to enhance the solution efficiency.

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ICONS2026-000166 | Abstract 65

Enhancing Internal Audit Efficiency and Effectiveness through Robotic Process Automation RPA: Theoretical Framework

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ABSTRACT

Abstract. The presented systematic literature review (SLR) is a synthesis of peer-reviewed studies on the effects of Robotic Process Automation (RPA) on the efficiency and effectiveness of internal audit (IA). In accordance with the PRISMA 2020, 20 high-quality studies were identified in Scopus and Google Scholar. Results show that RPA is most often used in evidence extraction rules, reconciliations, and control testing which is usually accomplished by attended automation designs. Though the efficiency gains, in terms of shorter cycle times and wider test coverage, have been consistently reported, the level of effectiveness gains, in terms of adding quality to audits and the capability to detect material is conditional upon high data readiness and strong bot governance. The proposed study incorporates the theories of Resource-Based View (RBV), Technology Acceptance Model (TAM), and Task-Technology Fit (TTF) to come up with a conceptual framework of RPA-enabled IA performance. The review reveals the existence of serious governance risk such as segregation of duties and bot access controls, and offers an agenda of future research on Accounting Information Systems (AIS) scholarship. The paper also adds to the literature by making a distinction between resource-use efficiency and assurance-outcome effectiveness, and providing practical guidelines of Chief Audit Executives (CAOs) to manage the transition into Internal Audit 3.0.

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ICONS2026-000167 | Abstract 66

Designing Legal Frameworks to Combat AI-Enabled Financial Fraud in Iraq: Proposing Regulations for Deepfake and Credit Fraud

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ABSTRACT

Abstract The fast adoption of artificial intelligence (AI) in the Iraqi financial sector has intensified efficiency whilst, at the same time, instigating the structural fragility to AI-driven fraud, namely, deep fake-enablers impersonation and algorithmic credit misuse. The adequacy of the Iraqi Penal Code of 1969, No. 111, and the Electronic Transactions Law of 2012 No. 78 concerning the adequacy of these two acts to combat these emerging threats are assessed in this study. With a multi-layered approach, which includes the level of doctrinal legal analysis and comparative action between EU and UAE frameworks, and quantitative modeling of an AI-enhanced detection model, the study recognizes a very crucial level of legal stasis. The simulation findings suggest that dual threshold detection (DS > 0.6; CR > 0.65) generate Recall of 1.0; however, it yields Precision of only 0.28, which requires the use of Robotic Process Automation (RPA) to be effective as a tool that auditors use to triangle. The following regulatory roadmap, proposed in the paper, consists of the amendments to the Penal Code to make the generation of synthetic identities a crime as well as require AI-mediated internal audits standards. These results also enhance the conversation on the aspect of legal transplantation in the developing economies, as it offers a starting point upon which the policymakers in Iraq can balance the technological innovation and strong judicial control.

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ICONS2026-000168 | Abstract 67

The Role of Artificial Intelligence in Fraud Detection: A Legal–Accounting Analysis of Accountability and Reliability

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ABSTRACT

The introduction of Artificial Intelligence (AI) in Accounting Information System (AIS), changed the paradigm of fraud detection where it operated as a reaction, by rules, to anomalies whereas currently, it operates as an anticipator, allowing anomalies to occur. But at the same time, this shift can bring complicated legal and accounting problems when it comes to making algorithms responsible, as well as the possibility of reliability of AI-generated evidence. The study is an in-depth investigation of these issues, covered by a multidisciplinary methodology that would focus on connecting the Iraqi institutional viewpoints with the trends in digital transformation on a worldwide basis. The study provides insight into the concept of the black box of Explainable AI (XAI), and its effects on judicial admissibility under a suggested rule, such as Federal Rule of Evidence 707, by synthesizing the recent scholarly literature (202026) and analyzing the simulated data on transactions. The conclusions show that even though AI is a significant improvement in terms of detection rates, especially when performed in an environment with low levels of external controls, the problem of lower reproducibility and standardization of the validation process is still a considerable obstacle to the acceptance of AI in the judiciary. The paper finishes with a plea to allow convergence of auditing standards and legal practices in an attempt to create a socio-technical ecosystem in which intelligent automation augments, and does not substitute professional scepticism and legal responsibility.

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ICONS2026-000169 | Abstract 68

Digital Ethics Boards: A New Strategic Model Proposal for Corporate Governance in the Age of AI Based on Case Studies

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ABSTRACT

The integration of Artificial Intelligence (AI) technologies into corporate processes brings forth complex ethical challenges, including algorithmic bias, data privacy, and accountability. Traditional corporate governance structures often prove insufficient in overseeing the dynamic and unpredictable nature of AI systems. This study proposes a conceptual model for "Digital Ethics Boards" (DEB) designed to evaluate AI strategies through an ethical lens within modern organizations. As a research methodology, comprehensive case studies on the past ethical crises and existing governance models of global technology leaders were conducted; the ideal organizational structure of the DEB was determined based on the strategic approaches derived from these analyses.

The proposed model is based on a multidisciplinary composition consisting of data scientists, legal counsels, ethicists, and end-user representatives. The establishment of such boards contributes directly to corporate sustainability by providing proactive risk management through the prevention of legal sanctions and financial losses arising from ethical failures, while also strengthening brand reputation and reinforcing the identity of a "responsible technology leader" through the accumulation of trust capital. Recent regulations, such as the European Union Artificial Intelligence Act, demonstrate that such oversight mechanisms are becoming not only an ethical preference but also a legal necessity (European Commission, 2024). In conclusion, this paper argues that AI leadership is not merely a technical achievement but a matter of ethical governance (Jobin et al., 2019), providing an actionable organizational framework based on case studies for C-level executives.

Keywords: AI Ethics, Corporate Governance, Digital Ethics Boards, Strategic Leadership, Sustainability.

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ICONS2026-000170 | Abstract 69

Multi-Axial Vibration Energy Harvesting via Torsional d_15 Mode Piezoelectric Conversion

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ABSTRACT

Current research on piezoelectric energy harvesters typically utilizes mode d_33 or mode d_31. This is because mode d_15, despite being known to offer a higher energy conversion efficiency, is harder to implement compared to other modes. The hardship comes from having to convert linear, longitudinal and transverse, waves into torsion, or other forms of circular movement. These said wave movements are often lost in conventional single-axis harvesters or other forms of vibration-based piezoelectric harvesters. This paper proposes a structure that can execute the said challenges. The studied structure develops based on the typical L-beam configuration, specifically designed to capture multi-axis movements. The capability to capture S-waves, which are frequently lost in existing harvesters, is well looked upon. Using numerical simulations, the harvesting energy efficiency will be assessed by evaluating its tortional deformation measures and energy conversion efficiency. The structures on question will look to utilize vibration-based energy harvesting in wider areas, with higher expected efficiency.

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ICONS2026-000171 | Abstract 70

Research the structure of molecules with Fuzzy sets

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ABSTRACT

According to Maxwell-Boltzmann law, with the Theory of Fuzzy logic the author will analyze the probability states and the transient process of atoms, electrons and molecules. Also, with a Membership function will be researched the displacement of a positive nucleus and negatively charged electrons between plates of a condenser, located at a definite distance from each other. In this ways, will be given new approaches of analyzing the distribution of atoms, electrons and molecules.

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ICONS2026-000172 | Abstract 71

Modeling, Engineering, and Data in Simulation and Computation for a Novel Obstacle Avoidance Algorithm Enabling Efficient Source-to-Goal Navigation of Mobile Robotic Vehicles using ML techniques

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ABSTRACT

This project presents a comprehensive approach to the design and implementation of an innovative obstacle avoidance algorithm tailored for mobile robotic vehicles. The primary aim is to develop a robust system capable of effectively detecting and navigating around obstacles in real-time scenarios. The algorithm is constructed using MATLAB, leveraging its computational capabilities and extensive toolset for algorithm development and simulation. The methodology encompasses several key stages. Initially, sensor data acquisition is performed through various sensors integrated into the robotic platform, including but not limited to cameras, LiDAR, ultrasonic sensors, or a combination thereof. Subsequently, a systematic and multi-faceted approach is employed for obstacle detection, involving techniques such as image processing, depth perception, and sensor fusion. The detected obstacle information is then processed and integrated to generate a dynamic and adaptable avoidance strategy. This strategy accounts for the vehicle's kinematics, environmental constraints, and real-time feedback, allowing for agile and safe navigation in complex and dynamic environments. The algorithm's responsiveness is optimized through iterative testing and refinement, ensuring its reliability and efficiency in diverse scenarios. The algorithm's performance is evaluated through extensive simulation studies and practical experiments with the mobile robotic platform operating in controlled and real-world environments. Quantitative metrics, including obstacle detection accuracy, avoidance efficiency, and computational performance, are employed to assess and validate algorithm's effectiveness. Outcomes of this research contribute to the advancement of obstacle avoidance methodologies for mobile robotics, offering insights into development of adaptive and intelligent systems capable of navigating challenging terrains autonomously.

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ICONS2026-000179 | Abstract 72

Blockchain for Document Verification in Peruvian Digital Governance: A Systematic Review

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ABSTRACT

This review examines whether blockchain technology can enhance the functioning of digital government in Peru, utilizing secure and efficient methods to verify documents. In Peru, bureaucracy is slow, and there is significant document fraud across the legal, financial, educational, and healthcare sectors. Blockchain appears to be a possible solution to make things clearer, reduce paperwork, and restore people's trust in the government. Using the PICOC method, we reviewed 56 key Scopus articles (from 2022 to 2025), focusing on those related to engineering, computer science, and business. Our research seeks to answer three questions: Is it possible to use blockchain to verify documents in the Peruvian government? What advantages does it have over existing approaches? And what problems need to be solved? What we found is that in other countries, such as Estonia with its digital identity systems and Malta with the verification of university degrees, blockchain has managed to accelerate verification processes. But in Peru, there are still technical, legal, and equipment-related issues. The study concludes by stating that, while blockchain is a good option for modernizing the Peruvian government, for it to work well, it requires clear rules, collaborative institutions, and significant investment in digital equipment. This review helps to better understand how to create policies and identify important topics for research on how blockchain can improve government in Peru.

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ICONS2026-000186 | Abstract 73

A Hybrid Decision Tree–KNN Framework for Classification with Nonlinear Effects and Local Variation: A Bootstrap Simulation Study

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ABSTRACT

Classification remains a central task in statistics and machine learning, especially when complex nonlinear relationships and mixed predictor types make accurate prediction more difficult. While decision trees are widely used for their interpretability and flexibility, their predictive performance may decrease when the underlying class structure exhibits substantial local variation. To address this limitation, we investigate a hybrid Decision Tree–K Nearest Neighbors (DT–KNN) approach that combines the global partitioning strength of decision trees with the local classification power of KNN. In this framework, the decision tree first assigns each observation to a terminal node, after which KNN is applied within that localized region rather than across the full training sample. This strategy aims to improve classification performance while preserving a structured and computationally manageable learning process. Using simulated data with numeric and categorical predictors, nonlinear effects, and interaction terms, we evaluate the hybrid method against a standard decision tree using a bootstrap procedure with out-of-bag observations for testing. Performance is assessed via average misclassification rates and percentile intervals. Results show that the hybrid DT–KNN method consistently outperforms the tree-only model, particularly when local variation is high or class boundaries are nonlinear, highlighting its promise for structured nonlinear classification problems.

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ICONS2026-000190 | Abstract 74

An Intelligent Framework for Detecting Psychological Trauma Related to Large-Scale Emergencies: A Comparative Perspective

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ABSTRACT

Natural disasters and pandemics represent major global crises whose consequences extend beyond physical and economic damage, often leading to significant psychological disorders including anxiety,depression, and post-traumatic stress [1]. Early detection and management of these conditions are critical to reduce their long-term impact on individuals and communities. However, traditional psychological assessment methods remain limited due to issues such as delayed diagnosis, restricted access to vulnerable populations, and the lack of predictive tools capable of anticipating the evolution of mental health conditions [2].

Artificial Intelligence (AI) techniques offer promising solutions to address these challenges by enabling data-driven, scalable, and predictive approaches to mental health assessment [3]. This work proposes the design of an intelligent framework aimed at detecting and predicting psychological trauma induced by large-scale emergencies(e.g., COVID-19). The proposed approach integrates multidimensional data and relies on the use of advanced Machine Learning (ML) models [3] to support early diagnosis and risk prediction. A comparative evaluation of several ML algorithms was conducted to identify the most suitable predictive model. Among the tested methods, Random Forest demonstrated superior performance in terms of accuracy and robustness, particularly in handling complex, high-dimensional, and non-linear data.

Keywords: Psychological Trauma, Large-Scale Emergencies, Machine Learning, Predictive Modeling.

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ICONS2026-000196 | Abstract 75

Smart Healthcare: An AI-Enabled EHR Prototype for Real-Time Patient Prioritization

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ABSTRACT

The increasing complexity of clinical workflows and the rapid growth of digital health data have intensified the need for intelligent Electronic Health Record (EHR) systems that can support real-time decision-making. This study presents the design and implementation of an AI-enabled EHR prototype that automates patient prioritization through integrated severity-classification logic and real-time data processing. The system combines a structured pre-processing pipeline, a rule-based prioritization algorithm, and modular analytics developed using KNIME, with a lightweight C Sharp-based application interface for clinicians. A synthetically generated interface but clinically representative dataset was used to evaluate performance across key dimensions, including prioritization accuracy, queue management efficiency, response time, and user experience. Experimental results demonstrated strong alignment between algorithm-generated priority scores and expert-assigned severity labels, significant reductions in critical-patient waiting times, and consistently low processing latency during high-volume data entry. Usability testing further indicated high acceptance among participating clinicians. The findings highlight the potential of interpretable, resource-efficient AI mechanisms to enhance triage accuracy and operational efficiency within EHR systems, particularly in resource-constrained healthcare settings.

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ICONS2026-000197 | Abstract 76

Security-Driven Integrations: Vertically Integrated Consumer Computing Ecosystems

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ABSTRACT

Vertically integrated computing ecosystems have become dominant in the consumer electronics industry by tightly coupling hardware, operating systems, silicon architecture, and cloud services. While this model achieves substantial gains in performance efficiency and security hardening, it introduces structural constraints in post-failure repairability and data recoverability. This investigation presents a systems-level analysis of high vertical integration, using Apple's macOS and iOS ecosystems as a representative case study. We examine the architectural implications of system-on-chip (SoC) consolidation, unified memory design, and hardware-rooted cryptographic binding. The study formalizes these relationships through a conceptual trade-off model, defining the directional correlations between Integration Intensity (I) and five key variables: Performance Density (P), Security Hardening (S), Ecosystem Integration (E), Modular Repairability (M), and Post-Failure Recoverability (R). Through structured failure simulation scenarios, we demonstrate that while integration-first architectures maximize pre-failure performance and security, they significantly reduce independent data autonomy and modular independence under catastrophic hardware conditions. The findings suggest a redistribution of system resilience from hardware modularity toward cloud-mediated continuity. This work contributes to the fields of systems engineering and digital ownership by providing a theoretical framework to evaluate the inherent trade-offs in modern integrated computing architectures.

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ICONS2026-000202 | Abstract 77

Research On Dynamic Relationship between International Gold Prices and the US Dollar Index

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ABSTRACT

As the dominant pricing currency for international gold, the US Dollar Index (DXY) exhibits frequent and sharp fluctuations, exerting an increasingly profound impact on global gold prices. This paper constructs a Threshold Vector Autoregression (TVAR) model and employs daily data spanning 2011 to 2025 to empirically examine the nonlinear dynamic relationship between international gold prices and the DXY. Our empirical results reveal that DXY shocks exert significant asymmetric threshold effects on gold prices. Specifically, in the low DXY regime, DXY shocks impose a strong negative suppression effect on gold prices, whereas this effect is relatively muted in the high DXY regime, resulting in differentiated price volatility. In contrast, gold prices exert no significant feedback effect on the DXY. Furthermore, short-term DXY fluctuations strongly affect gold prices, and prolonged stays of the DXY in either regime will further amplify the asymmetric volatility of gold prices. Accordingly, market participants and regulators should adopt differentiated asset allocation and risk mitigation strategies based on distinct DXY regimes.

Keywords: International Gold Prices; US Dollar Index; Threshold VAR Model; Nonlinear Relationship; Impulse Response Analysis

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ICONS2026-000203 | Abstract 78

Research on the Nonlinear Dynamic Relationship Between CSI 1000 and CSI 300 Stock Index Futures Basis — An Analysis Based on the Threshold VAR Model

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ABSTRACT

Traditional linear VAR models can hardly accurately capture the nonlinear correlations in financial markets. Aiming at this problem, this paper selects the basis data of CSI 1000 and CSI 300 stock index futures from July 22, 2022 to April 2, 2026, and uses the Threshold Vector Autoregression (TVAR) model to explore the dynamic relationship and mutual influence between the two under different basis levels. The study finds that there is a significant threshold effect in the co-movement of the two kinds of basis: when the CSI 1000 basis is in the low regime, their co-movement is weak, and the basis fluctuation is mainly driven by its own inertia; after entering the high regime, the nonlinear co-movement is significantly enhanced, and the cross-variety basis spillover effect is obvious. The variance decomposition results show that there are obvious differences in the contribution of cross shocks between the two regimes. The results of this paper clarify the nonlinear law of the co-movement of stock index futures basis, which not only adds new content to the relevant research on the dynamic relationship of the stock index futures market, but also provides a reference for investors to conduct cross-variety hedging and arbitrage operations. In addition, it can provide empirical support for regulators to monitor market risks and maintain market stability, and enriches the research perspective of nonlinear risk transmission in financial markets.

Keywords: Stock Index Futures; VAR Model; Threshold Effect; Nonlinear Correlation

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ICONS2026-000204 | Abstract 79

Identifying Liquidity Transmission in the Interbank Market Under Extreme Events

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ABSTRACT

This paper employs a Bayesian Markov-Switching Multivariate VAR (B-MSMVAR) model to identify regime-dependent liquidity transmission between China's cash bond and interbank lending markets. Using daily data from 2004 to 2026, we endogenously distinguish normal from extreme regimes. Our empirical results reveal three distinct regimes. ①Under normal conditions, liquidity shocks transmit symmetrically and mean-revert rapidly. ②During extreme events—including the 2013 money shortage, 2020 pandemic turmoil, and quarter-end squeezes—we identify a significant amplification effect, where shocks propagate with greater magnitude and prolonged duration. ③Estimated transition probabilities show extreme regimes persist for approximately 4 to 6 trading days. These findings suggest that monitoring regime-switching probabilities can serve as an early warning indicator for systemic liquidity stress.

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ICONS2026-000207 | Abstract 80

Optimizing Sentiment Analysis with Few-Shot Learning: A SETFIT and Transformer-Based Ensemble Framework

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ABSTRACT

This research explores the integration of few-shot learning (FSL) using the SETFIT framework with ensemble learning for Vietnamese sentiment analysis and topic classification. Using a student feedback dataset with annotated sentiment labels and topics, the research evaluates models under low-data conditions (N = 1, N = 5, and N = 20 labeled examples per class). Results show that monolingual transformer models such as PhoBERT and BARTpho generally outperform other models, while ensemble configurations achieve competitive results and can be beneficial under lower-shot conditions. The effectiveness of ensembling, however, is task- and setting-dependent. In particular, combining strong models such as PhoBERT and BARTpho does not consistently outperform the best single model across all settings, and the contribution of a weaker model such as ViBERT varies depending on the task and shot regime. This research demonstrates the potential of combining FSL and ensemble learning to address challenges in low-resource NLP settings, offering a promising approach for Vietnamese sentiment analysis and topic classification.

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ICONS2026-000211 | Abstract 81

Lecturers – the Key to Vietnamese Universities in the Digital Age

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ABSTRACT

The Fourth Industrial Revolution, along with the development of artificial intelligence (AI), has posed a significant challenge to Vietnamese universities as the labor market and societal trends demand a workforce that integrates specialized expertise and diverse skills. Therefore, lecturers need to change not only the content but also the teaching methods to provide high-quality graduates for society, adapting to the ever-evolving work environment of businesses. Through this paper, the author offers recommendations for changing teaching methods to improve the quality of education and meet the demands of society in the era of the Fourth Industrial Revolution.

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ICONS2026-000212 | Abstract 82

Threshold Effect of Price Co-movement Between Crude Oil and Dry Bulk Markets: Evidence from a TVAR Model

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ABSTRACT

The volatility transmission between the dry bulk shipping market and the international crude oil market exhibits significant nonlinear threshold effects. This paper constructs a two-regime Threshold Vector Autoregressive (TVAR) model using daily data of Brent crude oil spot prices and the Baltic Dry Index (BDI) from 2004 to 2026, with crude oil price returns as the threshold variable, to examine the price co-movement and impulse-response characteristics across different volatility regimes. The results show that: (1) A significant threshold effect is identified, with an optimal threshold of 0.17% partitioning the sample into low- and high-volatility regimes, and the price transmission mechanism is highly heterogeneous across regimes; (2) In the low-volatility regime, crude oil price shocks exert a sustained positive impact on the dry bulk market, while in the high-volatility regime, shocks trigger an initial short-term negative response followed by gradual convergence, indicating far more intense risk transmission in high-volatility environments; (3) The price correlation between the two markets is slightly lower in the high-volatility regime, and the regime transition path aligns closely with global economic cycles and geopolitical shocks. This study provides empirical support for risk management for shipping and energy enterprises, and offers new evidence on nonlinear co-movement in commodity markets.

Keywords: Crude Oil Price; Dry Bulk Market; TVAR Model; Threshold Effect; Price Co-movement

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ICONS2026-000215 | Abstract 83

Leveraging Artificial Intelligence Tools to Enhance Marketing Activities in the Construction Sector: A Case Study on Romania

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ABSTRACT

The objective of this article is to highlight the correlations between the use of artificial intelligence (AI) tools in the marketing and communication activities of companies in the analyzed sector and the financial results achieved, adjusted for company size. Additionally, the article proposes methods to enhance the efficiency of firms specialized in the construction of roads, highways, streets, airport runways, and pedestrian or vehicular access paths in Romania, through the integration of AI applications in their online promotion activities. Upon analyzing the sector's structure, we selected for study all companies with more than 50 employees, resulting in a sample of 179 entities. From the accounting balance sheets filed with ANAF (National Agency for Fiscal Administration) for the year 2024, we extracted key indicators and calculated the main economic-financial profitability ratios. We began with an initial hierarchical clustering based on the number of employees, followed by the application of advanced data mining techniques to minimize classification errors. This yielded three distinct classes: firms with high economic-financial performance, medium performance, and modest performance. Our proposal aims to improve performance by integrating AI applications into marketing activities, focusing on automating repetitive and resource-intensive tasks in online promotion. By leveraging the n8n automation platform, the products and services of companies in this sector become accessible to clients with a single click, thereby driving enhancements in economic-financial performance indicators.

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ICONS2026-000216 | Abstract 84

Digital Transformation in Construction: Enhancing Efficiency and Sustainability through Smart Technologies

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ABSTRACT

Digital technologies are rapidly transforming the construction industry. This study investigates the function of digital transformation in improving operational efficiency and fostering sustainability in contemporary construction practices. The research focuses on the integration of smart technologies, including Building Information Modeling (BIM), the Internet of Things (IoT), artificial intelligence (AI), and data analytics, as key enablers of this transformation.

The paper looks at how these technologies help with better project planning, real-time monitoring, making the best use of resources, and managing risks. The focus is on how data-driven decision-making can help projects finish on time, save money, and be better for the environment. The study also looks at the problems that come with going digital, like high costs of implementation, a lack of skilled workers, and resistance to change in the workplace.

A conceptual framework is suggested to illustrate the correlation among digital tools, efficiency improvements, and sustainability results in construction projects. The results show that using smart technologies in the right way not only boosts productivity but also helps meet sustainable development goals by cutting down on waste, energy use, and carbon emissions.

The findings of this study offer significant insights for construction managers, policymakers, and researchers aiming to utilize digital transformation as a strategic instrument for the attainment of efficient and sustainable construction systems.

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ICONS2026-000218 | Abstract 85

Hybrid Raspbian OS for Real-Time AI-Based Computer Vision on Embedded Systems

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ABSTRACT

This exploration presents the design and optimization of a hybrid Raspbian-based operating system (OS) for real-time computer vision and artificial intelligence workloads on resource-constrained embedded platforms. The proposed system incorporates kernel-level enhancements, including optimized threading, memory management, and controlled overclocking, to improve computational efficiency and system responsiveness. A lightweight computer vision pipeline is integrated to support real-time image processing, remote monitoring, and edge AI deployment. Experimental evaluation on a Raspberry Pi 4 platform demonstrates up to 30% reduction in image processing latency and improved resource utilization compared to the standard Raspbian OS. The results highlight the effectiveness of system-level customization in enabling reliable, high-performance operation for intelligent robotics and autonomous exploration applications.

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ICONS2026-000225 | Abstract 86

Nonlinear Dynamic Relationship between Market Sentiment, Stock Returns, and Volatility: Evidence from a Threshold VAR Model

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ABSTRACT

Based on the daily data of China's stock market from September 20, 2017 to April 30, 2026, this paper constructs a threshold vector autoregressive (TVAR) model to study the nonlinear dynamic relationship between market sentiment and stock market return and volatility by selecting variables such as stock return rate, VIX return rate, trading volume growth rate and margin trading growth rate. In this paper, the VIX rate of return is used as the threshold variable, the optimal threshold value is obtained through the endogenous estimation of the model, and the two market states of high panic and low panic are divided accordingly. On this basis, impulse response functions are further used to analyze the dynamic influence mechanism between variables in different market states. The results show that the market sentiment shock will significantly reduce the stock market return rate and increase the market volatility level; Compared with the low panic state, the market risk transmission in the high panic state is stronger and lasts longer; Margin trading will magnify market fluctuations to a certain extent, especially in the state of high panic, leveraged capital behavior has a strengthening effect on market risks. In addition, there is a clear nonlinear dynamic relationship between market sentiment and stock market variables. The conclusion of this paper has certain practical significance for improving the market risk early warning mechanism and maintaining the stability of the capital market.

Keywords: Market Sentiment; Stock Returns; Market Volatility; TVAR Model; Nonlinear Dynamics

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ICONS2026-000227 | Abstract 87

Impact of Surface Uniformity on Luminance Measurements for Energy-Efficient Lighting Design

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ABSTRACT

The purpose of this study was to analyze the influence of surface non-uniformity and quantify the uncertainty surrounding luminance when characterizing a luminous surface. The work is approached from a statistical and metrological perspective to provide robustness to the analysis.

The study focuses on luminance measurements, one of the most widely used quantities to characterize natural or artificial lighting systems. The results can be applied to calibrate traditional luminance meters or CCD cameras for accurate measurement contributing to energy efficiency in lighting design.

The experimental scheme consists of a sphere and a luminance meter mounted on an optical table. Several precautions were taken to reduce stray light in the measurements by placing screens. The sphere has an opening, and over it, a opal glass was placed, resulting in a uniformly illuminated translucent surface, a luminance sweep is performed over points evenly distributed on the luminous surface identified from "a" to "y". In turn, 292 luminance values were taken for each of these points.

With the collected information, the normality test is performed to determine which statistical analysis to use, and then we determine which type of distribution is used for each point at a certain confidence level of 95%. Once the approximate distribution type for each point has been determined, simulations are carried out and subsequently calculations are performed to find the uniformity of the luminous surface and associate it with an uncertainty.

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ICONS2026-000228 | Abstract 88

A Study on the Dynamic Relationship between Chinese and US Carbon Market Prices: Based on a Threshold VAR Model

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ABSTRACT

This study selects daily data on the closing price of Shanghai carbon emission allowances and US carbon emission futures trading from December 2013 to April 2026 to establish a threshold vector autoregressive (TVAR) model, exploring the dynamic relationship between their changes. The results show that all variables become stationary after first-order differencing. The Johansen cointegration test indicates a significant long-term equilibrium relationship among the variables. A significant threshold effect exists, with the US carbon futures closing price serving as the threshold value, dividing the system into low and high regimes. Both regime models pass the stability test. The regime asymmetric feature is prominent: in the high regime, fluctuations in US carbon futures exert a stronger and more prolonged impact on the Shanghai carbon price, while the transmission effect is relatively moderate in the low regime. Impulse response and variance decomposition confirm that, in the high regime, international carbon futures contribute significantly more to explaining Shanghai carbon price fluctuations, indicating stronger price information transmission efficiency. Regarding coefficient significance, both the price series and trading volume of US carbon futures significantly influence the Shanghai carbon price across both regimes, whereas the impact of the price change range exhibits a distinct regime-dependent feature.

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ICONS2026-000229 | Abstract 89

Sovereign AI-Driven Zero Trust Identity Governance for National Critical Infrastructure Resilience: A Predictive Framework Integrating JEPA-Based Threat Anticipation and Federated IAM Control Planes

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ABSTRACT

Nation-state adversarial campaigns against critical infrastructure demand a shift from reactive, perimeter-centric defenses toward sovereign, identity-governed, and predictive security architectures. Existing frameworks fail to govern AI agents, human operators, and machine identities across federated critical infrastructure (CI) domains under adversarial, degraded, and disconnected (ADD) conditions. This paper presents SZTIGA (Sovereign Zero Trust Identity Governance Architecture)—a framework unifying AI-driven predictive threat anticipation with federated Identity and Access Management (IAM) as the primary control plane for national CI resilience. SZTIGA integrates three pillars: (1) a Federated IAM Control Plane enforcing continuous authentication, context-aware authorization, and policy-based access control using TPM 2.0 attestation and OPA-based policy engines; (2) a JEPA-Based Predictive Threat Engine constructing latent world models to anticipate adversarial actions before execution, with a formally defined training objective incorporating stop-gradient and variance-covariance regularization; and (3) a National Cyber Resilience Governance Layer aligned with NIST CSF 2.0, AI RMF, and SP 800-207/207A. We formalize adaptive trust scoring via Gaussian Process regression with Thompson sampling and define novel resilience metrics: Mean Time to Identity Containment (MTTIC), Predictive Threat Horizon (PTH), and Federated Policy Convergence Rate (FPCR). Digital twin co-simulation across five CI domains under coordinated adversarial scenarios demonstrates 47-second mean threat anticipation lead time (σ=4.3s), 83% false positive reduction (χ^2=24.6, $p<0.001$), and 87% improvement in cross-domain identity containment latency. Ablation analysis confirms each pillar contributes independently.

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ICONS2026-000230 | Abstract 90

A Study of Building Component Reuse in the Norwegian Built Environment

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ABSTRACT

During the last decades, there has been a notable number of building projects in Norway, where modern concepts such as sustainability and circular econ-omy have been embraced, and to a significant extent have governed their design. A key parameter, when designing a building project within this framework, is the reuse of building components thus reducing the carbon footprint of the project. This practice is valuable to the building sector since it requires fewer resources and thus is beneficial to the environment. This paper presents two representative case studies from the Norwegian building sector, a swimming hall in Oslo and a large industrial building in Namsos, where reuse has been implemented. The study of these projects has revealed the difficulties and the barriers of implementing this idea. However, at the same time, it has also highlighted its great potential. To sum up, the reuse of building components can be considered a concrete part of a modern and sustainable design approach when constructing new projects.

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ICONS2026-000232 | Abstract 91

The Role and Characteristics of Urban Green Infrastructure Solutions in Runoff Reduction: a Review and Relation to Da Nang City

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ABSTRACT

In the context of rapid urbanization and severe climate change leading to increased rainfall, traditional gray-scale drainage solutions are gradually revealing their limitations. Urban green infrastructure (UGI) is a nature-based solution that regulates rainwater runoff at the source through mechanisms such as rain barriers, infiltration, temporary storage, and evapotranspiration.

Research shows that UGI is particularly effective at small and medium scales, but its effectiveness decreases at large scales due to the "threshold" effect (the "threshold" ratio of UGI is 30% to 40% of the urban area) and diminishing marginal benefits. Therefore, optimizing the location, spatial structure, and harmoniously combining "green" and "gray" infrastructure is key to sustainable drainage. The study also analyzes the case of Da Nang city, illustrating that UGI needs to be integrated in a multi-functional manner along major urban axes and spatially stratified (especially in coastal estuary areas to reduce tidal effects) to sustainably enhance urban flood resilience.

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ICONS2026-000236 | Abstract 92

Predictive Equations for the Elastic Modulus and Poisson's Ratio of Rice Husk Ash-Based Geopolymer SIFCON Using Mechanics-Informed Data-Driven Modeling

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ABSTRACT

The need to come up with sustainable and high-performance building materials has increased the pace of geopolymer-based composites. Nevertheless, traditional empirical models to estimate elastic properties may not be suitable in fiber-based systems like Slurry Infiltrated Fiber Concrete (SIFCON), especially when other binders like rice husk ash (RHA) are employed. This research paper seeks to create predictive equations of elastic modulus and Poisson ratio of RHA-based geopolymer SIFCON through a data-driven data modeling mechanism based on mechanics. An experimental program was performed on mixtures with hooked, straight, and hybrid steel fibers at volume fractions between 0% and 15%. Elasticity was established by performing both the static uniaxial compression test and ultrasonic pulse velocity tests. The use of data-driven models based on regression has been established by introducing fiber type and volume fraction as the important variables. The findings show that the fiber properties have a significant effect on the elastic behavior, and hooked and hybrid fibers exhibit better lateral deformation capacity and higher stiffness. Current empirical models, such as those based on the ACI, overstated the elastic modulus, especially at higher fiber contents. The given predictive equations proved to be more accurate than the traditional methods. The created mechanics-informed data-driven framework increases the prediction of elastic properties and the validity of non-destructive evaluation methods. These results justify the design and use of sustainable geopolymer SIFCON in structural engineering.

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ICONS2026-000237 | Abstract 93

Towards Data-Driven Optimization of Mechanical Performance of Agricultural Waste-Based Geopolymer Concrete for Sustainable Construction

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ABSTRACT

This paper examines how the type of biomass and the temperature of calcination affect the mechanical properties of a geopolymer concrete made using agricultural waste. The primary aluminosilicate precursors used were corn husk ash (CHA) and sugarcane bagasse ash (SCBA) which were calcined at 600 and 750°C. The twelve geopolymer mixtures were made with a fixed system of alkaline activator and were tested after 28 days with regard to compressive strength, flexural strength, splitting tensile strength, density, and water absorption. Findings showed that SCBA-based mixtures showed better performance than CHA mixtures with a maximum compressive strength of 37.9 MPa and lower water absorption because of better densification of the matrix and less porosity. The higher the temperature of calcination, the better the performance of CHA and the worse the performance of SCBA because some silica crystallized. Correlation analysis revealed that compressive strength and water absorption have a strong negative correlation, and microstructural refinements are the factors that control performance. The results offer a solid foundation towards data-driven optimization of geopolymer mix design through a linkage of processing parameters with performance indicators. The research demonstrates the possibility of using agricultural waste as a renewable source of making high-performance geopolymer concrete.

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ICONS2026-000238 | Abstract 94

Development of Eco-Friendly Luffa Fiber–Epoxy Composites for Improved Thermal Insulation in Wall Applications

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ABSTRACT

The need for sustainable materials in construction driven by digital has promoted the creation of eco-friendly composites with foreseeable behavior. This paper explores the hybrid bio-synthetic composites reinforced with ground luffa fibers (Luffa cylindrica) considering the influence of the particle size of the fiber (1.2, 2.36 and 4 mm) and the partial replacement of epoxy resin with natural resin of Commiphora abyssinica. It was found that particle size had a significant impact on performance, with the 2.36 mm fibers produced having the highest compressive strength (135.20 MPa) because of enhanced dispersion and interfacial bonding. The small particles resulted in agglomeration, and the large particles resulted in the formation of voids. Natural resin was used and this slightly decreased the mechanical strength but increased sustainability. The hydrophilic characteristic of the fibers increased water absorption and reduced thermal conductivity to as low as 0.135 W/m.K, which demonstrates better insulation performance. SEM analysis confirmed optimal fiber- matrix interaction at optimum particle size, whereas FTIR data indicated that bonding is controlled by hydrogen interactions without the formation of new chemical bonds. The received results reveal the stable and predictable material characteristics, and the developed composites can be introduced into the BIM-based design and the performance-oriented digital construction systems. The best combination is a balanced strength, insulation and sustainability.

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ICONS2026-000240 | Abstract 95

Bubbles in the Markets, the risK-Yield Discriminant OptimisatioN – KYDON solution

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ABSTRACT

The Bubbles in the markets can put in grave hazard the growth of the economies. Investing momentum and manipulation can easily distort expectations in irrational levels. The risK-Yield Discriminant OptimisatioN – KYDON optimises the portfolio selection in a volatile market, neutralising exposure to extreme events: bubbles and bursts. New approaches of i) Chaos Dynamics, ii) Behavioral Welfare, iii) Optimal AI classifiers, KYDON improve the optimal investment policy. KYDON detects potential bubbles, preparing its burst under expectations of long growth, and reduces the impact of systemic risk.

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ICONS2026-000243 | Abstract 96

Ascon-Based Deterministic Random Bit Generators for Embedded Systems

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ABSTRACT

As the Deterministic Random Bit Generator (DRBG) serves as a fundamental component in random number generation and cryptographic applications, its performance and security are particularly critical in resource-constrained embedded systems, where memory capacity and computational efficiency are limited. Establishing a high-performance and secure DRBG is therefore an important issue for embedded system design. Furthermore, the National Institute of Standards and Technology (NIST) established the Ascon lightweight cryptographic standard in August 2025, which is suitable for use in resource-limited embedded environments. Therefore, this study revises the DRBG standard and proposes three Ascon-driven constructions: the Ascon-Driven Hash-Based DRBG, the Ascon-Driven keyed-Hash Message Authentication Code (HMAC) DRBG, and the Ascon-Driven Counter-mode (CTR) DRBG. In the experiments, these methods are implemented on a Raspberry Pi platform. The experimental results demonstrate that the proposed approaches achieve higher computational efficiency and lower memory usage compared with existing DRBG implementations, making them suitable for deployment in embedded systems.

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ICONS2026-000244 | Abstract 97

Modeling Of Pedagogical Technology In Teaching Organizational And Technological Design Of Low-Rise Residential Buildings

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ABSTRACT

This scientific work examines the modeling of pedagogical technologies in teaching the organizational and technological design of low-rise residential buildings. The study focuses on integrating the principles of rational energy resource consumption, staged organization of construction processes, digital modeling, and a competency-based approach into the educational process. The proposed pedagogical model is aimed at developing students' skills in analyzing construction processes, identifying energy consumers, evaluating organizational and technological solutions, and making optimal design decisions.

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ICONS2026-000247 | Abstract 98

A Three-Dimensional Cognitive-Pedagogical Framework Based On Hamming Distance Principles

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ABSTRACT

This article presents an updated adaptive branching model for optimizing educational trajectories through a multiplicative framework defined as K = CF × PM × SRV, where three core parameters - Cognitive Foundation (CF), Pedagogical Mediation (PM), and Self-Regulation Vector (SRV) - are interpreted as spatial coordinates within a classical Cartesian three-dimensional phase space. The proposed model applies the Hamming distance principle, whereby only one parameter is modified per intervention step, ensuring precision, measurability, and pedagogical tractability. Experimental design implications are discussed, including diagnostic classification of learners, context-sensitive selection of branching paths, iterative re-assessment after each intervention step, and comparison of parallel trajectories in controlled trials. The model provides a theoretically grounded, empirically testable, and practically applicable framework for adaptive instruction in higher and secondary education.

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ICONS2026-000248 | Abstract 99

Conceptual Design Of A Competency-Based Cluster-Module Digital Platform For Technical Vocational Institutions

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ABSTRACT

The modernization of technical and vocational education in Uzbekistan requires a systemic transition from subject-centered curricula to competency-based, modular learning models aligned with contemporary labor market demands and Industry 4.0 standards. This article presents the conceptual framework and implementation strategy for developing a competency-based cluster-module digital learning platform for Uzbekistan's technical vocational institutions, drawing on the advanced experience of the Russian Federation's Federal State Educational Standards for Secondary Vocational Education (FGOS SPO), WorldSkills Russia standards, and dual training systems, alongside methodological insights from Germany's BIBB. The proposed platform organizes professional competencies into functional clusters aligned with specific technical fields—including electrotechnics, automation, and industrial technology—and structures modular learning content around each cluster, incorporating learning outcomes, cognitive segmentation according to Bloom's taxonomy, formative and summative assessment tools, and labor market-oriented competency maps. A core innovation of the platform is its autonomous digital architecture, which supports self-regulated learning without direct instructor involvement, integrating interactive multimedia content, AI-driven assessment analytics, and real-time learner monitoring. The research draws on comparative analysis of educational systems in Russia, Germany, and Italy, revealing that competency-based modular systems constitute over 80% of vocational curricula in leading countries, while this figure remains below 20% in Uzbekistan. Findings suggest that the platform can reduce instructional workload by 20–25%, improve graduate employability alignment with industry requirements by up to 85–90%, and serve as a replicable model for regional vocational education reform.

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ICONS2026-000250 | Abstract 100

Innovative technologies for developing students' project-based thinking competencies in architectural education

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ABSTRACT

This study examines the role of innovative technologies in developing students' project-based thinking competencies in architectural education. In the context of modern educational transformation, particular emphasis is placed on project-based learning, digital modeling (BIM), design studio pedagogy, and interactive and problem-based teaching methods.

The research proposes a pedagogical model aimed at fostering creative, analytical, and systemic thinking through the integration of real-world design tasks, interdisciplinary approaches, and digital tools. The findings indicate that the application of innovative technologies significantly enhances students' ability to make independent decisions, perform conceptual design, develop spatial thinking, and create sustainable architectural solutions.

The scientific novelty of the study lies in the development of an integrated framework that combines pedagogical and digital technologies to support project-based thinking. The practical significance is reflected in improving the quality of architectural education and preparing highly qualified professionals capable of addressing contemporary design challenges.

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ICONS2026-000251 | Abstract 101

Convergence Of Neurodidactic And Competency-Based Paradigms For Engineering Education: An Integrative Pedagogical Framework

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ABSTRACT

Contemporary engineering education faces a systemic challenge: competency-based outcomes and neurodidactic cognitive mechanisms are typically applied in isolation, producing a functional disconnection between learning architecture, cognitive development, and assessment evidence. This study develops, implements, and empirically validates an integrative pedagogical technology for preparing next-generation engineers by converging neurodidactic and competency-based paradigms within a credit-module system aligned with national qualifications framework requirements. The study introduces the multiplicative non-compensatory model K = CF × PM × SRV, where integral professional readiness (K) is the product of three mutually conditioned components: cognitive foundation (CF), pedagogical mediation (PM), and self-regulation vector (SRV). A compensatory deficit in any single component prevents the formation of integral professional competency. This model is operationalized through the eight-phase cognitive-processual mechanism and the metacomponent representing the transition from learner subjectivity to professional autonomy. The converged paradigm technology, grounded in cognitive load theory, dual coding, retrieval practice, and self-determination theory, represents a structurally coherent and empirically validated solution to the persistent gap between learning outcome design and cognitive mechanism in engineering education.

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ICONS2026-000253 | Abstract 102

Development of a Technology for the Selective Extraction of Selenium and Tellurium Compounds from Mining and Metallurgical Industrial Waste

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ABSTRACT

This research is aimed at developing a technology for selective separation of selenium (Se) and tellurium (Te) compounds from gas cleaning dust and slag of the mining and metallurgical industry. The urgency of the problem is that valuable elements in these technogenic wastes are not being sufficiently processed, resulting in economic losses and increasing environmental risks. As a scientific solution, a complex technological chain is proposed, based on acid treatment based on H2SO4, oxidative heat treatment, alkaline washing with NaOH/Na2CO3, selective purification of the solution based on pH/Eh control, and sequential separation of Se and Te. The research will create an opportunity to effectively process waste as secondary raw materials, form a local raw material base, reduce import dependence, and increase the supply of materials necessary for 'green energy.

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ICONS2026-000254 | Abstract 103

From Linguistics to Transformers: An Explainability-Driven Analysis of VAK Learning Style Detection in Text

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ABSTRACT

Abstract. Detecting learning styles from text is increasingly relevant for adaptive educational systems, yet most work treats the underlying models as black boxes. We shift the focus from prediction to explanation. Using 15,450 sentences labeled with Visual, Auditory, and Kinesthetic (VAK) styles, we compare three model categories TF-IDF baselines, a theory-driven linguistic feature model built on sensory lexicons, and a fine-tuned RoBERTa , then apply SHAP and LIME to analyze what each learns. While data-driven models all reach ∼98.6% accuracy, the linguistic model achieves only 72.2%, exposing a 26-point gap that shows models capture patterns far beyond sensory vocabulary. Only 14.3% of the transformer's top-5 SHAP tokens fall within matching lexicons. We further uncover a modality asymmetry: Visual and Kinesthetic sentences are detected through specific markers, while Auditory sentences are recognized through the absence of Visual and Kinesthetic cues. These findings provide concrete insights for designing transparent learning style detection systems.

Keywords: Explainable AI · Learning Styles · NLP · SHAP · MOOC · Educational Technology.

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ICONS2026-000259 | Abstract 104

Integrating Multi-Sensor Remote Sensing and Machine-Learning Techniques for Flood Susceptibility Mapping in the Lower Niger Delta, Nigeria

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ABSTRACT

Flood hazards remain a persistent challenge across the low-lying landscapes of the Lower Niger Delta, where hydro-climatic forcing interacts with rapid anthropogenic change. This study applies a multi-source geospatial and machine-learning framework to map flood susceptibility in Ogba/Egbema/Ndoni Local Government Area, Rivers State, Nigeria. Long-term Landsat data (1975–2023) were analysed to assess land-use/land-cover dynamics, while Sentinel-1 SAR imagery (2018–2022) was used to delineate historical flood inundation. River-stage variability was examined using satellite altimetry records from 2018–2024, and topographic controls were derived from a 30 m SRTM digital elevation model. Results indicate pronounced urban expansion and a decline in agricultural land, reflecting increased surface sealing and modified runoff behaviour. Flood maps show expanding inundation extents in recent years, consistent with worsening flood conditions, while altimetry reveals strong seasonal water-level variability with delayed downstream response. Flood susceptibility models built using Random Forest, Gradient Boosting, and Support Vector Machine classifiers (3,000 samples) show that Random Forest provides the highest predictive performance. Overall, the integration of multi-sensor remote sensing and machine learning offers a robust approach for flood-risk assessment in data-limited deltaic environments.

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ICONS2026-000264 | Abstract 105

Hybrid Decision Tree–KNN Framework for Classification with Nonlinear Effects and Local Variation: Bootstrap Simulation Study

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ABSTRACT

Classification remains a central task in statistics and machine learning, especially when complex nonlinear relationships and mixed predictor types make accurate prediction more difficult. While decision trees are widely used for their interpretability and flexibility, their predictive performance may decrease when the underlying class structure exhibits substantial local variation. To address this limitation, we investigate a hybrid Decision Tree–K Nearest Neighbors (DT–KNN) approach that combines the global partitioning strength of decision trees with the local classification power of KNN. In this framework, the decision tree first assigns each observation to a terminal node, after which KNN is applied within that localized region rather than across the full training sample. This strategy aims to improve classification performance while preserving a structured and computationally manageable learning process. Using simulated data with numeric and categorical predictors, nonlinear effects, and interaction terms, we evaluate the hybrid method against a standard decision tree and global KNN using a bootstrap procedure with out of bag observations for testing. Performance is assessed via average misclassification rates and percentile intervals. Results show that the hybrid DT–KNN method consistently outperforms the tree only model, particularly when local variation is high or class boundaries are nonlinear, highlighting its promise for structured nonlinear classification problems.

References

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ICONS2026-000270 | Abstract 106

Single-Layer Wideband High-Gain Circularly Polarized Metasurface Antenna for 5-GHz Applications

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ABSTRACT

This paper presents a single-layer circularly polarized (CP) metasurface (MS) antenna with wideband and high gain operation characteristics. The proposed antenna is optimized for 5-GHz wireless applications. The antenna consists of 4 × 4 truncated-corner unit cells and center fed by a small rectangular patch. Accordingly, single-layer configuration can be obtained, which distinguishes the proposed design from the other conventional MS antennas with multi-layer configuration. The final antenna has overall dimensions of 1.04 λ × 1.04 λ × 0.03 λ. The simulated bandwidth, in which the reflection coefficient is less than -10 dB and axial ratio is lower than 3 dB, is from 5.2 – 5.7 GHz, corresponding to about 9.2%. Across this band, the gain is always better than 9.0 dBi and the maximum gain of 10.3 dBi can be obtained at 5.54 GHz. Besides, good radiation patterns are also obtained by the proposed antenna.

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ICONS2026-000271 | Abstract 107

A Compact Mircrostrip Patch Antenna with Low Cross-Polarization Radiation for Portable Devices

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ABSTRACT

This work presents a method to design a quarter-wavelength patch antenna with extremely low cross-polarization radiation. The principle for miniaturization is to introduce additional capacitors on the radiating element by inserting several gaps and shorting pins. This capacitive loading induces a slow-wave effect, effectively lowering the antenna's operating frequency. The final radiating element with dimensions of 9.8 mm × 9.8 mm, which are approximately quarter-effective wavelength at 4.5 GHz, shows good operation characteristics around 4.5 GHz. Key simulated results include a peak broadside gain of 5.3 dBi, a half-power beamwidth of 100°, and cross-polarization radiation levels below –45 dB in the principal E- and H-planes. This cross-polarization suppression is a significant improvement over traditional quarter-wavelength patch designs, making the proposed antenna suitable for modern portable wireless devices where compact size and high signal purity are required.

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ICONS2026-000272 | Abstract 108

A Compact Dual-Circularly Polarized Antenna for Unmanned Aerial Vehicle Communications

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ABSTRACT

This paper presents a miniaturized antenna with dual-circular polarization (CP) designed for 5.6 GHz unmanned aerial vehicle (UAV) communications. To significantly reduce the fundamental resonant frequency, the square patch radiator is integrated with several capacitive gaps. Dual-CP radiation is achieved using orthogonal probe feeds that provide equal amplitudes and a 90° phase offset, managed by dual microstripline feeding networks. A compact prototype occupying 0.18 λ × 0.18 λ × 0.04 λ is simulated. Simulation results confirm consistent dual-circular polarization with well-balanced radiation patterns, achieving a maximum realized gain of 3.6 dBi and maintaining inter-port isolation above 10 dB throughout the 5.57–5.65 GHz frequency range. These results confirm that the proposed antenna offers a compact footprint while maintaining reliable radiation characteristics for drone applications.

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ICONS2026-000273 | Abstract 109

Operational Status and Treatment of Chloride Ions and Heavy Metals in Bottom Ash from Municipal Solid Waste Incinerators in Vietnam Toward Sustainable Recycling

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ABSTRACT

This study presents the technological characteristics and the current status of treatment and recycling of municipal solid waste incineration (MSWI) bottom ash from four industrial-scale waste-to-energy plants operating in Vietnam. Based on the scientific understanding of heavy metal stabilization and chloride removal mechanisms in bottom ash. the study conducts compositional and chemical characterization. with a focus on determining the concentrations of heavy metals and chloride ions in bottom ash samples collected from waste-to-energy facilities in Can Tho. Phu Son – Hue. and Seraphin – Hanoi. The results indicate that. although MSWI bottom ash in Vietnam is generally classified as non-hazardous waste. elevated heavy metal content. high chloride leaching potential. significant heterogeneity. and strong dependence on incineration technology constitute major barriers to its effective recycling. To promote sustainable reuse. the authors evaluate and propose treatment and recycling strategies for utilizing bottom ash as a precursor for green geopolymer materials. This approach is scientifically grounded. suitable for the Vietnamese context. and aligned with circular economy objectives.

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ICONS2026-000274 | Abstract 110

Solution of Applying Constructed Wetland Technology to Improve Water Quality of Kim Lien Lake in Hanoi City

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ABSTRACT

In the context of rapid urbanization, the balancing reservoir system has become an important project to regulate the climate, drain rainwater and increase urban green space. However, in Hanoi, lake renovation work still has many limitations such as: some lakes have been renovated with landscape infrastructure but the water quality has not yet met the requirements, being polluted due to receiving untreated domestic wastewater; encroachment and misuse of lakeside space; the city budget is not enough to apply centralized treatment technologies to all inner-city lakes. The article presents a solution to apply sustainable, economical, easy-to-implement and environmentally friendly water treatment technology to Kim Lien Lake, a typical lake in the city center, which has been seriously degraded, the lake water has turned black, dried up, smelled bad, and contained many organic substances, nutrients, microorganisms and heavy metals exceeding the standards [1]. The research results have analyzed and selected a model of a filter bed with trees, calculated and designed with a scale of 2 modules to treat 20m3/day of wastewater, along with instructions on project management and operation.

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ICONS2026-000275 | Abstract 111

Urban Planning Governance for Low-Emission Zones in Hanoi: Current Status and Capacity-Building Solutions

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ABSTRACT

Effective urban planning governance for Low Emission Zones (LEZs) is an urgent requirement to address environmental and socio-economic challenges in the context of contemporary urbanization, particularly in Hanoi—the cultural and political center of Vietnam. Although the establishment of LEZs represents a critical step toward sustainable development and climate change mitigation, the current capacity for intersectoral coordination in planning governance remains fragmented. This paper assesses the current state of urban planning governance for LEZs in Hanoi, with a focus on the legal framework stipulated in the 2024 Capital Law, as well as ongoing infrastructure preparations for the implementation of the LEZ pilot project within Ring Road No. 1. In addition, the study presents empirical findings from a survey on governance capacity, based on 369 responses from managerial officials and technical staff. The results indicate that 62.6% of managerial officials and 57.9% of technical staff recognize the necessity of urban planning governance. Building on these findings, the paper identifies key limitations and challenges related to human resources in urban management and proposes capacity-building solutions aimed at enhancing the effectiveness and sustainability of urban planning governance in the capital city.

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ICONS2026-000278 | Abstract 112

Optimization-Driven Energy Modeling of PPy-Coated IoT Sensor Networks for 6G-Enabled Smart Buildings

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ABSTRACT

This paper presents an optimization-oriented energy model for polypyrrole-coated Internet of Things (IoT) sensor networks. They are intended for 6G-enabled smart building monitoring. In this research, clustering-oriented communication with material-focused enhancement is considered. Conventional sensor nodes are assumed to be upgraded using a reusable polypyrrole conductive coating rather than fully replaced. This coating-based approach supports circular economy principles by extending sensor usability while improving energy behavior.

A MATLAB-based simulation model was developed to evaluate direct transmission, clustering, and clustering with PPy-coated sensor nodes. A simplified first-order radio energy model was used for simulations, and the PPy coating was incorporated into the model using a transmission-energy reduction factor. Sensitivity analysis was performed over a defined range of parameter values to ensure robustness and avoid dependence on a single fixed value. Network performance was evaluated using total remaining energy, First Node Death, Half Nodes Alive, and Last Node Death.

The results show that clustering improves energy distribution, while PPy-coated enhancement further delays node failures and supports more stable long-term monitoring. The proposed framework contributes to a sustainable, energy-aware 6G IoT infrastructure. It also aligns with smart building optimization research priorities.

Keywords: PPy-coated sensors; 6G smart buildings; clustering optimization; energy modeling; circular economy.

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ICONS2026-000281 | Abstract 113

The Digital Challenge: A Comprehensive Examination of the Adverse Effects and Implications of Artificial Intelligence in the Educational System

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ABSTRACT

The rapid integration of artificial intelligence (AI) in the educational system has been mostly characterized by positive discourses emphasizing efficiency, personalization, and innovation. However, stringent reviews of the adverse consequences are still insufficiently advanced. The study is a synthesis of findings on educational psychology, computer science ethics, and socio-economic policy to present a full typology of negative impacts of AI. This study used critical posthumanism and surveillance studies, where qualitative textual analysis of policy documents, ethical guidelines, and media stories was used in conjunction with organized observations. The study identifies four types of adverse effects: (1) pedagogical erosion, which includes the deterioration of critical thinking and writing skills that can be ascribed to the influence of generative AI; (2) ethical and privacy violations, which involve the decline of critical thinking and writing skills that can be attributed to the effect of generative AI; (3) algorithmic bias, which consists in the degradation of critical thinking and writing skills which can be attributed to the influence of generative AI; and (4) socio-emotional degradation. The outcomes have great implications for educational governance, curriculum development, and teacher preparation. Without proactive action, AI usage risks, in the first place, automating a simplistic, inequitable, and epistemically insecure education system, at the cost of marginalized groups of students. The paper concludes that AI is poised to rob a simplistic, inequitable, and epistemically weak educational system of active governance and pedagogical re-engineering.

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ICONS2026-000284 | Abstract 114

Intelligent UAV Simulation and Control Platform in Complex Urban Environments Based on GIS, Reinforcement Learning and Adaptive Energy Models

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ABSTRACT

The paper presents an advanced simulation platform for unmanned aerial vehicles (UAVs) operating in a realistic three-dimensional urban environment, built on GIS data, DEM models and buildings from OpenStreetMap or synthetically generated. The main goal is to analyze the behavior of autonomous UAVs in complex urban scenarios, integrating mobility, communications, collision avoidance and energy constraints.

The system includes primary UAVs, used for exploration, and dedicated UAVs, oriented towards communication support and energy optimization. The movement is modeled by a stochastic kinematic mechanism, which generates realistic and adaptive trajectories.

Obstacle avoidance is achieved by a reactive method based on artificial potential fields and minimum safety distances from buildings. UAV communications are modeled by simplified beamforming, differentiating Line-of-Sight (LOS) and Non-Line-of-Sight (NLOS) conditions, depending on the urban environment.

The energy component is based on the evolution of the State-of-Charge (SOC), including consumption and an aggregate energy harvesting model (solar, RF or wireless energy transfer). The dedicated UAVs use a Reinforcement Learning (Q-learning) algorithm to optimize decisions based on the energy state and operational conditions.

The results show stable autonomous navigation, collision avoidance efficiency, the negative impact of NLOS conditions on communications and increased autonomy through energy harvesting. The platform offers interactive 3D visualization and data export for further analysis, contributing to research on intelligent UAV systems and digital urban infrastructures.

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ICONS2026-000285 | Abstract 115

Classification Performance of BPSK Signals in an Autocorrelation Receiver

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ABSTRACT

Modern radio emission sources are frequently characterized by the widespread use of binary phase-shift keying (BPSK) signals as probing waveforms in practical applications. In radio monitoring and radiocommunication systems, reliable identification of the emitter type, specific source instance, and operating mode requires accurate determination of the modulation format of the received signal. Since key signal parameters such as frequency, phase, and amplitude are generally unknown a priori, conventional processing approaches are limited, and more robust techniques such as autocorrelation-based receivers are required [1].

This study investigates the performance of an autocorrelation receiver for BPSK signal detection through simulation-based analysis. The focus is placed on evaluating the influence of different signal code sequences on the probability of correct classification, as well as on determining the optimal code chip duration for reliable operation. The obtained results indicate that the proposed receiver structure ensures effective classification of BPSK signals at input signal-to-noise ratio (SNR) levels above −4.5 dB. Furthermore, high classification accuracy is achieved when the duration of the signal code sequence exceeds the reciprocal of the bandwidth of the band-pass filter in the difference-frequency domain.

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ICONS2026-000286 | Abstract 116

Multi-Port Dual-Band Antenna for MIMO Communication Systems

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ABSTRACT

This paper presents a multi-port dual-band antenna for multiple-input multiple-output (MIMO) communication systems. Dual-band operation is achieved by placing two patches in close proximity and capacitively exciting them using a probe-fed microstrip line. This configuration enables independent control of the two operating bands while maintaining a single-layer architecture. The final MIMO realization consists of eight dual-band elements, with grounded stubs employed to enhance inter-port isolation. The proposed MIMO array has an overall size of 1.38λ × 1.38λ × 0.03λ at 5.2 GHz. Simulated results demonstrate good operating characteristics at 5.2 and 6.6 GHz, with inter-port isolation better than 18 dB. In addition, the antenna achieves a maximum broadside gain of approximately 5.0 dBi at both bands. Owing to its dual-band operation, single-layer structure, and acceptable isolation performance, the proposed antenna is suitable for WiFi 5/6/6E applications.

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** The asterisk denotes the presenting author.*

ICONS2026-000287 | Abstract 117

A Single-Feed Cross-Shaped Dual-Band Metasurface Antenna Using Distributed Capacitive Loading for Sub-6 GHz 5G Applications

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ABSTRACT

The proposed research introduces a small dual-band antenna, which is intended for use in the sub-6 GHz band of 5G communication systems. In comparison with the traditional design of single-band antennas, modern designs demand multiple frequencies without expanding their size. Therefore, the research expands the existing metasurface architecture to accommodate two operating frequencies with the identical physical area. The proposed antenna consists of a 4×4 grid of metallic elements combined with another layer of rectangular patches. The latter acts as a capacitor to decrease the main resonance frequency in the lower frequency range. A cross-shaped feeding configuration located at the center alters the current distribution on the surface and ensures the additional frequency of band. According to the simulation results, the antenna shows effective behavior within both bands. The lower band operates within the range of 3.8-4.2 GHz and features a broadband performance with a maximum gain of 7.7 dBi, which is sufficient to transmit considerable amounts of data. The upper band runs between 4.8-4.86 GHz and provides precise operation with an ideal impedance match and a maximum gain of 6.0 dBi.

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ICONS2026-000288 | Abstract 118

Single-Layer Compact Dual-Band Antenna with High Front-to-Back Ratio for Multi-Service Wireless Applications

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ABSTRACT

This paper presents a compact, single-layer dual-band antenna with a high front-to-back ratio (FBR). The dual-band operation is realized using four square patches embedded with L-shaped slots, which form the main radiating aperture. To maintain a single-layer configuration, the radiating aperture is capacitively excited by a centrally located probe-fed patch. The final simulated design has compact overall dimensions of $0.45\lambda \times 0.45\lambda \times 0.02\lambda$ at the lower operating band. The antenna achieves good impedance matching over 4.47–4.60 GHz and 5.58–5.79 GHz. Across both operating bands, the simulated broadside gain remains stable at approximately 6.0 dBi. In addition, the antenna exhibits stable broadside radiation patterns with a high FBR of more than 18 dB in the lower band and greater than 20 dB in the higher band. Owing to its compact size, single-layer structure, dual-band operation, and high FBR, the proposed antenna is a promising candidate for sub-6 GHz 5G and WiFi 5/6 wireless communication systems.

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ICONS2026-000290 | Abstract 119

Novel Hybrid Deep Learning–Based Glaucoma Detection Using Fundus Images with GLCM-K Means-SVM-OTSU-HoG-KNN

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ABSTRACT

Glaucoma is one of the leading causes of irreversible blindness worldwide, and early diagnosis is essential to prevent severe vision loss and improve patient outcomes. Traditional manual examination of retinal fundus images is time-consuming and highly dependent on the expertise of ophthalmologists, thereby creating a need for automated and intelligent diagnostic systems. This paper presents a novel hybrid deep learning–based glaucoma detection framework using retinal fundus images integrated with GLCM, K-Means, SVM, OTSU, HoG, and KNN techniques for enhanced classification accuracy and reliable diagnosis. Initially, the acquired fundus images undergo preprocessing to remove noise and improve image quality for effective feature extraction. OTSU thresholding and K-Means clustering techniques are employed for accurate segmentation of the optic disc and cup regions, which are critical indicators in glaucoma diagnosis. Gray Level Co-occurrence Matrix (GLCM) and Histogram of Oriented Gradients (HoG) methods are utilized to extract significant texture and structural features from the retinal images. The extracted features are further processed using hybrid machine learning and deep learning classification models incorporating Support Vector Machine (SVM) and K-Nearest Neighbor (KNN) algorithms for efficient glaucoma identification and classification. The proposed system aims to improve detection accuracy, sensitivity, specificity, and computational efficiency compared to conventional diagnostic approaches. Experimental evaluation carried out on benchmark retinal fundus image datasets demonstrates superior performance. The developed intelligent diagnostic model provides an effective, low-cost, and reliable solution for early glaucoma screening in real-time healthcare and ophthalmological applications.

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ICONS2026-000301 | Abstract 120

Implementation of Modern IoT and Cloud-Based Communication Technologies for Real-Time Wind Speed Monitoring

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ABSTRACT

This study focuses on the development of a real-time wind speed monitoring system based on Internet of Things (IoT) technology. In an era where climate change and atmospheric conditions have significant impacts on human life and infrastructure, accurate and continuous monitoring of wind speed is essential for public safety and effective management of renewable energy sources.

By utilizing anemometric sensors integrated with a cloud-connected architecture, the proposed system aims to overcome the limitations of traditional monitoring solutions by providing real-time data collection, immediate analysis, and an intuitive user interface. The integration of IoT devices with cloud-based communication platforms ensures efficient, secure, and cost-effective data acquisition, processing, and visualization.

Experimental results indicate improved accuracy, responsiveness, and scalability compared to conventional systems. These findings suggest that the proposed approach can be effectively applied in various domains such as wind energy management, agriculture, meteorology, and infrastructure safety. The research contributes to the advancement of intelligent monitoring systems and supports the development of sustainable technological solutions for environmental data management.

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ICONS2026-000302 | Abstract 121

Modeling and Forward Kinematics Simulation of a 10-DOF Humanoid Biped Robot with Moving Hip Trajectory

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ABSTRACT

This study presents the construction and simulation of forward kinematics for a 10 degree of freedom (10DOF) bipedal humanoid robot for autonomous movement applications and humanoid robot control research. The kinematic model is established based on the Denavit-Hartenberg (DH) method combined with multi-DOF rotary joints at the hips, knees, and ankles of the robot's two legs. Based on this, a system of forward kinematic equations is constructed to determine the position and spatial trajectory of the joints and feet over time. The study also proposes a cyclical motion trajectory for the joint angles to simulate a continuous 20s walk with translational movement of the robot body in the forward direction, lateral oscillation of the hips, and vertical oscillation to increase similarity to biological gait. The computational content includes the foot trajectory in 3D space, endpoint velocity and acceleration, numerical Jacobi matrix, kinematic manipulation index, singularity conditions, and geometric collision checks between the two legs. In addition, the robot leg's working area was investigated using random sampling within the joint angle limits. Simulation results in MATLAB show that the proposed model is capable of generating stable gait movement, a continuous foot trajectory, and maintaining a safe distance between the two legs throughout the entire movement cycle. This research lays the foundation for advanced problems such as inverse kinematics, whole body dynamics, balance control, and gait optimization for humanoid robots.

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ICONS2026-000303 | Abstract 122

Inverse Kinematic Modeling of a Biped Humanoid Robot with Moving Hip Trajectory and Slope-Adaptive Foot Orientation

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ABSTRACT

This study presents a geometric inverse kinematic model for a 10-DOF bipedal humanoid robot designed to create a stable walking trajectory on horizontal and inclined planes. Based on an established forward kinematic model, the inverse kinematic problem is constructed to determine the hip, knee, and ankle joint angles from the desired foot trajectories and hip translational movement. The hip trajectory is described by the forward movement in the gait direction, lateral oscillation, and vertical oscillation to more closely mimic the biological characteristics of human gait. For each leg, the desired ankle position is determined from the foot position and foot orientation matrix; then, a two-link geometry problem in the longitudinal plane is used to calculate the hip, knee, and ankle angles. To avoid knee lock-up and kinematic singularities, the study imposes a minimum knee angle constraint, allowing for natural knee extension during the resistance phase while maintaining control. The model was extended to the case of walking on slopes by describing the ground as an inclined plane and adjusting the foot orientation parallel to the slope. Joint parameters including position, velocity, and acceleration were calculated over time, and the inverse kinematics results were verified through the forward kinematics model. In addition, CoM and ZMP parameters were included as initial foundations for stability analysis. MATLAB simulation results showed that the model is capable of generating continuous walking motion, controlling foot trajectory, and providing a basis for further studies on stability, balance control, and optimization of humanoid robot gait.

References

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ICONS2026-000304 | Abstract 123

Research on the nonlinear regional characteristics of digital economy's impact on PM2.5 concentration——From the perspective of semi-parametric spatial panel regression

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ABSTRACT

The digital economy serves as a core controllable socioeconomic driving force for PM2.5 emission. The impact of the digital economy on PM2.5 concentration exhibits significant regional heterogeneity across different provinces in China. Based on panel data from 30 provinces in China, this study explores the nonlinear regional characteristics of the digital economy's impact on PM2.5 concentration by employing a fixed effects partially linear additive spatial autoregressive model (PLASARM). The empirical results indicate that the impact of the digital economy on PM2.5 concentration varies across regions: the eastern region exhibits an upward trend, the central region demonstrates an N-shaped pattern, and the western region presents a U-shaped relationship. In light of these empirical findings, this study puts forward targeted implications for further establishing an effective collaborative mechanism between the digital economy and green development, thereby contributing to the mitigation of PM2.5 pollution.

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ICONS2026-000305 | Abstract 124

Low-Cost MQ Sensor-Based Electronic Nose for H_2S Detection in Gas Mixtures Using Logistic Regression and LSTM Models

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ABSTRACT

Electronic noses (E-noses) are sensing systems that emulate the human olfactory process by integrating arrays of gas sensors with pattern recognition algorithms to identify complex odors. In this work, an E-nose based on a three-element MQ sensor array (MQ2, MQ9, MQ135) is developed for H_2S detection in mixtures containing H_2S, CO, and NO_2. Sensor signals are collected via an Arduino-based platform with an external 16-bit ADC (ADS1115), digitally calibrated, and subjected to a temperature modulation strategy. The obtained data were analyzed using both machine learning and deep learning approaches. Logistic Regression demonstrates good performance in recognizing individual gases but shows confusion when dealing with complex gas mixtures, achieving an accuracy of approximately 83%. In contrast, the LSTM model accurately identifies both individual gases and binary mixtures, though some misclassification remains for ternary mixtures, improving the overall classification accuracy to about 90%. The proposed system demonstrates enhanced selectivity and reliability, offering a low-cost solution for gas discrimination in complex environments.

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ICONS2026-000306 | Abstract 125

Machine-Learning-Assisted Acetone and Ethanol Classification and Quantification using a PWM-Modulated MQ136 Sensor

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ABSTRACT

This paper presents a low-cost sensing framework for both classification and concentration estimation of acetone and ethanol using a single MQ136 metal oxide semiconductor (MOS) sensor. To overcome the limited selectivity of conventional steady-state operation, pulse-width modulation (PWM) is applied to dynamically control the sensor temperature, generating gas-specific thermal response signatures associated with adsorption–desorption kinetics. The sensor signals are segmented into modulation cycles and represented by statistical features capturing amplitude, temporal evolution, and signal energy. Principal component analysis shows that 99.7% of the total variance is retained within three components, indicating a compact and highly structured feature space. For gas classification, LDA and QDA achieve perfect classification accuracy (100%) under stratified two-fold cross-validation, confirming linear separability of the PWM-induced features. For concentration estimation, the Extra Trees regressor provides the best performance, achieving $R^2 \approx 0.99$ and MAE ≈ 1.4 ppm for both gases. These results demonstrate that PWM thermal modulation, combined with feature-based machine learning, enables a single low-cost MOS sensor to deliver reliable performance for both qualitative and quantitative VOC analysis.

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ICONS2026-000307 | Abstract 126

From PWM-induced dynamic signatures to AI-based gas identification: selective sensing of CO, NO_2, and H_2S using a MICS-4514 sensor

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ABSTRACT

Metal oxide semiconductor (MOS) gas sensors offer high sensitivity and low cost but suffer from limited selectivity toward different gases. This study presents a PWM-induced thermal modulation approach to generate unique dynamic response signatures for selective gas sensing using a dual-channel MICS-4514 sensor. The periodic heating profile enables the sensor to probe gas–surface interactions over a range of effective temperatures within a single cycle, resulting in distinct transient patterns for CO, NO_2, and H_2S. Time-domain features are extracted from these dynamic responses and subsequently utilized for AI-based gas identification and concentration estimation. Principal component analysis (PCA) is employed to visualize the feature space, demonstrating clear separability of the target gases. Machine learning models are developed to evaluate classification accuracy, while regression analysis provides a framework for prediction of gas concentrations. The results highlight that the integration of PWM-induced dynamic signatures with data-driven algorithms significantly enhances gas recognition performance using a single sensor platform. This approach offers a simple and efficient pathway toward low-cost and scalable multi-gas sensing systems.

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ICONS2026-000308 | Abstract 127

The role of the differential equations at training to mathematical modeling on salution of mechanical problems

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ABSTRACT

Mathematical modeling is one of the tools of modern research on the development of the national economy, the re-adaptation and renewal of production, the effective use of production equipment, and the use of electronic computers, which are one of the tools of modern research in this area. area, and the general professional application of the acquired knowledge is of great importance in the development of special subjects, conducting scientific research, creating a mathematical model of any technological processes, and accelerating scientific and technical research.

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ICONS2026-000309 | Abstract 128

Geometry and biological processes

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ABSTRACT

Geometrical approaches are common in biomedical applications, including neuroscience, imaging and diagnostics [DeKraker2018], mathematical modeling of the blood flow, designing coils for MRI scanners, investigations of the molecular mechanisms of the biological processes such as conformational changes of proteins [Anfinsen1973]. Most of this is driven by the intuition of the 3-dimensional space (e.g. the data for the proteins in the Protein Data Bank includes the 3D coordinates). The mechanistic models of processes are typically based on differential equations. The cellular transitions can be modeled as 0/1 switches incorporated into the equations. This setup can be expanded to include a deterministic and a probablistic components, together. Hybrid computational models are physics-informed and data-based at the same time. Once the data sets are involved, the use of geometry becomes somewhat more abstract: the geometric tools are applied to understand the structure of the data and the evolution of all parameters, not restricting the consideration only to the states of the 3-dimensional system. In this talk, we investigate the biological processes associated with food sensitivities in humans (such as lactose intolerance, peanut allergy, aiming to use these as models for other senistivities such as food triggers for headaches). We regards those as hidden Markov procceses. Our approach aligns with the framework of geometric deep learning [Bronstein2021]. We use constructions from differential geometry for a generalized label space. We show numerical examples computed on the data sets taken from public databases.

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ICONS2026-000310 | Abstract 129

Investor Selection in PPP Projects in Vietnam: Opportunities, Challenges, and Policy Implications

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ABSTRACT

Public–Private Partnerships (PPPs) have become an important mechanism for mobilizing private capital to support infrastructure development in Vietnam. However, the effectiveness of PPP project implementation depends largely on the investor selection process, which continues to face significant challenges related to transparency, institutional quality, financial capacity, and governance practices. This study adopts a qualitative research approach based on a comprehensive literature review and an analysis of Vietnam's legal framework governing PPPs to examine the opportunities and challenges associated with investor selection. Based on the findings, the study proposes several policy implications to improve the investor selection mechanism, including strengthening institutional quality, refining the evaluation criteria, enhancing information transparency, promoting digital transformation in procurement processes, and integrating sustainable development criteria into the investor selection process. These recommendations are expected to improve the effectiveness of PPP project implementation, enhance the ability to attract private investment, and foster sustainable infrastructure development in Vietnam.

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ICONS2026-000317 | Abstract 130

Artificial Neural Network and Machine Learning-Based Prediction of Tool Flank Wear in Turning of SKD11 Alloy Steel

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ABSTRACT

This study presents the results of evaluating a predictive model for flank wear tool during hard turning of alloy steel based on cutting process parameters (cutting speed, feed rate, depth of cut), machining time, and cutting force signals. Three types of artificial neural networks were investigated: Bayesian Regularized networks, MLP feedforward networks, and Cascade-forward networks. The 7-10-1, 7-17-1, and 7-24-1 network structures were trained with a random Train/Test/Validation data ratio, and the best ANN model was selected based on the highest R2 value in the test set. This ANN model was compared with two machine learning models: Support Vector Regression (SVR) and Random Forest (RF). Evaluation criteria included R2, MSE, RMSE, and MAPE. The results allow for the identification of a method with effective nonlinear representation capabilities for tool wear during hard turning, while clarifying the advantages or limitations of the methods. This approach provides a systematic evaluation framework for the tool wear monitoring problem, supporting the selection of a reliable predictive model in CNC machining of high-hardness alloys and forming the basis for developing an intelligent tool condition monitoring system.

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ICONS2026-000321 | Abstract 131

Towards a Practicable Digital Twin Workflow for Bridge Asset Management: A Case Study in Scotland

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ABSTRACT

Digital twins (DTs) are increasingly promoted as tools to enhance infrastructure asset management, particularly for ageing, climate-exposed assets such as bridges. In practice, however, infrastructure DT implementations remain limited. Many are characterised by fragmented workflows, poor interoperability, and a focus on visualisation rather than decision support (Adeagbo et al., 2024), leaving their operational value uncertain. This study examines whether a practicable DT workflow can improve the management of an existing bridge by integrating monitoring and predictive functionality within a single, automated digital environment. A proof-of-concept DT is developed for a road bridge on the A83 trunk road in Scotland using commercially available software. The workflow combines monitoring-style inputs with analytically derived performance indicators through automated, bidirectional data pipelines, enabling the DT to maintain asset condition (Gordan et al., 2024). An artefact-centred evaluation is undertaken, incorporating qualitative and quantitative assessments of monitoring capability, predictive functionality, workflow effectiveness, affordability, interoperability, and repeatability. The results demonstrate that the proposed DT workflow can support asset-management decision-making by enhancing situational awareness and by translating monitored conditions into interpretable, element-linked performance indicators suitable for prioritisation and escalation. The evaluation also reveals important limitations, including reliance on a specific software ecosystem, analytical simplifications, and organisational capability requirements that constrain deployment at scale. Overall, the findings indicate that the primary value of DTs for infrastructure asset management lies in integrated, automated information workflows and highlights the challenges that must be addressed to move from pilot demonstrations to routine operational use.

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ICONS2026-000327 | Abstract 132

Prediction and Optimization of Tool Flank Wear Using Bayesian Regularized ANN and Butterfly Optimization Algorithm

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ABSTRACT

This study presents an integrated framework combining Bayesian Regularized Artificial Neural Networks (BRANN) and the Butterfly Optimization Algorithm (BOA) for prediction and optimization of tool flank wear in CNC turning processes. The predictive model was developed using three primary cutting parameters, namely cutting speed, feed rate, and depth of cut. A Bayesian Regularized ANN trained using the trainbr algorithm was employed to capture the nonlinear relationship between machining parameters and tool wear while simultaneously reducing the risk of overfitting under limited experimental data conditions. The dataset was randomly divided into training, testing, and validation subsets with a ratio of 70/15/15, normalized based on the training set, and evaluated using R2, MSE, RMSE, and MAPE metrics. After determining the optimal ANN architecture, the trained network was utilized as a surrogate model for single-objective optimization using BOA to minimize the predicted flank wear within the experimental bounds of Vc, f and, ap. The proposed hybrid framework demonstrates the capability of combining machine learning and metaheuristic optimization to identify suitable machining conditions for reducing tool wear and improving tool life. The results provide a promising foundation for the development of intelligent monitoring and adaptive optimization systems in CNC turning applications.

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ICONS2026-000330 | Abstract 133

Cyber-physical IoT system for correct determination of initial boundary conditions of the digital twin of a high-rise residential building that was destroyed as a result of the AS-23a missile hitting it and exploding

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ABSTRACT

The work purpose was to correctly determine the initial boundary conditions of the Digital Twin of a high residential building (HRB) that was damaged and destroyed during the explosion of an AS-23a missile, in accordance with fib bulletin 59. The applied methods included the visual, instrumental examination of the HRB by non-destructive testing methods with geodetic and vibration instruments. IoT provided the connection of sensitive elements to the local network, the transfer of initial data to the database. After the experimental results were collected, the initial boundary conditions of the Digital Twin HRB were formed. They were transferred to the LIRACAD-2021 Software Package for calculating the stress-strain state of HRB building structures. As an example, the HRB on Lobanovsky Avenue, 6-A in Kyiv, Ukraine, was considered. It suffered significant damage and destruction as a result of being hit by an AS-23a missile. Engineering and geodetic measurements of the vertical and horizontal displacements of the HRB indicate that the deviations of building structures from the horizontal plane in the affected area reach 0.241 m. The relative difference of vertical displacements in the affected area is 0.0448 with an allowable value of 0.005, which is 9 times higher than the allowable values according to DSTU B V.1.2-3:2006. Vibrodynamic surveys on different floors of the building recorded a drop in the frequency of natural vibrations compared to the undamaged analogue of the HRB.

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ICONS2026-000331 | Abstract 134

Promoting net-zero emissions targets in Vietnam's construction industry: Lessons learned from Singapore and the UK

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ABSTRACT

Vietnam’s commitment to achieving net-zero emissions by 2050 requires a fundamental transformation of its construction industry, which is associated with high energy consumption, intensive material use, and significant lifecycle carbon emissions. Although national climate strategies and sectoral action plans have been introduced, Vietnam’s construction sector still lacks an integrated compliance framework linking energy performance, lifecycle carbon assessment, ESG reporting, and digital verification. This study develops a Vietnam-oriented roadmap for AI- and BIM-enabled ESG compliance to support the transition toward net-zero construction. Drawing lessons from Singapore and the United Kingdom, the research compares two complementary governance models: Singapore’s performance-based and market-oriented green building framework supported by certification and digital delivery mechanisms; and the UK’s legally anchored approach emphasizing whole-life carbon accountability, sustainability disclosure, and regulatory enforcement. Through comparative policy and transferability analysis, the study identifies major institutional, technical, and market gaps in Vietnam, including fragmented regulations, limited lifecycle data, manual compliance procedures, weak enforcement capacity, and constraints faced by small and medium-sized contractors. The proposed roadmap recommends a phased transition, beginning with AI-assisted checking for energy and green building code compliance, followed by BIM-based lifecycle carbon records and digital ESG reporting, and ultimately integrating ESG performance into investment approval, public procurement, and carbon governance mechanisms. The study contributes by shifting the discussion from isolated green building practices toward an integrated legal–digital compliance model for Vietnam’s net-zero construction transition

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ICONS2026-000333 | Abstract 135

Explainable AI for Proactive OHS Inspection: Advancing Digital Construction Safety and Human-Centric Governance

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ABSTRACT

Construction safety monitoring is increasingly automated, yet detection accuracy alone does not make an artificial-intelligence alert trustworthy, actionable or acceptable to workers. This paper develops a human-centred design for an explainable artificial intelligence (XAI) inspection platform that converts computer-vision detections of personal protective equipment (PPE) non-compliance and unsafe behaviour into contestable digital evidence. The study follows a design-science approach, operationalizing the Content-Context-Process-Outcome (CCPO) framework for occupational health and safety (OHS) inspection. Its distinctive contribution is a traceable mapping from each alert through the governing job-safety rule, inspector verification and corrective action to five indicators of a Vietnam-specific safety performance system (9 dimensions, 31 criteria, 93 indicators). A rule-weighted hazard score serves as an interpretable prioritization aid, not an autonomous enforcement decision, and three scenarios grounded in project documents illustrate the workflow within existing camera-based inspection practice. The paper derives testable propositions and a staged validation protocol covering detector performance, explanation fidelity, calibration, contestability and corrective-action closure. The result is a governance-ready architecture connecting perception to prevention while preserving human authority, worker participation and data-protection safeguards, with a transferable reference model for ASEAN OHS digitalization.

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ICONS2026-000334 | Abstract 136

Assessing Barriers to Green Apartment Development in Vietnamese Urban Areas

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ABSTRACT

In the process of urbanization, high-rise apartment buildings have become a dominant housing typology in urban areas, contributing to more efficient land use, improved living conditions, and the formation of concentrated residential, commercial, and service centers. However, this development has also increased pressure on technical infrastructure, energy and water consumption, construction material use, and the quality of the urban living environment. Although green building development in Vietnam has attracted increasing attention from the Government, investors, professional organizations, and consumers, the scale of green apartment development remains limited. The total certified green building floor area is only 17.33 million m², of which residential buildings and apartments account for 44.2%, considerably lower than the country's annual newly constructed floor area of approximately 100 million m² [1]. This limited development can be attributed to several barriers, including high initial investment costs, the lack of coordinated supporting policies, insufficient awareness among relevant stakeholders, and constraints related to materials, technologies, and design practices. This paper investigates the barriers to green apartment development in Vietnamese urban areas through analytical and synthetic methods, literature review, expert consultation, surveys, and descriptive statistical analysis. The findings provide both theoretical and practical foundations for identifying the key bottlenecks that hinder the wider adoption of green apartment buildings in Vietnam, thereby supporting further empirical assessment and policy orientations for sustainable housing development.

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ICONS2026-000336 | Abstract 137

Design and Integration of an Internet of Things (IoT)-Based Solar-Powered Smart Rice Pest Trapping System

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ABSTRACT

This study presents the design and integration of a smart rice pest trapping system based on the Internet of Things (IoT) and solar energy technologies for environmental monitoring and pest management in rice cultivation. The proposed system was developed using a distributed IoT architecture with an ESP32-based central controller integrated with a SIM7600 communication module, enabling real-time acquisition and transmission of field data to a remote server through Message Queuing Telemetry Transport (MQTT) and Hypertext Transfer Protocol (HTTP) communication protocols. Environmental sensors, including temperature, humidity, light intensity, wind speed, and operational status sensors, were integrated to monitor actual outdoor operating conditions. In addition, relay modules and electric motors were employed to automate the operation of the pest-attracting lighting unit. An independent power supply system based on photovoltaic solar panels, a solar charge controller, and a Lithium Iron Phosphate (LiFePO4) battery was implemented to ensure stable operation in off-grid agricultural environments. The analytical results demonstrate that the proposed architecture exhibits high feasibility in terms of mechatronic integration, IoT communication, and energy management, thereby satisfying the requirements of sustainable, energy-efficient, and autonomous operation for smart rice farming applications in Vietnam.

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ICONS2026-000337 | Abstract 138

Design and Construction Strategies Enabling Deconstruction Potential: A Typology-Based Analytical Study of the Greek Polykatoikia

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ABSTRACT

Design for Deconstruction (DfD) is widely recognised as a key strategy for supporting circular construction by enabling material reuse, adaptability, and end-of-life recovery. However, its explicit implementation remains limited in conventional practice, where design and construction decisions are primarily driven by constructability, cost, and structural performance. Consequently, deconstruction-relevant strategies may emerge implicitly without being intentionally designed according to DfD principles. This study investigates how deconstruction potential is shaped by design and construction strategies embedded within the Greek Polykatoikia building typology. A typology-based analytical framework was developed to interpret documented technical characteristics through four analytical levels: Technical Evidence, Technical Decisions, Abstracted Strategies, and Deconstruction Potential. The framework was applied to identify recurring strategies and evaluate their qualitative implications for material separation, structural adaptability, and component recovery. The analysis identified four recurring design and construction strategies. The results show that conventional reinforced concrete construction simultaneously contains enabling and constraining characteristics: structural regularity, centralized infrastructure, and frame-infill separation support adaptability, whereas monolithic continuity and wet-bonded interfaces limit material separation and component recovery. These findings demonstrate that deconstruction potential may emerge as a latent property of conventional building typologies rather than solely from intentionally implemented DfD principles. The proposed framework provides a systematic approach for revealing latent circularity within existing building stocks and offers a transferable basis for analysing other conventional building typologies.

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ICONS2026-000341 | Abstract 139

Application of BIM Technology in Construction Schedule Management for Industrial Projects in Vietnam

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ABSTRACT

In the context of industrialization and modernization, the demand for industrial construction projects in Vietnam has rapidly increased in both quantity and scale. However, construction schedule management still faces many challenges, such as project delays, cost overruns, poor coordination among stakeholders, and limitations in information management. These issues reduce investment efficiency and weaken the competitiveness of Vietnamese construction enterprises in international integration. This study examines the application of BIM (Building Information Modeling), particularly BIM 4D, which is considered an essential trend in the modern construction industry due to its ability to digitize and manage the entire project lifecycle. Although the Vietnamese Government has introduced policies to encourage BIM adoption, practical implementation remains fragmented and mainly focuses on 3D modeling, without fully utilizing BIM 4D for schedule management. Major barriers include the shortage of qualified human resources, inconsistent implementation, lack of standardized procedures and technical frameworks, and high initial investment costs. To address these challenges, the study proposes solutions for integrating 3D models with construction schedule data using software such as Autodesk Revit, Autodesk Navisworks, and Synchro 4D. The study also highlights the importance of the Common Data Environment (CDE) in improving collaboration, information sharing, and project data management. The research findings demonstrate that BIM 4D contributes significantly to visualizing construction processes, improving schedule control, enabling early detection of technical conflicts and errors, optimizing resource allocation, reducing risks, and enhancing the overall quality of industrial project management.

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ICONS2026-000343 | Abstract 140

Inverse Kinematics Analysis of the Yaw-Pitch System for Tracking the Direction and Range of Short-Range UAV Targets

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ABSTRACT

This study presents the trajectory planning and inverse kinematics (IK) problem for a Yaw-Pitch robotic manipulator. Based on the Denavit–Hartenberg (DH) formulation, the forward kinematic (FK) model is established to describe the position of the end-effector point (EEP) in the fixed coordinate system. The workspace of the system is identified as a spherical surface centered at the elevation joint with a radius equal to the length of the end-effector link. To ensure geometric feasibility, an inclined circular trajectory planning method is proposed by constructing the intersection between the spherical workspace and an inclined plane in 3D space. The trajectory parameter is generated using a fifth-order polynomial interpolation to guarantee continuous position, velocity, and acceleration profiles at both the initial and terminal conditions. From the planned trajectory of point E, the IK problem is solved to determine the joint trajectories q1 and q2, followed by validation using FK reconstruction. MATLAB simulation results demonstrate that the proposed trajectory remains entirely within the workspace, while the IK verification error is approximately zero. Furthermore, the joint trajectories exhibit smooth and continuous behavior without abrupt velocity or acceleration discontinuities. The proposed approach provides a fundamental basis for Yaw-Pitch tracking systems applied to surveillance platforms, camera orientation mechanisms, and short-range UAV target tracking applications.

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ICONS2026-000344 | Abstract 141

Intersection of cylinders for geometrical tolerancing to medical applications

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ABSTRACT

The intersection of particle trajectories with planes and conic surfaces such as the cylinder, cone and sphere has found valuable applications in geometric methods and packages in electron-photon Monte Carlo calculations. Physics informed geometric modelling involving intersecting cylinders is directly connected to a number of biomedical applications such as investigation of blood flow in coronary vessels, dynamics of cancer cell migration, and minimally invasive neurosurgery. Interesting applications of intersections exist in arterial bifurcation, since branching flow occurs at many points in the human body.

A clinical application of a concept underlying geometric intersections is in the field of Minimally Invasive Neurosurgery (MIN), in which the technique of stereotactic volumetric resection for brain tumours is used. In stereotactic localization of the brain tumor, insertion of a cylindrical guide is passed through a predetermined trajectory to minimize disruption of good brain tissue. Once situated in the tumor cavity, the tumor is resected entirely through a cylindrical guide with the use of a smaIl cylindrical suction device, lasers, and/or conventional scissors/forceps and causes minimal damage to the surrounding brain. Conceptual and technical evolution have extended our ability to perform minimally invasive surgery.

The insights obtained from the computational methods help draw meaningful conclusions from the experimental data as well as predictions for the design of experiments or medical instruments. In this talk, we will revisit the results from the papers [Vallurietal1994] and [Vallurietal1998] on the intersection of cylinders, geometric modelling, and applications, and address some follow-up questions.

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ICONS2026-000345 | Abstract 142

Toward BIM-Enabled Fire Safety Compliance Verification: Lessons from a Hospital in Vietnam

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ABSTRACT

Fire safety compliance verification in complex construction projects remains heavily dependent on document-based coordination and fragmented workflows. This study investigates a fire safety acceptance inspection case from a large public hospital project in Vietnam to examine how inspection findings reveal broader coordination, governance, and information management challenges during commissioning and handover stages. Using a qualitative exploratory case study approach, the research analyses official inspection records related to fire compartmentation, escape routes, smoke control, sprinkler systems, alarm integration, and commissioning activities. The findings indicate that many deficiencies were associated not only with technical defects but also with fragmented information flows, incomplete systems integration, undocumented modifications, and weak lifecycle coordination. The study further reveals a gap between formal compliance documentation and operational readiness during final acceptance stages. Based on the analysed findings, the paper argues for a transition toward BIM-enabled fire safety compliance verification frameworks supporting traceable information management, integrated coordination, and lifecycle-oriented verification processes in complex healthcare projects.

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ICONS2026-000346 | Abstract 143

Can Current BIM EIRs Support Lifecycle ROI Measurement? Evidence from Public Building Projects in Vietnam

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ABSTRACT

Building Information Modelling (BIM) is increasingly expected to generate value throughout the asset lifecycle, yet lifecycle return on investment (ROI) remains difficult to measure. Existing BIM ROI studies primarily evaluate post-implementation economic or project performance outcomes, while Exchange Information Requirements (EIRs) are generally treated as technical specifications for information delivery rather than mechanisms for enabling lifecycle value measurement. This study investigates whether BIM EIRs embedded in public procurement documents are sufficiently structured to support lifecycle BIM ROI measurement from the owner's perspective. A directed qualitative content analysis was conducted on five BIM-enabled public procurement packages across feasibility study, design, and appraisal stages in Vietnam. Using a framework derived from BIM ROI, ISO 19650, EIR, and information governance literature, the documents were analysed against five dimensions: strategic value alignment, performance measurability, information traceability, lifecycle information continuity, and governance accountability. The findings indicate that current procurement documents increasingly specify structured BIM deliverables, CDE workflows, traceability mechanisms, and governance responsibilities, but remain focused on information delivery rather than lifecycle value measurement. This study reconceptualises BIM ROI as an information governance capability and proposes a Lifecycle ROI-enabled EIR framework that positions procurement-stage EIRs as the governance infrastructure through which lifecycle BIM value becomes measurable, traceable, accountable, and operationally continuous, providing practical guidance for owner-oriented BIM procurement.

References

[1] N/A

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ICONS2026-000347 | Abstract 144

Networks in biomedical applications, pair groupoids, and fNIRS

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ABSTRACT

A network (a finite set of nodes some of which are connected by the edges) is often a part of a physics based model used for simulation or data analysis in biomedical applications, such as, for example, the connectome [Vecchio2017] or diagnostic tests on humans that use multiple sensors or electrodes. In mathematics, a network is a graph (V,E), where V is a finite set (the vertices of the graph) and E is another finite set, a set of edges, that satisfies some mildly restrictive conditions. There is, in a sense, a more general concept of a pair groupoid. It relates every two points on a given manifold. It can be a useful component in the set up of a quantitative study of a region of a human body or analysis of diagnostic or real time data. Source-detector pairs are used in fNIRS (functional near-infrared spectroscopy).

It is a non-invasive, fairly inexpensive, and portable brain imaging technique that yields data near the cortical surface. The underlying idea is to track the changes of the hemoglobin concentration. A typical fNIRS cap with the optodes would be set up with, say, 12 sources and 12 detectors, to arrange for the total of 32 channels. In this presentation, we discuss what it means to replace graphs by pair groupoids, when this is appropriate, and possible advantages and limitations of this approach. We demonstrate the calculations using one of the data sets publicly available via [Luke2024], [Yucel2025].

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ICONS2026-000351 | Abstract 145

Product prediction for copper tube straightening machine using neural networks

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ABSTRACT

A straightening machine for copper tubes has been constructed and experimentally investigated. Fine tuning of the straightening parameters is a time-consuming trial-and-error procedure that can be supported by computational mechanics or machine learning tools. Here an artificial neural network technique, trained by experimental measurements, has been used for the prediction of the final product. Effective application of the method will result in considerable savings of time and material, allowing for the fine tuning of the machine by personnel with lower experience. The machine has been constructed for Dimas S.A. Solar collectors company. The paper is based on Kalatzis, (2025) and follows methodology developed, among others, in Spathopoulos and Stavroulakis (2020).

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ICONS2026-000352 | Abstract 146

Shear Force in a Beam-Column Connection from a Linearly Distributed Load Occupying Various Possible Positions on a Cantilever Beam – Part II - Asymmetric Cross-Section

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ABSTRACT

The beam-column connection is often responsible for building damage during earthquakes. There is still uncertainty regarding the calculation of shear forc-es. In the current Eurocode 2, these forces are determined capacitively. How-ever, this does not allow the determination of forces as a result of the actual acting load and does not take into account the influence of the concrete cross-section. This article considers a mathematical model of a cantilever beam, which allows taking into account all its dimensions in height, as well as the properties of the materials from which it is composed. A boundary stage of crack initiation and growth between the beam and the column is considered. The load is linearly distributed, which occupies various possible positions. The reactions of the supports at the lateral edge of the beam in height are de-termined. Menabrea's theorem is used. With the exact forces determined by the newly derived formulas, the shear force is calculated. To validate the re-sults, the new shear strength was compared with that determined by the ap-proximate method recommended in the literature. The difference ranges from 15.67% to 30.74%. . Comparison was made with the shear strength deter-mined according to Eurocode 2. The difference ranges from 9.73% to 40.68%.

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ICONS2026-000353 | Abstract 147

Variation on the shear force of a cantilever beam under the action at a linearly distributed load and intensity to the free end of the beam – Part I, symmetrical cross-section

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ABSTRACT

The beam-column connection is an important structural element in frame structures. Shear forces are the on cause of a number of failures in frame structures during earthquakes. In current Eurocode, these forces are determined capacitively based solely on the amount of reinforcement. However, this does not answer the question of how large the shear forces actually are under a specific load. The contribution of the concrete cross-section and its material properties is not taken into account. This article examines a cantilever beam subjected to a linearly distributed load with an intensity at the free end of the beam. A new mathematical model of the beam is introduced, taking into account the full dimensions and mass properties of the materials. Expressions for the magnitudes of the resulting support reactions are derived. The Menabrea method is used. A limit stage is examined. The derived expressions provide values for the support reactions both before the appearance of a crack between the beam and the column and during its growth. The cross-section of the beam is symmetrical. The value of the shear force at the beam-column connection is calculated based on the exact values of the forces in the beam. The results are compared with those recommended in the literature, with differences ranging from 5.47% to 21.53% depending on the stage of crack development. A comparison with Eurocode was made. The difference ranges from 1.31% to 16.97%.

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ICONS2026-000354 | Abstract 148

Variation on the shear force of a cantilever beam under the action at a linearly distributed load and intensity to the free end of the beam – Part II, asymmetrical cross-section

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ABSTRACT

The seismic response of frame structures is often accompanied by sudden failure caused by the exhaustion of shear stresses in the beam-column connection. Determining the shear forces responsible for these phenomena involves calculating the forces transmitted to the connection from the beam, through its reinforcing bars, and through the concrete. In current Eurocode, these forces are determined capacitively based on the amount of reinforcement. The determination of the actual shear forces remains an unresolved issue. This article examines a cantilever beam subjected to a linearly distributed load with an intensity at the free end of the beam. A new mathematical model of the beam is used. The full dimensions and mass properties of the beam materials are taken into account. The beam has an asymmetrical cross-section. Expressions for the magnitudes of the support reactions in the limit state are derived. The shear force is calculated based on the exact values of the forces in the beam. The results are compared with those recommended in the literature, with a difference ranging from 5.47% to 21.53%, depending on the crack development stage. A comparison with Eurocode has been made. The difference ranges from -3.38% to 16.97%, based solely on the maximum value of the shear force determined by the exact method.

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ICONS2026-000369 | Abstract 149

Attitude, Subjective Norm, and Perceived Behavioral Control Analysis of Educational Tourism Ban in West Java: A Systematic Literature Review

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ABSTRACT

Abstract. This research analyzes the educational tourism ban in West Java, Indonesia through the perspectives of attitude, subjective norm, and perceived behavioral control within the Theory of Planned Behavior. The policy refers to the Circular Letter of the Governor of West Java, issued in May 2025. The policy prohibits schools around West Java, Indonesia from organizing educational tours that burden parents financially. Using a phenomenological-hermeneutic approach. Utilizing systematic literature review as the approach, this research examines the transformation of educational tourism derived from learning activity into mass tourism consumption. Utilizing publish/perish, Mendeley, and VOSViewer, this research explores public perceptions, social pressures, and stakeholders' control over educational tourism practices. The findings indicate a crisis of meaning in educational tourism, where educational values are increasingly overshadowed by commercial interests and socio-economic pressures within the tourism sector.

Keywords: Attitude, Subjective Norm, Perceived Behavioral Control, Educational Tourism, West Java.

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ICONS2026-000371 | Abstract 150

Tourism Marketing Expenditures and International Tourist Arrivals: A Systematic Literature Review

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ABSTRACT

This paper uses a systematic literature review (SLR) to examine the relationship between tourism marketing budgets and international tourist arrivals. This study seeks to clarify the role that budget allocation for tourism marketing can play in inbound tourism performance consistently, alongside identifying any contextual factors which may strengthen this relationship. Analysis on systematic literature review helped to identify the conceptual structure of the field with VOSviewer on 1,185 editorial records related to tourism marketing, supported by PRISMA procedures and Covidence as a screening tool for 269 focused studies followed by synthesis from sixteen eligible empirical articles finalised for inclusion. The findings indicate that tourism promotion expenditure generally contributes positively to tourism demand across various destinations, target markets, allocation strategies, and promotional channels. The VOSviewer mapping also reveals that the existing literature remains relatively fragmented from a conceptual perspective, as only a limited number of studies explicitly connect and integrate discussions on promotion spending with tourist arrivals at destinations. This study combines macro-level bibliometric mapping with empirically oriented meta-analytical approaches to provide a broader understanding of tourism promotion budgets as an often overlooked policy instrument capable of influencing tourism demand, particularly within the context of post-pandemic tourism recovery.

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ICONS2026-000384 | Abstract 151

Integrated Cost–Time–Quality Performance Assessment for Project Management in Major Public Infrastructure Projects

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ABSTRACT

Major public infrastructure projects require systematic monitoring frameworks capable of capturing deviations in cost, schedule, and quality during construction. This paper presents an integrated performance assessment approach based on Total Quality Management principles, applied to the case of the New International Airport of Crete at Kasteli, Heraklion. The proposed methodology combines three complementary indicators: cost performance, schedule performance, and quality conformance. Cost performance is evaluated by comparing actual and planned financial outflows, schedule performance is assessed using the Schedule Performance Index, and quality performance is measured through a conformance-rate approach reflecting compliance with specifications, approved designs, and project requirements. These indicators are integrated through a weighted-sum formulation into a composite Public Project Quality Index, enabling the structured evaluation of project progress across different construction phases.

The case study demonstrates that the proposed index can support decision-making by identifying performance deviations, highlighting the relative influence of cost, time, and quality parameters, and assisting in the evaluation of corrective actions. The methodology offers a practical tool for project managers, concession authorities, and public-sector stakeholders seeking to improve transparency, control, and quality-oriented governance in large-scale infrastructure projects. The framework can be further extended by incorporating environmental, social, and user-satisfaction indicators for a broader sustainability-oriented assessment.

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ICONS2026-000387 | Abstract 152

Enterprise Decision Intelligence, AI-Augmented Recommendations and Sustained Organizational Performance in Knowledge-Intensive Enterprises: A PLS-SEM Validation

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ABSTRACT

The global service sector contributes about 65% of world GDP, with BFSI, IT & ITeS, Retail & eCommerce, and Healthcare leading enterprise analytics investment and knowledge-worker employment. India's four-sector knowledge-intensive service economy employs more than 12 million technology and analytics professionals and contributes over 55% of national GDP. Yet most analytics initiatives still fail to reach full operational maturity. This gap highlights the need to understand which organizational mechanisms turn analytics use into sustained performance.

This study proposes and validates the Sustained Organizational Performance (SOP) Model, a five-construct PLS-SEM framework grounded in Resource-Based Theory and the VRIN perspective. The model examines how Enterprise Decision Intelligence Utilization (EDIU) influences Operational Decision Intelligence (ODI) and Strategic Decision Intelligence (SDI), how these mediate the EDIU–SOP relationship, and whether AI-Augmented Recommendation Systems (AARS) shape the decision-to-performance link. Primary data were collected from 305 CxOs and senior decision-makers across BFSI, IT & ITeS, Retail & eCommerce, and Healthcare firms in India.

Results show that EDIU significantly predicts both ODI and SDI. Strategic decision intelligence is the strongest pathway to sustained organizational performance, while AARS moderates the SDI–SOP relationship through a substitution effect. The direct EDIU–SOP path is not significant, indicating that analytics investment alone does not create performance gains without stronger decision intelligence capability. The SOP Model provides an empirically validated framework for linking enterprise analytics, AI-enabled recommendations, and sustained performance across major knowledge-intensive service sectors.

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ICONS2026-000390 | Abstract 153

Historical Flood Validation Using Machine Learning and GIS in Oxfordshire, United Kingdom

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ABSTRACT

Historical flood validation is necessary before machine-learning flood maps can be used for spatial plan-ning and risk communication. This paper presents a GIS-based validation workflow for Oxfordshire, United Kingdom, using a historical flood extent raster from 2000-2018 as the observed reference. Twen-ty-four terrain, land-cover, vegetation, rainfall, hydrological proximity, infrastructure and geological pre-dictors were evaluated with Logistic Regression, Random Forest, Extra Trees and Gradient Boosting. A 70/30 stratified train-test split, five-fold cross-validation, ROC-AUC, F1-score, precision, recall, confu-sion matrix, Taylor statistics, feature importance and SHAP explainability were used to assess perfor-mance. Random Forest was selected as the best model, with test AUC = 0.965, accuracy = 0.910, preci-sion = 0.904, recall = 0.918 and F1-score = 0.911. Full-raster validation also showed strong discrimina-tion (AUC = 0.970) and high recall (0.928). The most important predictors were elevation, flood-zone in-formation, rainfall variables and distance to watercourse. Spatial outputs show that higher validation probabilities are concentrated along low-lying river corridors and connected drainage pathways, while most of Oxfordshire remains in the very-low validation class.

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ICONS2026-000391 | Abstract 154

Optimizing Monkeypox Lesion Segmentation via Kernel Density Estimation Techniques

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ABSTRACT

Monkeypox (MPX) is a virus that has been rapidly spread across countries. The symptoms are a severe rash, lymphadenopathy, and fever. MPX has emerged as a significant public health issue, and prompt recognition and accurate diagnosis are vital for its management and control. To automate MPX diagnosis, the image data of cutaneous lesions need to be segmented. However, it remains challenging due to lesion heterogeneity, similarity to other dermatological conditions, lack of sufficient annotated datasets, and computational constraints. The segmentation technique used in this study for the segmentation of MPX lesions is the kernel-based probability density function (PDF). The performance of different kernel functions, i.e., Gaussian, Uniform, Epanechnikov, Biweight, and Triweight, in modeling the distribution of pixel intensities and their ability to allow threshold-based segmentation have been investigated. As preprocessing techniques, median filtering and CLAHE were applied to improve the visibility of the lesions. The experimental results in the MPXSkin Lesion Dataset (MSLD) show that the Gaussian and uniform kernels have remarkable segmentation quality. The Gaussian kernel performs better than the uniform kernel (MSE = 0.0040, PSNR = 23.98 dB, SSIM = 0.99, and IoU = 0.92-0.95).The findings illustrate that kernel-based PDF modeling serves as a lightweight and efficient alternative to computationally intensive deep learning models, yielding promising This approach yields promising outcomes in clinical and resource-limited environments. The suggested paradigm is applicable to different dermatological and medical imaging segmentation.

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ICONS2026-000392 | Abstract 155

Development of an AI-Based Air Quality Index and Health Risk Classification System for Port Harcourt, Nigeria

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ABSTRACT

Air pollution is a major environmental health challenge in rapidly urbanizing African cities. Port Harcourt, the commercial center of Nigeria's Niger Delta petroleum region, experiences chronic multi-pollutant exposure but lacks an operational data-driven Air Quality Index (AQI) and health-risk classification system. This paper presents an AI-based AQI framework using 576 station-month observations from 48 monitoring stations collected during twelve monthly campaigns between August 2023 and January 2025, with a planned February-July 2024 data gap. The US EPA sub-index method was extended with documented breakpoints for CO2, CH4 and N2O, while O3 and CO followed standard 8-hour AQI conventions. Five machine learning classifiers were evaluated by stratified five-fold cross-validation. Mean AQI was 240.0 +/- 36.8, classed as Very Unhealthy; 89.6% of observations exceeded AQI 200 and 2.3% reached Hazardous levels. Gradient Boosting performed best, with 98.96% accuracy, 93.48% macro-F1 and one-vs-rest AUC values of 0.995-1.000. O3 and CO dominated AQI formation and model importance, while Diobu, Marine Base and Trans Amadi emerged as persistent hotspots. The framework provides a reproducible basis for real-time public health alerts and environmental governance in petroleum-impacted African cities.

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ICONS2026-000395 | Abstract 156

AI-Based Rainfall Anomaly Impact Assessment on Vegetation Stress in Oxfordshire, United Kingdom

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ABSTRACT

This study develops an artificial intelligence and machine-learning geospatial framework for predict-ing the impact of rainfall anomaly on vegetation stress across Oxfordshire, United Kingdom. The workflow integrates rainfall anomaly indicators, rainfall-deficit pressure, multi-index vegetation met-rics, terrain, land-cover, hydrological-proximity, and urban-context variables to construct a rainfall-anomaly impact index and a five-class vegetation-stress prediction target. Four supervised machine-learning algorithms, Logistic Regression, Random Forest, Extra Trees, and Gradient Boosting, were trained and evaluated using stratified cross-validation and a 70/30 stratified train-test split. Model performance was assessed using accuracy, macro precision, macro recall, macro F1-score, multi-class one-vs-rest AUC, confusion matrix analysis, a validation block plot, and a Taylor diagram. Logistic Regression achieved the strongest predictive performance, with test accuracy of 0.993, mac-ro F1-score of 0.993, and one-vs-rest macro AUC of 0.9999, indicating excellent class separability across the five vegetation-stress categories. Explainable AI techniques, including feature-importance ranking and SHAP analysis, identified rainfall anomaly impact index, rainfall anomaly, rainfall-deficit pressure, NDVI, NDMI, and EVI as the dominant predictors. The spatial prediction outputs show higher vegetation stress mainly in eastern and south-eastern Oxfordshire, corresponding with stronger rainfall anomaly pressure. The findings demonstrate that interpretable AI/ML models can effectively combine rainfall anomaly and remote-sensing variables for spatially explicit vegetation-stress prediction, environmental monitoring, and climate-impact assessment.

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ICONS2026-000396 | Abstract 157

Evaluating Physics-Informed Feature Engineering for Surrogate Modeling of 4D-Printed PLA Beam Morphing

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ABSTRACT

Thermally activated 4D-printed PLA structures exhibit complex deformation responses that are difficult to model efficiently using experiments or finite element simulations alone. Additive manufacturing datasets are often small, making surrogate-model performance highly sensitive to both algorithm choice and input representation. This study evaluates whether simple domain-knowledge feature engineering can improve classical surrogate modeling of thermally activated 4D-printed PLA beams. Three physics-informed composite features, namely Aspect Ratio, Thermal Gradient, and Flow Dynamics, were derived from six raw fused filament fabrication parameters. A factorial comparison was conducted across 80 experimental configurations, evaluating Multiple Linear Regression, Response Surface Methodology (RSM), and Kriging using both raw and engineered feature sets under 5-fold cross-validation. The results show that the engineered features provide only modest and response-dependent improvements for parametric models, rather than a universal increase in predictive accuracy. RSM benefits most consistently, suggesting that physically motivated descriptors can support interpretable surrogate modeling in small datasets. In contrast, Kriging exhibits degraded generalization when additional features are introduced, highlighting the sensitivity of distance-based non-parametric models to dimensionality. These findings position physics-informed feature engineering as a useful but limited tool for surrogate modeling of 4D-printed PLA beam morphing.

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ICONS2026-000397 | Abstract 158

Mapping FDM Process Parameters to Effective Thermo-Mechanical Drivers in 4D-Printed PLA Beams Using Machine Learning

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ABSTRACT

Thermally activated shape morphing in fused deposition modeling (FDM) 4D-printed PLA structures remains difficult to simulate because nominal slicer settings do not fully describe the internal thermo-mechanical state generated during printing. Conventional finite element analysis requires suitable material-property inputs, yet FDM introduces hidden variables such as residual stresses, layer-dependent cooling histories, and imperfect interlayer bonding. To address this issue, this study employs a bi-layer effective coefficient of thermal expansion (CTE) framework as a physical proxy for the morphing response. The objective is to evaluate whether machine learning can predict these effective thermo-mechanical drivers directly from nominal process parameters, including activation temperature, printing speed, layer height, layer width, nozzle temperature, and bed temperature, using an 80-run experimental design. The results show that machine learning models can capture the overall effective expansion response with moderate accuracy. However, the differential CTE component governing bending between the top and bottom layers is highly nonlinear and weakly predictable. These findings demonstrate the limitations of direct process-to-physics mapping and motivate hybrid modeling strategies for reliable predictive simulation of 4D-printed smart structures.

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ICONS2026-000398 | Abstract 159

Topology Optimization of Structures in Space: A Review

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ABSTRACT

Topology optimization (TO) has become a primary computational design tool for space structures, where launch costs of EUR 20,000–100,000 per kilogram make every gram of avoidable mass consequential. This review synthesizes the methods, constraints, applications, and additive manufacturing (AM) integration that define TO for space hardware. Density-based (Solid Isotropic Material with Penalization, SIMP), evolutionary (Bi-directional Evolutionary Structural Optimization, BESO), and level-set families share filtering and regularization machinery, while iso-geometric and machine-learning-accelerated methods are emerging as the next frontier. Space-specific constraints (launch vibration, multi-load-case stress and frequency, and European Cooperation for Space Standardization (ECSS) qualification) define a design space more demanding than terrestrial TO, with thermal, vacuum, and radiation effects largely outside current formulations. Documented applications span flight-proven satellite brackets, lunar rover and lander components, and commercial aerospace platforms, with mass savings of 28–56% at component level and on the order of 1,000 kg at platform level. Embedding AM constraints into the TO loop is the enabling pathway for translating optimized designs into qualified hardware. Outstanding challenges include 3D scalability, validation, and Technology Readiness Level maturation; machine-learning acceleration, multi-scale TO, fail-safe TO, and in-orbit AM are the most actively pursued future directions.

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ICONS2026-000399 | Abstract 160

Innovative Technologies in the Educational Process

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ABSTRACT

The rapid development of digital technologies has transformed the educational process from a predominantly teacher-centered transmission model into a dynamic, data-informed, and learner-centered ecosystem. This article examines how innovative technologies, including artificial intelligence, learning analytics, virtual and augmented reality, cloud-based learning management systems, open educational resources, digital assessment tools, and assistive technologies, can be integrated into teaching and learning in a pedagogically meaningful, ethical, and sustainable manner. The purpose of the study is to develop an integrative analytical framework for evaluating the contribution of innovative technologies to learning quality, accessibility, personalization, teacher productivity, and institutional resilience. The study applies a conceptual integrative review method based on recent international policy documents and scientific literature published mainly between 2023 and 2026. The results show that technology improves educational quality only when it is aligned with learning outcomes, teacher digital competence, evidence-based instructional design, inclusive access, and reliable governance of data and artificial intelligence. The article proposes a human-centered implementation model and a practical matrix for selecting technologies according to their pedagogical function, expected effect, risks, and assessment indicators. It is concluded that innovation in education should not be understood as the mere introduction of devices or platforms, but as a systematic reorganisation of the educational process in which technology strengthens human reasoning, collaboration, creativity, feedback and lifelong learning

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ICONS2026-000403 | Abstract 161

Explainable Machine Learning Assessment of Land-Cover Driven Environmental Vulnerability in Tower Hamlets, United Kingdom

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ABSTRACT

This study presents a compact, explainable machine-learning workflow for as-sessing land-cover driven environmental vulnerability in Tower Hamlets, Lon-don. A rule-based vulnerability index was first produced from remote-sensing, rainfall, topographic, geological, greenspace and building-proximity indicators. The index was then used to create a proxy binary target for supervised learn-ing, while the index itself was excluded from the predictor set to reduce direct information leakage. Four models logistic regression, gradient boosting, ran-dom forest and extra trees were evaluated with spatial block splitting and group cross-validation. Logistic regression gave the most balanced result, with 0.991 test accuracy, 0.976 precision, 1.000 recall, 0.988 F1-score and 0.9998 AUC. Spatial outputs show that very high vulnerability is concentrated mainly in the western and central-western parts of the borough, while very low vul-nerability dominates the eastern and south-eastern areas. Explainability results indicate that buildings, rainfall anomaly, extreme rainfall, slope, maximum daily rainfall and distance to buildings are the dominant drivers. The study demonstrates how interpretable machine learning can translate heterogeneous urban environmental layers into decision-support maps.

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ICONS2026-000404 | Abstract 162

AI-Based Flood Vulnerability and Urban Infrastructure Exposure Mapping in Tower Hamlets, United Kingdom

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ABSTRACT

Urban flood-risk assessment requires spatially explicit, explainable and asset-level information to sup-port planning and emergency response. This study presents an AI-based workflow for mapping flood vulnerability and urban infrastructure exposure in Tower Hamlets, United Kingdom. Multi-source geo-spatial predictors, including terrain, rainfall, vegetation, land cover, geology, hydrology, proximity to flood zones and urban asset data, were integrated within a supervised machine-learning framework. Four models Random Forest, Extra Trees, Gradient Boosting and Logistic Regression were evaluated, and the best-performing model was used to generate flood probability, susceptibility and confidence maps. The Random Forest model produced the strongest performance, achieving an accuracy of 0.9896, precision of 0.9914, recall of 0.9958, F1-score of 0.9936 and AUC of 0.9990. The five-class vulnerability map shows that very high vulnerability covers 15.67 km², representing 70.3% of the classified area, while very low vulnerability covers 5.62 km². Exposure analysis indicates that 3,086 buildings and 3,548 road features fall within the very high exposure class. Feature importance and SHAP analysis identify flood-zone distance, rainfall variables and elevation as key controls. The workflow provides actionable evidence for urban flood-risk planning and infrastructure prioritisation.

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ICONS2026-000405 | Abstract 163

WHO AM I IF AI CAN DO MY JOB? Leadership Identity Threat in the Age of Generative AI.

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ABSTRACT

The rapid diffusion of generative artificial intelligence (GenAI) into organizational life is reshaping the landscape of leadership work. Tasks once emblematic of senior leadership—strategic analysis, performance feedback, forecasting, and narrative report writing—are now performed with remarkable competence by AI systems. This paper introduces the construct of AI-Induced Leadership Identity Threat (AILIT), a novel form of role-level identity disruption that emerges when leaders perceive that AI encroaches upon activities central to their professional self-concept. Drawing on Identity Theory and Role Identity Theory, we develop a conceptual framework that delineates the antecedents, boundary conditions, and consequences of AILIT. We propose that leaders whose identities are tightly coupled with task-specific competencies will experience greater threat, manifesting as identity salience disruption, role ambiguity, defensive behavioral responses, or adaptive identity reconfiguration. Theoretical contributions, practical implications, and a future research agenda are discussed.

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ICONS2026-000406 | Abstract 164

LEADING WITH AI UNDER INSTITUTIONAL VOIDS: AI-Enabled Leadership in Contexts of Regulatory Instability, Informational Unreliability, and Expertise Scarcity

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ABSTRACT

The dominant discourse on artificial intelligence (AI) in leadership assumes stable institutional environments: reliable information flows, enforceable regulatory frameworks, and accessible expert labor markets. Yet more than half of the world's economic activity unfolds in contexts where these assumptions fail—where data are unreliable, regulations shift unpredictably, and domain expertise is scarce. This paper introduces the concept of Void-Adapted AI Leadership (VAAL), which describes how leaders in institutionally thin environments appropriate AI tools not merely as efficiency instruments but as institutional substitutes that partially compensate for missing or dysfunctional market, regulatory, and knowledge infrastructures. Drawing on Institutional Theory and Institutional Voids scholarship, with empirical illustration from Iran, the broader Middle East, and other developing economies, we develop a conceptual framework mapping the three primary institutional void dimensions—informational, regulatory, and expertise voids—onto distinct AI leadership practices. We theorize that AI use in these contexts is characterized by bricolage, improvisation, and compensatory deployment rather than the optimization logic documented in Western-centric AI leadership research. The paper makes three contributions: it extends institutional voids theory into the domain of AI-enabled leadership, it introduces VAAL as a new construct, and it advances a research agenda to redress the systematic Global South blind spot in AI leadership scholarship.

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ICONS2026-000407 | Abstract 165

BEYOND HUMAN LEADERSHIP Toward a Theory of Hybrid Intelligence Leadership

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ABSTRACT

Leadership theory has, since its inception, assumed a human subject: a person who perceives, decides, influences, and takes responsibility. Generative AI disrupts this assumption with unprecedented force. When intelligence—the capacity to perceive environments, generate options, evaluate consequences, and guide action—is distributed between human leaders and AI systems, the foundational categories of leadership theory require reconstruction. This paper advances a theory of Hybrid Intelligence Leadership (HIL), defined as the enactment of organizational leadership through the dynamic integration of human and artificial intelligence, wherein neither the human nor the AI system alone constitutes the leadership agent but rather the coupled human–AI system does. Drawing on distributed cognition theory, actor-network theory, upper echelons theory, and complexity leadership theory, we develop a conceptual framework that reconceptualizes the leadership agent, the leadership process, and the leadership context for hybrid intelligence environments. We advance nine theoretical propositions and introduce three new constructs: the Hybrid Intelligence Leadership System (HILS), Cognitive Authority Distribution (CAD), and Accountable Moral Anchoring (AMA). We discuss contributions to leadership theory, organization theory, and entrepreneurship theory, and identify a program of future research. Our central argument is that leadership in the age of generative AI is not a human activity assisted by AI; it is a genuinely novel form of distributed intelligence enactment that existing theory is not equipped to explain.

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ICONS2026-000408 | Abstract 166

Risk and Compliance Issues of Artificial Intelligence (AI) Use in the Online Learning Environment

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ABSTRACT

With the continuous drive for many organizations to incorporate, monitor, and evaluate new technology, the use of AI is everywhere in the workplace and the learning environment. In 2026, Grant Thornton reported an AI Impact Survey in which they identified an "AI proof gap," that reinforces why organizations must be on board with their AI commitment or face the risks inherent in organizational shortcomings. According to the survey, 78 percent of over 950 business executives from across 10 industries revealed they "lack strong confidence they could pass an independent AI governance within 90 days;" and “organizations deploying AI can't show how decisions are made and who is accountable for the outcome “ (Grant Thornton, 2026, para. 1). The information gap between a seemingly helter skelter use of AI and critically needed sophisticated success with AI advancement has placed a critical responsibility on online educational institutions to meet the demand of preparing a global workforce for a new paradigm of work. Equally important is the corresponding responsibility to follow accreditation standards for online learning programs that are morphing in response to these rapid changes, as well as compliance with overall educational institutional standards. This paper addresses ways of identifying risk and compliance issues with the application of AI in organizations, as well as recommending ways for improvement.

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ICONS2026-000410 | Abstract 167

Artificial Intelligence in Linguistics: a Scientific and Methodological Analysis and Development Prospects

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ABSTRACT

This article presents a scientific and methodological analysis of the integration of artificial intelligence (AI) into the field of linguistics. It examines the evolution of approaches to language analysis: from early algorithms based on the formalization of linguistic rules. The authors emphasize that AI not only automates routine tasks but also opens up new opportunities for identifying hidden patterns, text attribution, modeling language change, and forecasting trends in language development. The paper outlines prospects for further interdisciplinary collaboration. It concludes that artificial intelligence is becoming a catalyst for fundamental transformations in both theoretical and applied linguistics, contributing to the emergence of new scientific paradigms.

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ICONS2026-000411 | Abstract 168

Euphony as Main Linguistic Name Giving Motive for Cultural Community

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ABSTRACT

The work is devoted to theoretical and experimental studies of proper names and their phonetic significance and is aimed at identifying the features of interconnection of proper names' phonosemantic characteristics and euphony, as the main motive of name giving. Popular proper names for the last 18 years were chosen as the study material. One of the basic methods of this study is phonosemantic analysis, as well as a sociolinguistic experiment, the purpose of which is to find associations that are caused by the phonetic shaping of the name among Russian speakers, as well as to confirm the assumption that euphony is a significant motive of a name giving process. Using experimental data, and taking into account the fact that all phonosemantic measurements are not absolute, but probable, it was stated that sound shaping of proper names has significance in name giving process.

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ICONS2026-000412 | Abstract 169

Medical Discourse as an Object of Linguistic Research: Possibilities of Artificial Intelligence Application

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ABSTRACT

This article examines medical discourse as an object of linguistic analysis, with a focus on the underexplored domain of Kazakh-language clinical communication. A pilot corpus of 58 Kazakh-language medical discourse samples collected from online consultation platforms and healthcare resources (2023–2025) was analysed using discourse analysis, conceptual metaphor identification, and communicative-pragmatic analysis. The analysis reveals that the DISEASE IS AN ENEMY metaphor accounts for 39% of metaphorical patterns annotated in the pilot corpus, while persuasion and empathy strategies together constitute 73% of communicative tactics in doctor–patient dialogue. The study contributes to research on Kazakh-language clinical discourse by systematising the linguistic features of Kazakh medical discourse and identifying key points of intersection with contemporary NLP systems.

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ICONS2026-000415 | Abstract 170

Influence of 3D Printing Parameters on the Hyperelastic Performance of TPU Specimens: An Experimental Investigation

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ABSTRACT

In the fast-growing aerospace industry, the additive manufacturing (AM) of flexible, functional components has emerged as a critical requirement for applications involving vibration isolation, sealing, and impact absorption. Thermoplastic Polyurethane (TPU) distinguishes itself among Fused Filament Fabrication (FFF) materials due to its exceptional elasticity, high tear resistance, and dynamic load-damping capabilities. However, the layer-wise deposition principle inherent to FFF introduces significant structural anisotropy, which complicates the predictable hyperelastic behavior of the printed parts. This study systematically optimizes the tensile properties and elongation characteristics of TPU by varying five key printing parameters: Infill Angle, Build Orientation, Printing Speed, Layer Height, and Nozzle Temperature. Utilizing a Taguchi L18 orthogonal array, 90 elastomeric samples were fabricated and subjected to tensile testing. Signal-to-Noise (S/N) ratio analysis is employed to evaluate the discrepancy in optimal design directions. Preliminary results indicate that while build orientation severely dictates the ultimate tensile strength and elongation at break—with flat-printing geometries maximizing polymer chain alignment—the thermal parameters and extrusion speeds govern the inter-layer fusion essential for consistent elastomeric recoil. The identified optimal parameter sets provide a reliable framework for engineers to implement TPU in advanced, dynamic aerospace applications.

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ICONS2026-000416 | Abstract 171

Experimental and Numerical Investigation of Flexural Properties in Vacuum-Infused Unidirectional Carbon-Fiber/Epoxy Laminates

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ABSTRACT

This study investigates the flexural response of vacuum-infused unidirectional carbon-fiber/epoxy laminates and evaluates the fidelity of finite element predictions under three-point bending. Eleven four-ply stacking sequences combining 0°, 90°, and ±45° fiber orientations were manufactured by Vacuum Infusion Processing and tested according to ASTM D790. The experimental results confirmed the dominant role of fiber orientation: $[0/0]_2$ laminates exhibited the highest flexural strength and stiffness, whereas $[90/90]_2$ laminates showed the lowest load-bearing capacity, governed mainly by transverse matrix cracking. Hybrid and off-axis configurations displayed intermediate performance, with damage dominated by interlaminar shear, matrix cracking, and mixed-mode fracture. A corresponding finite element model was developed in ANSYS using composite laminate definitions based on orthotropic ply properties and Classical Laminate Theory. Although the numerical model captured the general stiffness hierarchy of the laminates, substantial deviations were observed for off-axis and asymmetric layups. These discrepancies are primarily attributed to the displacement-controlled remote boundary conditions, which restricted the natural bending–twisting coupling and lateral deformation of the physical specimens. This restriction produced an artificial stiffening effect, leading to overestimated reaction forces and internal stresses. The findings highlight the critical need for experimentally consistent boundary conditions when simulating thin off-axis composite laminates.

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ICONS2026-000417 | Abstract 172

4D Printing and Smart Materials in the Built Environment: A mini-review

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ABSTRACT

Smart materials and 4D printing are emerging as promising technologies for architecture, engineering, and construction (AEC), enabling building components and structural systems that can adapt over time in response to environmental or operational stimuli. Unlike conventional 3D printing, 4D printing introduces programmed transformations through materials capable of changing shape, stiffness, permeability, colour, or functionality under stimuli such as temperature, humidity, light, electric or magnetic fields, and mechanical loading. This review examines the current state of smart materials and 4D printing in AEC, focusing on their potential for adaptive façades, responsive building envelopes, climate-sensitive shading systems, deployable structures, self-healing components, self-monitoring systems, and resource-efficient construction. Key material classes are discussed, including shape-memory polymers and alloys, hydrogels, piezoelectric materials, electroactive polymers, thermoresponsive composites, and moisture-responsive bio-inspired materials. The review also highlights the role of computational design, additive manufacturing, material programming, and digital simulation in developing predictable and controllable adaptive systems for the built environment. Despite significant progress, several challenges continue to limit practical implementation, including scalability, durability, long-term performance, structural reliability, cost, standardization, multi-material fabrication, and the lack of validated design codes. Future research directions are identified in sustainable smart materials, large-scale 4D printing, AI-assisted optimization, digital twins, circular construction, and performance-based certification. Overall, smart materials and 4D printing offer a pathway toward more adaptive, resilient, energy-efficient, and human-centred built environments.

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ICONS2026-000418 | Abstract 173

Computer-Based Optimization of Algorithms for the Experimental Analysis of Wind Turbines in Energy Generation

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ABSTRACT

This study presents a computational optimization framework focused on enhancing the performance of algorithms employed in the experimental analysis of wind turbines for energy production. The proposed approach optimizes key algorithmic parameters, reduces computational processing time, and supports improved decision-making in the design and placement of wind turbines. Experimental data are utilized to validate the effectiveness of the optimized algorithms, demonstrating significant improvements in modelling accuracy and energy output prediction. Furthermore, this research provides a comparative analysis of the algorithms used in the experimental evaluation of wind turbines. By employing real-world data from various European countries and simulations developed in Python, the study integrates empirical, analytical, and machine learning approaches to assess model performance under diverse environmental conditions. The findings highlight the strengths and limitations of each method, offering valuable insights into their effectiveness for energy forecasting and turbine optimization. This interdisciplinary work contributes to advancing efficient wind energy systems and supports the continued development of sustainable technologies.

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ICONS2026-000423 | Abstract 174

Computational Simulation of Vibration and Aerodynamic Effects in Wind Energy Turbines and Their Environmental Impact

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ABSTRACT

By the end of 2021, the Bajgora Wind Farm in Kosovo was fully commissioned with 27 General Electric wind turbines and a total installed capacity of 105 MW, making it the largest wind energy facility and renewable electricity producer. It represents a significant contribution to Kosovo's energy transition strategy by increasing the share of renewable energy sources in the national power mix and reducing dependence on fossil fuel-based generation. The main objective of this study is to investigate, through computational simulation and analytical evaluation, the effects of structural vibrations, atmospheric turbulence, and aerodynamic forces on turbine performance at the Bajgora Wind Farm. The research uses field measurements and meteorological data including temperature, wind speed, relative humidity, atmospheric pressure, solar radiation, and precipitation, recorded through anemometers and monitoring instruments. Data were processed and analyzed to evaluate turbine operation under varying environmental conditions and to identify performance sensitivity to meteorological changes. Energy production was analyzed using WeatherLink software, correlating meteorological variables with turbine output, while simulations modeled airflow, turbulence intensity, and aerodynamic loading on turbine blades. Vibration behavior was also assessed, as excessive vibrations can affect reliability, lifespan, and maintenance requirements of wind turbines. Overall results provide a quantitative assessment of the relationship between atmospheric conditions, aerodynamic performance, turbulence, and structural response of turbines in Bajgora, supporting optimization of wind energy systems in similar environments. These findings are valuable for improving predictive performance models, enhancing turbine efficiency, and supporting sustainable wind energy development in Kosovo and similar regions globally.

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ICONS2026-000424 | Abstract 175

From CT-Scans to a cold treatment: A 3D Digital Twin of the Human Thigh

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ABSTRACT

This study presents the development of a 3D digital twin model of a human thigh portion subjected to two distinct cold modalities: cold water immersion (CWI) and whole-body cryotherapy (WBC). Unlike traditional analytical models that simplify human limbs into concentric cylinders, this work leverages anatomically accurate geometries derived from actual patient CT-scan images to account for true tissue heterogeneity. The thermal behavior within the domains (bone, marrow, muscle, and adipose tissue) is governed by Pennes' bio-heat equation, integrating non-linear thermoregulation phenomena such as local vasoconstriction laws. Numerical simulations were implemented using an in-house C++ finite element code and validated against existing experimental literature. The numerical results demonstrate a highly heterogeneous temperature field across the muscle surface, strongly influenced by localized variations in subcutaneous fat thickness. Furthermore, a comparative analysis between treatments highlights that CWI provides significantly deeper muscle cooling compared to WBC, which remains mostly superficial due to lower heat transfer coefficients. Finally, evaluating a second subject with a higher body mass index underlines the critical protective insulating effect of thicker adipose tissue. This digital twin framework successfully eliminates geometric bias, offering a powerful tool for personalized medicine, treatment optimization, and clinical diagnostics in thermal therapies.

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ICONS2026-000425 | Abstract 176

Trustworthy AI Aspects of EU-funded Research: An Exploratory Research

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) and its widespread integration across multiple sectors of society underscore the growing need for ethical and Trustworthy AI (TAI) systems. In response, numerous EU-funded research initiatives under the Horizon 2020 and Horizon Europe frameworks have focused on developing methods and tools that support the realization of TAI and its implementation in Europe. However, there is a lack of research on the EU-funded Trustworthy AI research landscape. Aiming to address this need, this paper presents and exploratory survey of EU-funded research projects, aiming to map, classify and analyse TAI research output, emerging from EU-funded initiatives. Our analysis revealed a continuity across funding schemes linked with core TAI priorities and a gradual shift towards more technically oriented outputs in recent programmes. Across funding programmes, projects prioritise technical robustness and transparency, reflecting the deployment needs and regulatory requirements. Respondents highlighted the need for explainable AI and TAI metrics, generative AI as well as legal issues and AI Act compliance as the top emerging research priorities. Both Horizon Europe and Horizon 2020 projects place particular emphasis on human-centric AI, followed by all other areas. These findings provide an empirical baseline for understanding TAI research focus, within the European research ecosystem, offering a foundation for future TAI research and policy areas. As such, the paper highlights the need for the creation of an EU-TAI Observatory, as a meta-inventory of TAI research for knowledge sharing, collaboration and evidence-based TAI policies.

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ICONS2026-000426 | Abstract 177

Securing the Internet of Agents: Trustworthy Discovery, Accountable Collaboration, and Resilient Ecosystems

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ABSTRACT

The Internet of Agents (IoA) represents an emerging paradigm in Artificial Intelligence (AI) in which heterogeneous agents of different entities discover, negotiate, delegate tasks to, and collaborate across organizational, jurisdictional, and geographic boundaries [1]. Unlike traditional Multi-Agent Systems (MAS), where agents are typically instantiated and controlled within a bounded environment, the IoA exploits capabilities distributed across domains and locations: data may not be movable, authority to act may be local, expertise and tools may be proprietary, and performance, cost, or energy use may depend on where agents, models, data, and controlled systems are located. This shifts the challenge from making individual agents or closed MAS capable, to enabling open networks of independently operated agents to establish trust, collaborate safely, remain accountable, and recover from failures. The security of open agent ecosystems remains underdeveloped. Agent discovery becomes security-critical: agents must decide whether to trust unfamiliar agents found e.g., through registries, based on verifiable identity, capability claims, reputation, provenance, and authorization. Collaboration must tolerate adversarial conditions: agents may disagree, be strategic, produce low-quality outputs, behave unreliably, pursue conflicting goals, or become compromised, requiring mechanisms for verification, negotiation, redundancy, and recovery. Finally, IoA infrastructure itself becomes part of the attack surface: registries, indexes, identity systems, communication protocols, and reputation mechanisms must remain resilient against spoofing, poisoning, Sybil attacks, collusion, and cascading failures. We therefore argue for an infrastructure-aware approach to IoA security and governance, centered on appropriate, dynamic, robust orchestration, secure cross-entity collaboration, and ecosystem-level resilience.

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ICONS2026-000427 | Abstract 178

Kinematics Modeling, Singularity Analysis, and Dexterity Evaluation of a Belt-Driven 3DOF Welding Robot Considering Transmission Compliance

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ABSTRACT

This study presents a comprehensive kinematics modeling and singularity analysis framework for a belt driven 3 degree of freedom (3DOF) welding robot designed for automated welding applications. Unlike conventional serial manipulators, the proposed robot employs timing-belt transmission mechanisms that introduce compliance and elastic deformation, significantly affecting positioning accuracy and operational stability. The primary objective of this research is to develop accurate forward and inverse kinematic models while investigating the influence of transmission compliance on workspace characteristics and singular configurations. Denavit-Hartenberg (DH) methodology is employed to establish the kinematic model, and the Jacobian matrix is derived to evaluate velocity transmission, dexterity, and singularity conditions. Furthermore, an enhanced compliance-aware Jacobian formulation is proposed to characterize elastic singularities caused by belt flexibility and transmission stiffness variations. Numerical simulations are conducted to identify singular regions, evaluate manipulability indices, and analyze workspace accessibility under different transmission stiffness conditions. The results demonstrate that transmission compliance significantly alters the distribution of singular configurations and reduces the effective manipulability of the robot near critical regions. The proposed framework provides a more realistic assessment of belt-driven robotic systems compared with conventional geometric approaches. Scientifically, this work extends classical singularity analysis by incorporating transmission elasticity into the kinematic formulation. Practically, the findings contribute to improving trajectory planning, welding accuracy, structural design optimization, and operational safety of low-cost industrial welding robots.

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ICONS2026-000428 | Abstract 179

Analyzing the Relationship Between Preprocessing Design Variables and the Structural Dimensions of Reluctance Synchronous Motors for Design Optimization.

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ABSTRACT

Synchronous Reluctance Motors (SynRMs) are attracting significant interest in industrial drive systems due to their simple rotor structure, lack of rare earth materials, and high efficiency. During the pre-design process, evaluating the influence of design variables on the motor's electromagnetic dimensions is crucial for guiding the selection of optimal parameters from the outset. This study focuses on analyzing the sensitivity of two fundamental design variables linear load (ac) and shape ratio (ar) to the main dimensions of a SynRM motor, including the stator inner diameter, active core length, and stator outer diameter. Based on analytical models developed from the theory of the specific power of electrical machines, a simulation program was developed in Matlab to investigate the entire design space. Local and global sensitivity analysis methods were applied to quantify the extent to which each input variable influences the output quantities. The research results show that linear electrical load has a dominant influence on motor diameter size, while the shape ratio strongly determines the iron core length and the overall shape of the structure. The obtained results provide a scientific basis for building size optimization models and developing SynRM rapid design tools for modern drive applications.

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ICONS2026-000429 | Abstract 180

Building an Energy Model and MPC Controller for a 3DOF Welding Robot Using a Belt Drive Mechanism

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ABSTRACT

This paper presents a comprehensive approach to building a kinematic, dynamic, energy consumption model and a Model Predictive Control (MPC) controller for a 3-DOF industrial welding robot using a belt drive mechanism. The goal of the study is to establish a mathematical modeling foundation for motion analysis, energy consumption evaluation, and trajectory control strategy development capable of meeting the system's operational constraints. First, the forward kinematics, inverse kinematics, and Jacobi matrix models of the robot are built based on the Denavit–Hartenberg method. Next, the dynamic model is established using the Euler–Lagrange method to fully describe the relationship between the driving torque and the movement of the joints. Based on the dynamic model, the robot's energy consumption model was constructed using mechanical power and accumulated energy during the trajectory execution. Then, an MPC controller was designed to control the robot to follow the desired trajectory under constraints on position, velocity, and joint torque. Simulation results in the Matlab/Simulink environment showed that the proposed model accurately describes the robot's motion characteristics, while the MPC controller ensures high trajectory tracking accuracy and maintains reasonable energy consumption. Scientifically, the research provides a unified modeling framework between kinematics, dynamics, energy, and predictive control for belt-driven welding robots. Practically, the results obtained provide an important basis for the design, optimization, and development of future industrial welding robot systems.

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ICONS2026-000430 | Abstract 181

Do Large Language Models Exploit Moral Wiggle Room? Benchmarking Strategic Behavior in GenAI using the Dictator Game

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ABSTRACT

Driven by the rapid integration of Artificial Intelligence (AI) in socio-economic environments, understanding how generative models align with human social preferences remains a critical challenge. Because Large Language Models (LLMs) are constantly updated, tracking their behavioral shifting baseline is essential. This paper presents a two-stage experimental design to investigate whether an AI agent—specifically ChatGPT—displays strategic behavior and exploits "plausible deniability" when facing accountability gray areas. First, we establish a behavioral baseline by subjecting the current iteration of the LLM to a standard, pure Dictator Game to measure its intrinsic fairness and altruistic heuristics. Second, we replicate the seminal experimental framework of Andreoni and Bernheim (2009), introducing a modified Dictator Game with varying exogenous probabilities of intervention by an external algorithm (the "nature" condition). This condition conceals whether a selfish outcome stemmed from the AI's choice or a system override. We hypothesize that while the LLM will exhibit a strong adherence to the 50-50 fairness norm in the pure baseline due to safety alignment, its decision-making pattern will shift significantly under uncertainty, strategically exploiting the moral wiggle room to deviate from altruistic outcomes. By comparing these results directly against established human benchmarks, this research contributes to the fields of machine psychology and behavioral AI economics, providing vital insights into how altruism, egoism, and social signaling evolve across AI generations.

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ICONS2026-000431 | Abstract 182

Application of Innovative Technologies in Drying Agricultural Products

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ABSTRACT

The issues of using innovative technologies in the drying process of agricultural products and their improvement are comprehensively studied. In the current conditions of globalization, ensuring food safety, extending the shelf life of products, and delivering them to the consumer while maintaining their quality indicators (organoleptic, physicochemical, and biological properties) are some of the urgent scientific and practical problems. In this regard, improving drying processes, introducing resource and energy-saving technologies, and developing environmentally friendly methods are of great importance. As part of the study, traditional drying methods (natural solar drying, hot air drying, etc.) were analyzed, and their main disadvantages were identified as high energy consumption, long process duration, reduced product quality, and dependence on external environmental factors. Also, innovative technologies of solar-based dryers were considered as modern innovative solutions, and their energy efficiency, environmental friendliness, and economic feasibility were substantiated. The structural features of solar dryers and heat and mass transfer processes were analyzed, and scientifically based ways to increase their efficiency were proposed. In particular, proposals were made to automate the drying process, that is, to introduce intelligent control systems that control temperature, humidity, and air flow, thereby maintaining stable product quality and reducing energy consumption.

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ICONS2026-000436 | Abstract 183

Tropical Cryptography and Post-Quantum Security: Challenges and Perspectives

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ABSTRACT

Tropical cryptography has attracted increasing attention as a potential source of post-quantum cryptographic primitives. Unlike classical schemes based on integer factorization or discrete logarithms, tropical constructions rely on semiring structures, tropical matrix operations, and associated computational problems arising from idempotent algebra. Because these frameworks are not known to reduce to the hidden subgroup problems underlying Shor's algorithm, they have been proposed as alternative candidates for post-quantum security.

In this talk, we examine the opportunities and challenges associated with tropical cryptography from a post-quantum perspective. We review several families of tropical cryptographic constructions and discuss the extent to which the absence of a direct Shor-type attack translates into practical cryptographic security. Special attention will be given to the role of algebraic structure in the design and analysis of tropical protocols, and to the important distinction between the hardness of computational problems and the security of instances generated within real protocols.

Finally, we outline possible research directions for strengthening semiring-based cryptography, including the exploration of richer algebraic frameworks, hybrid architectures, and new approaches to constructing post-quantum primitives. The goal of this talk is to provide a balanced perspective on the current state of tropical cryptography and its potential role within the broader landscape of post-quantum security.

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ICONS2026-000449 | Abstract 184

AI-Enabled Manifold Learning for Sustainable Agricultural Export Forecasting: A Comparison of ARDL, XGBoost and XGBoost-Manifold Models

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ABSTRACT

Agricultural exports are a major contributor to Vietnam's economic growth and sustainable development. However, export systems often exhibit nonlinear dynamics, complex interactions, and latent structures that are difficult to capture using conventional econometric models. This study proposes an AI-enabled manifold learning framework for forecasting Vietnam's agricultural exports using monthly data on three major commodities: pepper, coffee, and cashew.

The export system is represented by a multivariate state vector comprising the export values of the three commodities. First, Isomap is employed to identify the intrinsic low-dimensional manifold underlying the export dynamics while preserving geodesic distances and neighborhood relationships. Next, XGBoost is trained in the manifold space to predict future system states. The proposed XGBoost-Manifold model is compared with two benchmark approaches, namely the Autoregressive Distributed Lag (ARDL) model and conventional XGBoost.

The results indicate the existence of a meaningful low-dimensional manifold structure in the agricultural export system. Moreover, XGBoost-Manifold consistently outperforms ARDL and conventional XGBoost in out-of-sample forecasting, yielding lower forecasting errors and higher predictive accuracy. These findings suggest that manifold learning can effectively uncover latent dynamic patterns, reduce redundant information, and enhance nonlinear forecasting performance. The proposed framework provides a practical AI-driven digital tool for data-driven decision-making and sustainable agricultural trade management.

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ICONS2026-000451 | Abstract 185

Edge-Based Neural Surrogates for Tumor Growth

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ABSTRACT

Mathematical modeling plays a central role in computational oncology, where PDEs capture essential biophysical processes such as nutrient diffusion, cell proliferation, perfusion, heat transfer, and tissue deformation. Although PDE solvers provide accurate descriptions of tumor evolution, they require significant computational resources and long runtimes—making them unsuitable for intraoperative monitoring or bedside diagnostics.

Recent advances in machine learning have enabled neural surrogate models capable of approximating PDE solutions at vastly reduced computational cost. Among these, Fourier Neural Operators (FNOs) offer a powerful resolution independent mapping between function spaces, allowing rapid approximation of tumor growth dynamics and related multiphysics processes.

Tumor growth dynamics are frequently modeled using partial differential equations (PDEs) describing nutrient diffusion, cellular proliferation, perfusion, and spatial heterogeneity. While these PDE-based formulations achieve high-fidelity predictions, their computational cost prohibits real-time clinical use. This work introduces a neural surrogate framework based on Fourier Neural Operators (FNOs) to efficiently learn PDE solution operators and approximate tumor dynamics. After model compression and hardware aware optimization, we demonstrate the feasibility of deploying these learned surrogates on embedded platforms—including ARM Cortex M microcontrollers and FPGA accelerators. The resulting systems support portable, low power devices capable of real time tumor growth prediction at the patient's bedside. We discuss challenges related to boundary condition variability, quantization robustness, and clinical validation, and highlight the transformative potential of embedded PDE–ANN architectures in diagnostic imaging and personalized oncology.

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ICONS2026-000460 | Abstract 186

The Illusion of Understanding: Trust, Visual Literacy, and AI-Generated Data Visualizations

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ABSTRACT

Generative artificial intelligence (AI) is increasingly used to create data visualizations that support communication, analysis, and decision-making across educational, organizational, and public contexts. Although these systems enhance efficiency and visual quality, they may also introduce persuasive design elements that influence interpretation without altering data. As AI-generated visualizations become more prevalent, understanding how individuals evaluate their credibility has become a challenge for trustworthy AI. This study investigates the relationship between trust, visual literacy, and AI-generated data visualizations. Drawing upon trustworthy AI, AI literacy, and visual literacy, the research examines how aesthetic enhancement and algorithmic design choices shape perceptions of credibility, transparency, and reliability. A comparative visualization framework will be employed in which identical datasets are represented through neutral and persuasive AI-generated visualizations. The study explores whether users can recognize manipulation when visual appeal and perceived credibility diverge. Data will be collected from three stakeholder groups: university students, academic staff with expertise in design and communication, and university administrators engaged in data-informed decision-making. Participants will evaluate the visualizations using rating scales and open-ended responses focusing on trustworthiness, transparency, persuasiveness, and perceived manipulation. The study contributes to discussions on trustworthy AI by identifying factors that influence trust in AI-generated visualizations and highlighting visual literacy as a critical competency for AI use. The findings are expected to inform AI literacy education, organizational decision-making, and transparent, accountable AI-supported communication practices.

Keywords: Trustworthy AI; AI Literacy; Visual Literacy; Data Visualization; Human–AI Trust; Generative Artificial Intelligence

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ICONS2026-000461 | Abstract 187

Sensory-Informed Digital Mediation for Extreme Habitats: Translating Desert Analogue Fieldwork into Adaptive Design Requirements

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ABSTRACT

This paper presents preliminary findings from ArchiSpace, a Horizon Europe MSCA Staff Exchanges project (HORIZON-MSCA-2023-SE-01, Grant Agreement No. 101183089) investigating space architecture design and prototyping in planetary analogue environments. Framed within the DiGiCES2026 focus on digital tools for efficient, sustainable, and resilient construction, the paper explores how qualitative sensory fieldwork can inform human-centred digital design strategies for future extreme habitats.

The study reports an exploratory sensory case study conducted in Erfoud and Merzouga, Morocco. Through participant fieldnotes, situated observation, audiovisual field documentation, and reflective discussion, researchers examined how individuals with strong coastal sensory-cultural references experienced an arid/desert-edge analogue environment.

Preliminary findings suggest that adaptation was not supported by environmental comfort alone, but by multisensory mechanisms including partial familiarity, symbolic safety anchors, signs of life, controlled surprise, embodied orientation, and abstract sensory resonance. Roads, vegetation, animal traces, wind, silence, horizon lines, and land-art structures operated as perceptual mediators, helping participants negotiate unfamiliarity, exposure, and sense of belonging.

The paper proposes that such qualitative sensory evidence can be translated into digital design requirements for adaptive habitat environments. Rather than relying on literal simulations of familiar places, AR, media systems, digital twins, and responsive spatial interfaces may support psychological adaptation by introducing abstract, configurable, and personally resonant cues. These findings contribute to emerging discussions on digital construction workflows that integrate not only operational performance, but also sensory, emotional, and experiential habitability.

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ICONS2026-000463 | Abstract 188

Digital Twins and mHealth- Design Guidelines for Upper Limb Rehabilitation

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ABSTRACT

Upper limb rehabilitation requires transitioning toward patient-centered, high-fidelity digital ecosystems (Duan et al., 2023). However, the lack of frameworks translating clinical requirements into software specifications often results in low adoption or low scientific rigor. This work consolidates the design guidelines governing future digital health technologies in this domain.

This work presents a computational requirements framework derived from assistive technology data to define the convergence between Digital Twins and mHealth applications. Under this framework, the digital twin operates as a dynamic representation governed by: 1) a multiscale, 2-DOF kinematic model (shoulder/elbow) (Chapman, 2008; Winter, 2009) respecting mechanical homeostasis and physiological ranges of motion; 2) real-time predictive simulation algorithms fed by IMU sensors to anticipate risks like hyperextension; and 3) a strict Verification, Validation, and Uncertainty Quantification infrastructure (Karoulla et al., 2024). Concurrently, the mHealth application follows an MVC pattern, prioritizing low-cost Android portability and structured storage for remote traceability.

Formal analysis demonstrates that integrating the digital twin and mHealth platform enables translating raw biomechanical data into quantitative clinical indicators correlated with Fugl-Meyer and ARAT scales. Furthermore, the conceptual model details how immediate, gamified biofeedback mechanisms can safely stimulate neuroplasticity, mitigating fatigue and preventing compensatory motor patterns at home (Gassert & Dietz, 2018; Riaño et al., 2020).

The proposed framework establishes a rigorous, sustainable, and reproducible roadmap for rehabilitation technologies. By ensuring data objectivity to reduce therapeutic subjectivity, this work lays the foundation for trustworthy decision-support platforms at the point of care.

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ICONS2026-000465 | Abstract 189

Impact of Message Framing on Purchase Intention of Environmentally Friendly Bags in India

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ABSTRACT

Environmentally friendly behavior may have a significant positive impact on the environment and our communities by connecting collection and processing. Governments and businesses work hard to create persuasive communication plans that motivate individuals by employing things that facilitated it. A quasi-experiment with 3 (environment related message: control, positive, negative) x 3 (personal message: control, positive, negative) between group design was undertaken in the study, resulting in nine cells carrying nine message types, this study provides some pertinent findings thereby, adding to extant research in the area .Message framing is more effective in inducing higher purchase intention towards environmentally friendly bags when positive consequences of purchasing such bags is included in the message. While no significant difference in purchase intention was found between positive and negative framing, the study finds that a positively framed message is more effective than a message which uses no message framing strategy. To the best of our knowledge, we are the first to look at the framing impact in relation to conveying messages about environmentally friendly bags. Our findings, in conclusion, offer strong theoretical backing and recommendations for marketers and policymakers.

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ICONS2026-000468 | Abstract 190

Sustainable Financial Analytics for Banking Stock Forecasting: Evidence from TPB Stock in Vietnam.

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ABSTRACT

Abstract

This study develops a sustainable financial analytics framework for forecasting banking stock prices in Vietnam, focusing on TPB stock of Tien Phong Commercial Joint Stock Bank. The research integrates Long Short-Term Memory (LSTM) neural networks with moving-average technical indicators, including Simple Moving Average (SMA), Exponential Moving Average (EMA), and Weighted Moving Average (WMA), over 5-, 10-, and 20-day horizons. Daily closing price data from August 17, 2017, to July 30, 2025, are processed through data cleaning, normalization, and training-testing partitioning.

The models are trained using 100 and 150 epochs and evaluated through Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE), and the coefficient of determination (R^2). Empirical results show that the LSTM-SMA20 model with 100 epochs achieves the best performance, yielding MSE = 103,685.27, RMSE = 322, MAPE = 1.67%, and R^2 = 88.23%. Its superior forecasting capability is attributed to effective noise reduction and long-term trend extraction.

Forecasts for the next three months indicate a positive outlook for TPB stock, with expected prices ranging from 14,500 to 18,500 VND per share. The study contributes to the literature on sustainable financial analytics by demonstrating the effectiveness of hybrid deep-learning models in banking stock forecasting. The findings provide practical implications for investors, financial institutions, and policymakers in improving risk management, supporting informed investment decisions, and promoting financial stability in Vietnam's banking sector.

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ICONS2026-000471 | Abstract 191

Driving Sustainable Competitive Growth Through Digital Transformation: A Strategic Formulation Approach in the Sports Construction Industry

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ABSTRACT

The problems faced by CV Cempaka Wangi Sport include increas-ingly fierce competition in the sports field construction services business, suboptimal utilization of digital technology, and fluctuations in the number of projects that affect the company's development. This study aims to formulate an appropriate business strategy to improve the company's competitiveness and business sustainability. The methods used include the Internal Factor Evaluation (IFE), External Factor Evaluation (EFE), Internal-External (IE), Strengths, Weaknesses, Opportunities, Threats (SWOT) Matrix, and Quantitative Strategic Planning Matrix (QSPM). The results showed an IFE Matrix score of 2.055 and an EFE Matrix score of 2.803. Based on the IE Matrix, the company is in Quadrant V with the hold and maintain category. The SWOT analysis produced 20 alternative strategies which were then narrowed down to 5 main strategies according to the company's position in the IE Matrix. Furthermore, the QSPM analysis showed that the most appropriate priority strategy is optimize digital marketing through social media and websites to expand market reach and increase brand awareness. This strategy is expected to help companies face the dynamics of the business environment and support sustainable business growth.

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ICONS2026-000472 | Abstract 192

Corneal Characteristics and Visual Function in Eyes with Refractive Anomalies: A Comparative Study with Emmetropic Controls

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ABSTRACT

Background: Corneal biomechanical assessment represents an important component of modern ophthalmic evaluation, particularly in patients with refractive anomalies. Varia-tions in central corneal thickness and corneal curvature may influence refractive status, visual performance, and eligibility for refractive surgical procedures. This study aimed to evaluate differences in corneal structural parameters between emmetropic eyes and eyes with refractive anomalies by analyzing central corneal thickness, corneal curvature, and visual acuity.

Methods: This retrospective observational study included 330 participants examined at the University Clinical Center of Kosovo. Participants were classified into hypermetropic, myopic, astigmatic, and emmetropic groups. Comprehensive ophthalmological exami-nation included visual acuity assessment, automated keratometry, and ultrasound pachymetry. Statistical analysis was performed using SPSS software, with correlations assessed using Spearman analysis.

Results: Significant differences in central corneal thickness were identified between re-fractive groups and emmetropic controls ($P < 0.001$). Hypermetropic participants demonstrated higher mean corneal thickness values, whereas myopic eyes showed thinner corneas. Age-related reduction in corneal thickness was observed predominantly among emmetropic individuals. Weak correlations between corneal thickness and corneal curvature were identified in astigmatic and emmetropic eyes, while no significant associations were found in hypermetropic and myopic groups.

Conclusions: The findings suggest that refractive status may influence corneal biome-chanical characteristics and that combined assessment of corneal thickness, curvature, and visual acuity may improve screening strategies in refractive ophthalmology. Detailed corneal evaluation may contribute to safer refractive surgery planning and earlier identification of biomechanically vulnerable corneas.

Keywords: central corneal thickness; refractive anomalies; corneal biomechanics; visual acuity; corneal curvature

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ICONS2026-000476 | Abstract 193

AI-Driven Sustainability and Purchase Intention in the Food and Beverage Industry: A Systematic Literature Review of Transparency and Greenwashing Skepticism.

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ABSTRACT

The food and beverage (F&B) industry is increasingly deploying artificial intelligence at the operational level through machine learning-based food waste management, intelligent inventory optimization, and algorithmic carbon tracking yet consumer responses to these AI-driven sustainability initiatives remain theoretically unexplored. Existing literature on sustainability perception and brand outcomes is built around conventional green marketing signals and does not account for the qualitatively distinct nature of AI-operated sustainability as a credibility signal. This paper addresses three identified gaps in brand credibility models, in integrated sequential mediation design, and in the sustainability-to-credibility relationship by proposing a moderated sequential mediation conceptual framework. A systematic review of 36 Scopus-indexed studies published between 2018 and 2026, drawn from six thematic clusters, forms the evidential base. The framework proposes that customer perception of AI-driven sustainability initiatives builds perceived brand credibility which sequentially develops customer trust, culminating in purchase intention. Perceived transparency is proposed as a positive moderator and greenwashing risk as a negative moderator, both acting on the AI sustainability perception-to-credibility path. The framework advances seven theoretical propositions and represents the first integrated conceptual model combining these five constructs in the F&B context. Theoretically, the framework resolves conflicting findings in the green trust literature by specifying when the sustainability-to-credibility relationship holds and when it collapses. It guides F&B brand managers on communicating AI sustainability initiatives to maximize credibility and trust outcomes. Future empirical validation using PLS-SEM with F&B consumers is recommended.

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ICONS2026-000482 | Abstract 194

Methodology of the Concept for Restructuring the Organizational and Production Structure into a Cyber-Physical Production System

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ABSTRACT

The Methodology of the Concept for Restructuring the Organizational and Production Structure into a Cyber-Physical Production System is determined by the following elements:

- the relevance of the research topic;
- the object of the research;
- the subject of the analysis;
- the research objective;
- the research tasks;
- the research hypothesis;
- a unified conceptual framework.

For the purposes of the research, the definitions of the following concepts have been refined and further developed: system, production system, cyber-physical production system, organizational and production structure, restructuring of the organizational and production structure, restructuring of the organizational and production structure into a cyber-physical production system, optimization of the organizational and production structure during its restructuring into a cyber-physical production system, the distinction between the concepts of restructuring and change has been clearly established.

The Methodology of the Concept provides the logical, research, and practical framework for studying, modeling, and validating the process of restructuring the organizational and production structure into a cyber-physical production system. It ensures a systematic interrelationship between the research problem, the object, the subject, the objective, the research tasks, the hypothesis, and the conceptual framework of the study. This enables the restructuring process to be considered not as an isolated organizational change but as a comprehensive, strategically managed, and scientifically grounded transition toward a smart, autonomous, and cyber-physically integrated production system.

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ICONS2026-000484 | Abstract 195

A Hydraulic–Economic Digital Twin for Tariff Simulation in Regulated Gas Distribution Operators: A Multiphysics, Data-Informed Framework with Real-World Validation

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ABSTRACT

In my professional interactions with regulated gas distribution operators (GDOs) in Bulgaria, I have noted a disconnect between the hydraulic transport system and the revenue-cap tariff system in operational practices. While these systems are linked through factors like technological-loss allowances and asset-utilization terms, smaller to medium-sized operators often rely on deterministic spreadsheets that lack the ability to account for forecast uncertainty and its impact on allowed revenue. Over the course of four regulatory cycles in Bulgaria, there have been average absolute percentage errors of about 40% in predicting commercial demand, leading to issues such as tariff under-recovery and financial stability challenges for operators. To address this issue, I suggest the implementation of a hydraulic-economic digital twin (DT) that integrates a quasi-steady Weymouth solver with an economic model adjusted to fit the EWRC accounting framework. This DT has been developed and tested at GDO over the past 18 months. By applying this digital twin to a network, the mean absolute percentage error in annual demand forecasting was reduced from the regulatory baseline of 39.8% to 9.3%. Additionally, the 95% confidence interval for revenue projections narrowed by a factor of 3.6, and the accuracy of tariff adjustments improved from 50% to 78%. Stress testing scenarios demonstrated potential revenue shifts of approximately -10% during a mild recession and +22% following a gas price surge, both of which were deemed plausible by the operator's management. This methodology is scalable to the similarly structured operators.

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ICONS2026-000486 | Abstract 196

A Digital Maturity Framework for Regulated SME Gas Distribution Operators: Sector-Wide Assessment and Capability Gap Analysis from Bulgaria

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ABSTRACT

Based on my research into tariff proposals for Bulgarian gas distribution operators (GDOs), I have come to a simple observation: the operators most exposed by the tightening EWRC (KEWR in Bulgaria) reporting cadence are not those with the fewest tools, but those whose management team has no shared way of describing its current capability state. Without that vocabulary, digital tools get commissioned on intuition, board oversight reduces to status updates, and the regulator cannot independently verify what has actually been built. This paper presents a Five-Dimension by Five-Level Digital Maturity Framework that I built for the regulated SME utility context. The five dimensions are Data & Measurement, Technology & Platforms, Processes & Workflows, People & Capabilities, and Governance & Compliance. The five levels run from Initial (L1) to Optimised (L5) along indicators scored from documentation review and a single structured interview. I put the framework to the 4P-IRM risk-management categorisation from earlier work, then applied it to currently active Bulgarian GDOs. Seventy-nine percent score below L3, with the largest sector-wide gaps in People & Capabilities and Processes & Workflows, not in Technology, despite the prevailing vendor narrative. The observing case operator scores L3 on average, with a three-intervention roadmap to L4 that the management team committed to during the validation workshop. The framework produces a defensible self-assessment artifact for the EWRC regulatory file and an evidence base for sector-level policy coordination. Keywords: Digital maturity model, Organisational readiness, Regulated SME, Gas distribution, Capability assessment,

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ICONS2026-000488 | Abstract 197

A Systems Engineering Framework Supporting Roadmap Development toward Lights-Out Manufacturing

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ABSTRACT

The transition toward Lights-Out Manufacturing (LOM) has emerged as a strategic objective for manufacturing enterprises, driven by rapid advances in artificial intelligence (AI), the Industrial Internet of Things (IIoT), cyber-physical systems, and autonomous production technologies. Although existing research offers numerous technological solutions, digital transformation models, and readiness assessment approaches, limited attention has been devoted to integrated systems engineering approaches that support the systematic development of enterprise roadmaps for this transition.

This paper proposes a Systems Engineering Framework supporting roadmap development toward Lights-Out Manufacturing. The framework conceptualizes the manufacturing enterprise as an integrated socio-technical system and structures the transformation process through six interconnected enterprise transformation domains: organizational, production, technological, informational, human, and decision. It provides a structured approach for analysing the current enterprise state, identifying transformation gaps, supporting strategic decision-making, developing transition roadmaps, and monitoring implementation throughout the transformation lifecycle.

Unlike technology-oriented approaches that primarily address individual aspects of digital transformation, the proposed framework adopts an integrated enterprise-wide systems engineering perspective that enables coordinated transformation planning across all enterprise transformation domains. The framework establishes a conceptual foundation for the future development of quantitative readiness assessment models, decision-support methodologies, and empirical validation of enterprise transformation toward Lights-Out Manufacturing.

Keywords: Lights-Out Manufacturing; Systems Engineering; Enterprise Transformation; Enterprise Transformation Domains; Transformation Roadmap; Industry 5.0; Socio-Technical Systems.

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ICONS2026-000489 | Abstract 198

Enhancing business management in healthcare through digital: the mediating role of medical education

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ABSTRACT

This study examines the role of digital transformation in enhancing the efficiency of business management within the healthcare system. A conceptual and empirical framework is proposed to explain the relationship between digital transformation and healthcare development. Simultaneously, the mediating role of medical education is investigated in the interaction between business management and digitalization in the healthcare sector. The proposed model demonstrates that digital transformation exerts a direct influence on the effectiveness of business management in healthcare. In this context, medical education functions as an integrative mechanism facilitating the development of both digital and managerial competencies. The purpose of the study is to provide an analytical assessment of how digital transformation, mediated through medical education, affects business management in healthcare. Methodologically, the research applies a mixed-method approach combining statistical data analysis and structural equation modeling (SEM) to evaluate interdependent effects using the case of the Eurasian Economic Union. The findings indicate that investments in digital transformation alone are insufficient without corresponding reforms in medical education. Strengthening the alignment between learning outcomes and the practical demands of healthcare management significantly improves the overall efficiency of business management in the healthcare system. The study contributes to the academic literature by bridging the gap between digital transformation, education, and business management, particularly within the healthcare sector. The results provide implications for improving business management practices and ensuring the sustainable functioning of healthcare systems.

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ICONS2026-000500 | Abstract 199

Method for Restructuring the Organizational and Production Structure in a Cyber-Physical Production System

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ABSTRACT

The method of the Concept for Restructuring the Organizational and Production Structure into a Cyber-Physical Production System is an original authorial contribution. It represents a synthesis of systematically integrated sequential actions that constitute a specific algorithm applicable and relevant to the research problem under investigation.

The resource capabilities of the organizational and production architecture, considered as a research stage within the method of the Concept for Restructuring the Organizational and Production Structure into a Cyber-Physical Production System, are determined on the basis of the Synergy Assessment Model for the Production Organization, which establishes a relationship between the potential for implementing restructuring and the opportunity to achieve a synergistic effect within a specified period of time.

The criteria defining the optimality of restructuring the organizational and production structure into a cyber-physical production system are reduced to effectiveness, efficiency, and profitability. Collectively, these three criteria provide a reliable basis for achieving a balanced and optimal relationship between generated revenues and incurred costs, thereby constituting the foundation of the value added created through the restructuring process.

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ICONS2026-000501 | Abstract 200

Model for Assessing Synergy in the Manufacturing Business Organization

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ABSTRACT

The proposed Model for Assessing Synergy in the Manufacturing Business Organization constitutes a key component of the Concept for Restructuring the Organizational and Production Structure into a Cyber-Physical Production System. The model is based on the premise that the availability and effective utilization of organizational resources determine the long-term potential for achieving synergy and provide the foundation for informed restructuring decisions. It integrates resource availability, production processes, organizational relationships, financial performance, investment requirements, and strategic development into a unified analytical framework.

The model comprises eight sequential stages, including the assessment of existing resources and results, forecasting long-term competitiveness without restructuring, estimating restructuring investments and their payback period, evaluating future organizational performance, calculating an efficiency coefficient, measuring the expected improvement resulting from restructuring, and determining the existence of long-term synergy. A modified 3R model—Resources, Relationships and Processes, and Results—is embedded within the assessment framework to analyze the interactions between organizational inputs, operational efficiency, and achieved outcomes.

The proposed methodology enables production organizations to evaluate whether restructuring into a cyber-physical production system is economically justified and strategically beneficial. The resulting synergy assessment supports managerial decision-making by identifying opportunities for sustainable competitiveness, improved resource utilization, enhanced organizational performance, and long-term value creation under the conditions of digital transformation and Industry 4.0.

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ICONS2026-000502 | Abstract 201

Organizational Readiness for AI Transformation in Small and Medium-Sized Enterprises: Strategic Perspectives

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ABSTRACT

Organizational readiness has emerged as a critical prerequisite for successful AI transformation in Small and Medium-Sized Enterprises (SMEs). However, many SMEs continue to face significant challenges because organizational, managerial, and cultural capabilities often fail to evolve at the same pace as technological advancements. Although existing research has extensively explored AI adoption and digital transformation, organizational readiness for AI transformation remains insufficiently conceptualized as an integrated strategic managerial capability.

This study addresses this research gap by proposing a strategic perspective that positions organizational readiness as the primary enabler of successful AI transformation in SMEs. Building upon this perspective, the paper develops a Strategic Framework integrating strategic planning, leadership commitment, organizational capabilities, change management, AI transformation, performance evaluation, and continuous improvement into a coherent managerial approach. The framework is developed through a critical review and synthesis of contemporary research on AI transformation and organizational change management.

The proposed framework contributes to the current body of knowledge by offering a structured managerial approach to strengthening organizational readiness for sustainable AI transformation. It also provides a conceptual foundation for future research on strategic and algorithmic approaches to AI transformation in SMEs.

Keywords: Artificial Intelligence (AI), Organizational Readiness, AI Transformation, Strategic Management, Small and Medium-Sized Enterprises (SMEs)

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ICONS2026-000504 | Abstract 202

An Attribute-Based Random Forest Framework for Assessing and Forecasting Fertilizer Product Obsolescence

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ABSTRACT

The study proposes a simulation-based Random Forest framework for assessing and forecasting fertilizer product obsolescence through a model based on unified product attributes and synthetic data.

The study examines the obsolescence of fertilizer products not only as a physicochemical process, but also as a multidimensional phenomenon shaped by environmental profile, safety, regulatory compliance, economic efficiency, market relevance, and technological adaptability. Each product attribute is represented through quantitative indicators, which are normalized on a common scale from 0 to 100 and used to form an integrated assessment of the degree of obsolescence.

To demonstrate the proposed approach, a synthetic dataset was generated based on expert assumptions, predefined value ranges, and rule-based logic. A Random Forest Classifier is applied to classify fertilizer products into four obsolescence classes: low, medium, high, and critical. In addition, accuracy, precision, recall, F1-score, a confusion matrix, and feature importance analysis are used to evaluate the internal logic and classification behavior of the model.

The main contribution of the paper is the development of an applicable attribute-based framework for assessment, forecasting, comparison of product groups, and support of strategic decision-making, without claiming definitive empirical validity.

Key words: fertilizer product obsolescence; Random Forest; synthetic data; product attribute; attribute-based framework; feature importance; sustainability; obsolescence classification; decision support.

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ICONS2026-000506 | Abstract 203

The Effects of Extrinsic and Intrinsic Motivation on Employee Performance in Indonesia's Footwear Industry Companies

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ABSTRACT

The footwear industry is a strategic sector in Indonesia. However, this industry has experienced a decline in export volume. Therefore, footwear industry companies must improve efficiency and productivity. This study aims to analyze the influence of extrinsic and intrinsic motivation on employee performance in footwear industry companies in Indonesia. This study used a quantitative approach with a survey method of 200 employees of footwear industry companies in East Java Province. Respondents were selected using a purposive sampling technique. Data were analyzed using PLS-based SEM. The model met the criteria for validity and reliability, while the structural model had adequate predictive ability. The results of the study show that extrinsic motivation has a positive and significant effect on employee performance ($\beta = 0.321$, $p < 0.05$). However, intrinsic motivation was shown to have a stronger influence ($\beta = 0.381$, $p < 0.05$), so organizations need to develop strategies that not only focus on providing external incentives, but also are able to foster motivation from within employees. Previous research has discussed the influence of motivation in a single variable, but this study evaluates the comparison of the strength of the influence of extrinsic and intrinsic motivation specifically on employee performance. This research contributes to the HRM literature in the Indonesian footwear industry. These findings show that intrinsic motivation has a stronger influence as a psychological mechanism to improve employee performance than extrinsic motivation. Practically, companies must pay attention to the development of intrinsic motivation factors to support improving employee performance.

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ICONS2026-000508 | Abstract 204

Sustaining Organizational Knowledge by Reducing Turnover Intention Through Knowledge Sharing and Perceived Organizational Support in SaaS Companies

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ABSTRACT

The transformation of the software-as-a-service (SaaS) industry has been accelerated by artificial intelligence, cloud computing, and digital collaboration platforms, increasing corporate reliance on digital talent. Corporate sustainability increasingly depends on an organization's ability to retain the strategic knowledge held by its employees. As Southeast Asia's largest digital economy, Indonesia continues to see growing SaaS adoption, making the retention of strategic knowledge a critical issue for SaaS companies. The relationships between knowledge sharing, perceived organizational support, and turnover intention have been widely studied, empirical evidence explaining the mechanisms linking these three variables within SaaS companies remains limited. This study aims to analyze the impact of knowledge sharing and perceived organizational support on the turnover intention of 325 employees in SaaS industry using SEM. The results indicate a negative and significant relationship between knowledge sharing and turnover intention (β=-0.414; $p< 0.001$); perceived organizational support has a negative and significant on turnover intention (β= -0.525; $p<0.001$), while the relationship between Perceived Organizational Support and Knowledge Sharing is positive. These findings indicate that perceived organizational support enhances knowledge sharing and together with knowledge sharing practices, reduces turnover intention. This research contributes to the literature by advancing understanding of knowledge sharing as a knowledge-based retention mechanism and explaining how perceived organizational support reduces turnover intention, thereby supporting organizational knowledge sustainability. The findings provide a foundation for SaaS companies to design startegies that maintain critical knowledge continuity by strengthening knowledge sharing and organizational support.

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ICONS2026-000509 | Abstract 205

Care, Power, and Accountability as a Feminism-inspired Trustworthy AI Framework for Public-Sector Decision Systems

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ABSTRACT

Artificial intelligence is used as decision systems' mechanism for the public sector, including welfare, healthcare, education, migration, housing, employment services, and citizen support. Although Trustworthy AI frameworks provide important principles such as fairness, transparency, robustness, privacy, accountability, and human oversight, they often remain too abstract or compliance-oriented to address the social realities in which public-sector AI operates. AI systems should be evaluated not only by technical performance or legal compliance but also by their effects on dignity, vulnerability, power dynamic relations, and the lived experiences of affected communities. Drawing on feminist philosophy of technology, ethics of care, situated knowledge, and intersectionality, the paper proposes the CA.P.A. Framework: Care, Power, Accountability. Care examines whether AI preserves human support, dignity, and responsiveness. Power asks who designs, controls, benefits from, and is burdened by AI systems. Accountability requires accessible explanations, appeals, audits, corrections, and redress. The framework offers both a critical and practical contribution, enriching Trustworthy AI by making it more attentive to inequality, institutional responsibility, and democratic public governance.

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ICONS2026-000513 | Abstract 206

The AI Act Needs a Philosophical Critique through the Prism of Artificial Intelligence as a Drastic and Dynamic Socio-technical Entity

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ABSTRACT

The European Union's AI Act is important but incomplete. Its difficulties are technical, legal, and administrative, but they are also philosophical. The AI Act combines product-safety logic, market harmonisation, language related to fundamental rights, and risk management. It establishes useful obligations but also introduces unstable classifications, reliance on standards and self-assessment, limited assessment of fundamental rights impacts, fragile human oversight, uncertain policies for general-purpose AI, partial transparency, increased innovation burdens, and environmental blind spots. The philosophical problem is that the AI Act mainly treats AI as a system to be classified, documented, certified, and monitored, while AI is becoming an infrastructure of perception, knowledge, labour, communication, culture, and public power. Europe does not need less AI regulation, but deeper regulation, and specifically a framework that governs not only risk, but also meaning, non-use, human agency, and the kind of progress AI should serve.

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ICONS2026-000517 | Abstract 207

The Effect of Digital Marketing Strategy, Investment in Digital, and Customer Engagement on MSME Performance through Digital Transformation, and the Direct Effect of Digital Marketing Capability on Food-Sector MSMEs in West Java Author 1

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) in the food sector play a strategic role in supporting regional economic growth, particularly in West Java Province. This study analyzes the effect of Digital Marketing Strategy, Investment in Digital, and Customer Engagement on Digital Transformation, the effect of Digital Marketing Capability and Digital Transformation on MSME Performance, and the mediating role of Digital Transformation in these relationships among food-sector MSMEs in West Java. A quantitative causal approach was used, with data collected via questionnaires and analyzed using Structural Equation Modeling based on Partial Least Squares (SEM-PLS) with SmartPLS software. Results show that Digital Marketing Strategy, Investment in Digital, and Customer Engagement have a positive and significant effect on Digital Transformation, while Digital Marketing Capability and Digital Transformation have a positive and significant effect on MSME Performance. Digital Transformation mediates the effect of Investment in Digital and Customer Engagement on MSME Performance, but does not mediate the effect of Digital Marketing Strategy. These findings highlight digital transformation's important role in improving MSME performance and offer practical implications for MSME actors and policymakers in formulating effective digitalization strategies.

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ICONS2026-000519 | Abstract 208

Construction XR Intelligent Management System for Multi-Operator and Multi-Robot Complex Collaborative Tasks

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ABSTRACT

This paper based on the concept of digital twin and extended reality technology, investigates the design and key technologies of a construction XR intelligent management system for multi-operator and multi-robot complex collaborative tasks. First, the overall system architecture is designed for the collaborative modes of two types of construction operators and two types of construction robots. It establishes a multi-layered collaborative structure and digital twin theoretical model consisting of a Physical Subsystem, VR Subsystem, and AR Subsystem, and elaborates on the functional modules of each subsystem and their collaborative mechanisms. Secondly, the research focuses on key challenges such as the construction of holographic models, object virtual-physical mapping and multimodal interaction, virtual scene reconstruction, task allocation, and path planning, and proposes corresponding technical implementation paths. Finally, empirical tests were conducted with a scaled model of a truss structure, with multiple task nodes set up to evaluate the system's feasibility and effectiveness.

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ICONS2026-000521 | Abstract 209

Smartphone-Based Photogrammetry for Prosthetic Design and Topology Optimization

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ABSTRACT

Additive manufacturing combined with generative design allows the creation of new personalized medical devices, yet accurate patient anatomy capture at the initial step usually requires highly specialised 3D scanning equipment which is often unavailable in resource constrained environments. This paper proposes a low-cost, end-to-end methodology for producing an acurrate 3D model of a human lower arm using standard smartphone photogrammetry adapted for prosthetic design and subsequent topology optimization (TO).

The presented workflow captures a series of overlapping photos of the lower arm with a consumer-grade mobile device, which are processed to reconstruct a 3D mesh of the limb geometry. Then this digital model is directly imported into a computer-aided engineering (CAE) environment as the physical boundary for designing a custom prosthetic arm. Finite element analysis (FEA) simulations of physiological loads are applied to drive a TO algorithm which removes material to reduce weight while maintaining structural stiffness and user comfort.

Results indicate that smartphone photogrammetry is a robust, accessible method for decentralized, patient-specific prosthetic manufacturing, allowing dimensional accuracy for complex generative design pipelines.

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ICONS2026-000522 | Abstract 210

From Demolition Site to Mobile Screen: A Prototype AI Tool for Rapid Visual Screening of Reclaimed Concrete and Steel Elements

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ABSTRACT

Selective demolition can enable direct reuse of structural elements, yet decisions on which elements to recover are often made under time pressure and rely primarily on manual inspection and engineering judgement.

We developed and evaluated a prototype AI-assisted tool for rapid visual screening of reclaimed precast concrete and structural steel using photographs captured with mobile devices. The reuse assessment was formulated as a binary classification task (Reusable / Non-reusable) based on visible surface condition. ResNet-50 and MobileNetV2 were fine-tuned on an annotated image dataset and compared in terms of classification accuracy, inference speed, and model size. ResNet-50 delivered the highest predictive performance, whereas MobileNetV2 provided a better balance between accuracy, computational efficiency, and suitability for deployment on mobile devices. Both models were incorporated into a lightweight prototype interface that returns a predicted class, a confidence score, and a visual explanation to support early-stage decision-making during selective demolition.

Although detailed engineering assessment remains essential before structural elements are approved for reuse, the proposed approach could help practitioners identify promising candidates more efficiently, contributing to more effective material recovery in circular construction.

Acknowledgements

Part of this research was supported by the ADAPT4CE project, "Adaptive digital systems for sustainable construction and material management in the circular economy" (No. 101182768), under the Marie Skłodowska-Curie Actions (MSCA) Staff Exchange (SE) scheme of Horizon Europe. Their support is gratefully acknowledged.

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ICONS2026-000525 | Abstract 211

Context Aware of a Production Line in a Manufacturing System

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ABSTRACT

Manufacturing systems have always played a crucial role in industry, but the manufacturing landscape is rapidly changing due to various factors, including market forces and technological advancements. The current industrial revolution, known as Industry 4.0, aims to transform production systems into cyber-physical production systems (CPPS), enabling intelligent, real-time decision-making. Modeling and managing CPPS is a challenging task due to the complex interactions between entities within the system. Identifying real-time situations requires a range of modeling methodologies and implementation techniques to transform massive amounts of data into knowledge and to reason with it. This area of study is known as context-awareness. It is only recently that the integration of context-aware systems in industrial applications has experienced an increase. However, these applications have enormous potential, as they are adaptable to changing environmental conditions, allowing them to make informed decisions that can improve the effectiveness and efficiency of the production process

In this paper, a case study is presented in which operational context from a manufacturing plant's production line is incorporated. The objective of this research is to analyze the advantages of this approach since the production line generates a massive amount of data and the occurrence of random events needs to be considered immediately to cut costs and improve efficiency. It is therefore much more convenient to transform this data into structured knowledge, enabling reasoning and decision-making with real-time updated contextual information.

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ICONS2026-000526 | Abstract 212

CRLL-X: A Controlled Executable Language for Multi-Robot Logistics Missions

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ABSTRACT

This article presents CRLL-X, a controlled domain-specific language designed to describe, formalize, and execute logistics missions in multi-robot environments. The proposal addresses the gap between human mission instructions, which are often ambiguous and context-dependent, and the formal representations required by robotic planning, coordination, and execution systems. CRLL-X introduces a structured linguistic layer that transforms controlled mission statements into an abstract syntax tree, applies semantic validation, and desugars high-level expressions into a reduced executable core. This core includes primitives for sequential execution, conditional behavior, waiting conditions, resource reservation, parallel coordination, policy specification, and robot actions.

The article develops the conceptual and technical foundations of CRLL-X as an intermediate representation between natural language and robotic backends such as simulators, planners, behavior trees, and ROS 2-based execution architectures. A reference implementation in Python is proposed, using grammar-based parsing, explicit domain modeling, semantic checks, and traceable execution. The language is evaluated through a structured corpus of valid and invalid mission cases, controlled natural language expressions, and grid-based planning scenarios. The results are expected to show that CRLL-X can improve mission clarity, reduce ambiguity, support verification, and provide a reproducible path from human intent to executable multi-robot behavior.

CRLL-X is positioned as a contribution to explainable, auditable, and human-centered robot programming, especially for logistics scenarios involving shared resources, temporal constraints, cooperative tasks, and safety-critical coordination.

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ICONS2026-000528 | Abstract 213

Who is the Traitor? A Byzantine Generals Governance Mechanism for Overcoming ESG Transition Barriers in Family Agribusinesses

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ABSTRACT

This study addresses ESG transition barriers and decision-making gridlocks caused by internal kinship factions and greenwashing data fraud in family agribusinesses by applying the Byzantine Generals Problem (BGP) model. We transform this socio-emotional conflict into a decentralized, fault-tolerant verification network where deceptive family members or untrusted sub-contractors are formalized as malicious nodes (f). The proposed governance mechanism optimizes ESG data reliability through three precise algorithmic steps. First, high-dimensional family profiles—comprising generational gap indices and equity structures—undergo non-linear dimensionality reduction via t-Distributed Stochastic Neighbor Embedding (t-SNE). Second, K-means clustering partitions the lower-dimensional manifold into localized kinship factions, where a scale-invariant geometric contraction-expansion model dynamically assigns algorithmic voting weights based on bloodline hierarchy. Finally, a modified Byzantine consensus protocol utilizes these weights to execute a 3f+1 node-validation threshold on environmental and financial ledgers. This mathematical restriction ensures that even if up to one-third of family factions falsify carbon accounting or profit data, the system successfully filters the noise and reaches absolute consensus without a central authority. Experimental results using synthetic family tree graphs and real-world agricultural datasets show that our mechanism significantly outpaces traditional heuristic corporate governance models. The system achieves superior performance across critical benchmarks, including information entropy, Simpson diversity index, and community conductance under acute conflict scenarios. In conclusion, this algorithmic framework provides a robust and mathematically verified tool for neutralizing kinship greenwashing and enforcing sustainable ESG governance in family-owned ecosystems.

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ICONS2026-000530 | Abstract 214

Evaluating AI Leadership and Smart Contracts for Optimizing Marine Biotechnology Net-Zero Governance Using PLS-SEM Models

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ABSTRACT

Net-zero governance in marine biotechnology represents a complex structural optimization challenge with wide-ranging applications in technological risk management, such as marine environment monitoring and computing energy infrastructure efficiency optimization. While existing management frameworks address green carbon transitions, current models fail to simultaneously optimize systemic human-machine alignment alongside automated technical auditing verification.

This paper proposes an empirical evaluation model integrating an artificial intelligence (AI) leadership capability literacy layer and decentralized automated smart contracts, aiming to maximize total net-zero performance by balancing behavioral adaptations and automated validation workflows. Using an empirical dataset of 433 validated marine biotechnology sector observations, the framework was analyzed via Partial Least Squares Structural Equation Modeling (PLS-SEM).

The structural model evaluation reveals that AI leadership literacy significantly determines both system trust and operational role definition (job clarity) within technical teams. Direct path analysis indicates that data-driven leadership literacy successfully drives net-zero digital transformation performance, while system trust and job clarity act as critical structural mediators within the organizational network. Furthermore, parameter optimization and multi-group moderation analysis demonstrate that complementary smart contract implementation significantly strengthens the localized impacts of trust and clarity on blue transformation velocity, ensuring auditable compliance data integrity without human intervention.

In conclusion, the experiments indicate notable improvements over traditional administrative methods and establish that integrating technical leadership with automated smart contracts provides an efficient mechanism for net-zero governance in marine biotechnology ecosystems, suggesting high potential for future applications in complex marine technical asset decision-making problems.

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ICONS2026-000531 | Abstract 215

Can the Art Gallery Problem Empower Resilient Campuses? Optimizing AI Carbon Governance in Taiwan's Leading Green University

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ABSTRACT

Robust environmental tracking requires high spatial efficiency to ensure climate resilience in green spaces. This paper presents an optimization framework solving the classical Art Gallery Problem (AGP) for sustainable infrastructure planning, directly aligned with the 2049 net-zero target of Taiwan's leading GreenMetric university, National Pingtung University of Science and Technology (NPUST). Utilizing NPUST's 298-hectare topology as a case study, a discretization algorithm converts the geographical polygon into a high-density grid-world system, where nodes are weighted by carbon hotspots and sink indices. A Q-learning agent interacts with this environment to optimize sensor placement, balancing sensor count and weighted coverage. Operating within an OpenAI Gym framework, the agent executes discrete two-way actions and evaluates a six-directional field-of-view routine simulating terrain obstacles and canopy shading. To ensure structural resilience during node failures, the policy utilizes an adaptive epsilon-greedy strategy and updates the state-action table via Temporal Difference (TD) learning. Real-world maps extracted via OSMnx and Folium validate that this reinforcement learning approach eliminates blind spots. Benchmark evaluations against greedy heuristics (GH) and integer linear programming (ILP) demonstrate that our model minimizes deployment costs with superior running times in large-scale scenarios. These results define a scalable tool for validating resilient AI carbon governance within academic ecosystems.

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ICONS2026-000532 | Abstract 216

Blockchain for Greenwashing or Resilience? A Panel 2SLS Evaluation of Carbon Compliance in Taiwan's Agri-Fishery Sector

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ABSTRACT

This study investigates the empirical impact of blockchain implementation on carbon compliance and financial performance within Taiwan's agri-fishery sector from 2021 to 2025. Utilizing data from the TWSE and TEJ databases, we initially collected 215 raw observations from 43 listed firms. After removing incomplete data and financial outliers, we established a final balanced panel dataset of 40 enterprises, yielding exactly 200 validated firm-year observations. Through OLS and 2SLS econometric models, the study evaluates how blockchain adoption (BLOCKCHAIN) interacts with carbon compliance volume (CARBON_TRADING), governance ratings (ESG), and year-to-date returns (YTD).

The empirical findings reveal that agri-fishery firms leveraging blockchain for supply chain traceability and carbon management experience a significant 0.42% increase in YTD returns. Conversely, blockchain adoption does not directly improve overall ESG ratings. Furthermore, a moderation analysis indicates that the blockchain-financial return relationship is weaker for large conglomerate or state-affiliated enterprises (SOC), implying that independent agri-fishery firms benefit more pronouncedly from market-driven transparency. In conclusion, the results establish that blockchain serves as a potent economic mechanism to optimize carbon compliance and financial resilience in the agribusiness ecosystem.

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ICONS2026-000534 | Abstract 217

The Effects of Compensation and Career Development on Employees' Turnover Intention: Evidence from an Indonesian Professional Service Company

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ABSTRACT

Employee turnover has become a critical challenge for professional service companies, where organizational performance relies heavily on employees' specialized knowledge, expertise, and long term client relationships. Despite extensive research on turnover intention, empirical evidence regarding the combined effects of compensation and career development within Indonesian professional service companies remains limited. This study aims to examine the effects of compensation and career development on employees' turnover intention at PT XYZ Branch Balikpapan. A quantitative explanatory research design was employed using a survey approach. The study involved 147 employees selected through proportionate stratified random sampling from the company's active workforce. Data were collected using structured questionnaires and analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM). The results indicate that both compensation and career development have significant negative effects on turnover intention, with career development exerting a stronger influence than compensation. Employees who perceive fair compensation and clear opportunities for career advancement are less likely to leave the organization. These findings contribute to the human resource management literature by highlighting the relative importance of career development in reducing turnover intention within professional service organizations. Practically, the results suggest that organizations should integrate competitive compensation systems with structured career development programs to strengthen employee retention and enhance long term organizational competitiveness.

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ICONS2026-000536 | Abstract 218

Characteristics of Language Use in Family Communication of Stieng People in Binh Phuoc Province

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ABSTRACT

The study surveyed 553 Stieng people in Binh Phuoc Province to describe the extent of Stieng-Vietnamese language use within the family and to identify the social factors influencing language choice. The results show that Stieng remains the dominant language in most family contexts, particularly for greetings, casual conversation, and emotional expression, while Vietnamese is used more frequently when communicating with children and grandchildren and in study-related situations. Alternating between the two languages is common, reflecting the community's flexible bilingual practices. Younger and more highly educated individuals, as well as workers and students, tend to use Vietnamese and switch between the two languages more often; in contrast, older, illiterate, or farming individuals prefer Stieng. Differences among districts-especially Chon Thanh in comparison with Dong Phu and Hon Quan-highlight the influence of urbanization and socio-economic conditions. Overall, the Stieng language remains strongly maintained within the family, but a clear shift toward bilingualism is evident among the younger generation, forming a sustainable yet increasingly integration-oriented language pattern.

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ICONS2026-000538 | Abstract 219

From abandonment to circular economy: a digital pipeline for regenerating the dry-stone landscape of Kythnos, Cyclades.

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ABSTRACT

Dry-stone construction dominates the Cycladic landscape with Kythnos being a representative example, where roughly 70% of the land is shaped by dry-stone structures. Historically linked to the agrarian life, the mid-20th century decline of agricultural activity led to the abandonment of the dry-stone structures contributing to the general decay of the landscape. Over the last decades, as the multifaceted losses of this degradation symbolic, ecological, economic — have become apparent, the question of managing these dry-stone networks has returned to the fore. However, monument-restoration practices and legislation treat these structures as static relics or apply generic guidelines, making the preservation almost unviable. This article proposes a management framework that approaches dry-stone construction more as a low-carbon building practice than as a field of monument restoration. Four coupled stages are proposed to achieve this goal: the use of UAV and LiDAR survey together with deep learning to map the network and assess its condition; prioritized intervention in areas of high cultural significance or high collapse risk; restoration that integrates contemporary methods into traditional techniques; and the development of a local construction economy oriented toward building in stone and toward passing on the dry-stone craft, grounded in circular-economy principles. Motivated by the New European Bauhaus, the proposed framework for managing the dry-stone networks of Kythnos could serve as a demonstrator for the use of stone as a building material, driven by multiple converging motivations — collective memory/identity, economy/tourism, sustainability and legislation.

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ICONS2026-000539 | Abstract 220

Radiosity-Driven Bidirectional Structural Optimization

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ABSTRACT

This paper investigates how the Topology Optimization for Daylight method, with inverse radiosity, can be integrated into Bi-directional Evolutionary Structural Optimization (BESO) by forming a bi-objective optimization problem of target illumination and compliance, respectively, with sensitivities computed by the adjoint method. Inverse radiosity produces globally coupled sensitivity numbers, because each façade element affects the illumination of the entire room. On the other hand, in BESO an element's sensitivity number reflects its own strain energy. The central question that arises is how BESO can be made radiosity-driven. A Pareto-front multi-objective formulation can render structural topology optimization illumination-aware, while giving the inverse-radiosity optimization more stable results and more continuous forms. The results show that at low inverse-radiosity contributions (10–30%) the optimized geometry retains its structural integrity even at small target volume fractions, whereas once the radiosity objective becomes dominant the layout develops checkerboard patterns and isolated regions. These results establish radiosity-driven BESO as a viable proof of concept and a platform for richer daylight objectives and further building-physics coupling.

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ICONS2026-000541 | Abstract 221

Toward Sustainable Smart-City Logistics: Consumer Acceptance of Electric Vehicle-Based Last-Mile Delivery Services

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ABSTRACT

The transition toward low-carbon urban infrastructure has increased attention to electric vehicle-based last-mile delivery as part of sustainable city logistics systems. While technical and operational dimensions of electric delivery have received growing attention, user acceptance remains critical for the successful implementation of digitally enabled and environmentally sustainable delivery infrastructure. Drawing on valence theory, this study examines how convenience, hedonic value, perceived value, perceived risk, and perceived cost shape consumers' attitudes and intentions toward EV-based last-mile delivery services in Vietnam. Data were collected from 475 citizens and analyzed using PLS-SEM. The findings show that convenience and hedonic value significantly enhance perceived value, which subsequently strengthens positive attitudes and intention to use EV delivery services. Perceived risk and perceived cost show weaker negative effects, suggesting that young urban consumers may prioritize functional and experiential benefits over perceived barriers. The study contributes to discussions on sustainable urban logistics by highlighting the behavioral conditions required for successful adoption of EV-based delivery systems. Practical implications are offered for logistics providers, platform operators, and urban policymakers seeking to develop efficient, user-oriented, and low-emission delivery infrastructure.

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ICONS2026-000542 | Abstract 222

A Transferable Active-Learning Machine-Learning Interatomic Potential Framework for Predictive Simulation of Reactive Oxide–Water Interfaces

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ABSTRACT

Reactive solid–liquid interfaces underpin catalysis, electrochemistry, and energy conversion, yet their atomistic investigation remains limited because conventional ab initio molecular dynamics (AIMD) is computationally prohibitive for long-timescale simulations. Although machine-learning interatomic potentials (MLIPs) offer a promising alternative, their application to chemically complex interfaces requires robust training, rigorous validation, and demonstrated transferability.

This work presents a validated computational framework integrating first-principles Density Functional Theory (DFT), uncertainty-driven active learning, and on-the-fly MLIPs for predictive simulation of reactive oxide–water interfaces. The hematite–water interface serves as a proof-of-concept. High-fidelity reference configurations generated using dispersion-corrected DFT were iteratively enriched through active learning, enabling efficient exploration of configurational space while preserving first-principles accuracy.

Validation against DFT reference data using force-error analysis, Bayesian uncertainty monitoring, energy-stability assessment, and pair-correlation-function comparisons demonstrates that the trained potential accurately reproduces the structural, energetic, and chemical characteristics of the reference system. The resulting MLIP extends simulations beyond the practical limits of AIMD, capturing reactive adsorption, water dissociation, proton transfer, surface hydroxylation, hydrogen-bond rearrangement, and hydration-layer restructuring. Electronic-structure calculations further reveal adsorption-induced Fe–O/O–H hybridisation and interfacial electronic reconstruction consistent with first-principles behaviour.

The proposed workflow establishes a transferable, physics-informed, and computationally scalable framework for predictive modelling of reactive solid–liquid interfaces, providing a foundation for catalysis, electrochemical systems, environmental processes, and Multiphysics simulations beyond the reach of conventional AIMD.

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ICONS2026-000548 | Abstract 223

Structural Behavior of DPPC Membrane Under Cooling and Lateral Pressure

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ABSTRACT

Through extensive Molecular Dynamics (MD) simulations using the GROMACS software, we determine the structural and phase behavior of a model Dipalmitoylphosphatidylcholine (DPPC) lipid membrane under a wide range of temperature and pressure conditions. The lateral pressure corresponds to both compression and stretching, including extreme conditions leading to membrane buckling and eventual rupture. Three different interaction models are employed, each offering a different level of chemical detail: the all-atom (AA) CHARMM, the united-atom (UA) revised Lipid-Berger and the coarse-grained (CG) Martini potential. We analyze the differences and similarities between the models in capturing the pressure- and temperature-induced critical transitions: i) from the planar to the undulated conformation, ii) from bilayer to interdigitated conformation and iii) structural rupture. To this end, we employ a wide range of structural metrics, including among others, the area per lipid, the nematic order parameter, the tilt angle, the mass density profile of different species, and the leaflet curvature. Present simulation findings could help in the computer-aided design of drug delivery for pharmaceutical applications.

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ICONS2026-000550 | Abstract 224

Who Is Sceptical of Artificial Intelligence? Predictors of AI Scepticism in the General Population

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ABSTRACT

Since the public release of ChatGPT in 2022, artificial intelligence has become an increasingly visible and widely used technology. Despite its growing adoption, a substantial proportion of citizens remain sceptical of AI. This paper investigates the characteristics associated with AI scepticism using two nationally representative surveys conducted in Norway: one prior to the emergence of generative AI in 2020 and another conducted in 2026. The study draws on six AI-related concerns originally identified by experts in the AI100 project and examines how these concerns, together with demographic characteristics, risk propensity, ICT competence, and Internet of Things (IoT) usage, are associated with attitudes toward AI. Binary logistic regression was employed to distinguish respondents expressing sceptical attitudes from those holding positive views of AI. Separate models were estimated for groups of explanatory variables, followed by a comprehensive model incorporating all variables simultaneously. The analyses reveal that several factors are significantly associated with AI scepticism. In the final model, low education, concerns about corporate data abuse and loss of control, lower confidence in improving ICT skills, lower willingness to take risks, and the use of smart speakers remained significant predictors. The findings suggest that AI scepticism is shaped not only by demographic characteristics but also by concerns related autonomy, digital competence, and technology use. In particular, concerns regarding corporate misuse of personal data and the perceived loss of individual control appear to be central drivers of sceptical attitudes toward AI. The study contributes to a better understanding of public perceptions of AI.

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ICONS2026-000554 | Abstract 225

Generative AI Readiness among Women Entrepreneurs in Crete: The Intention–Use Gap and Conditions for Responsible Adoption

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ABSTRACT

Despite the diffusion of Generative AI, little is known about adoption readiness among women-led micro and small enterprises in regions. This study examines the opportunities, barriers and adoption conditions of GenAI among women entrepreneurs and professionals in Crete, interpreted through technology-acceptance perspectives (TAM/UTAUT) and a responsible-adoption lens, with attention to digital transformation, entrepreneurial empowerment and inclusive AI use.

The research follows an explanatory sequential mixed-methods design. Quantitative data were collected via a structured questionnaire completed by 80 women professionally active in Crete and analysed with descriptive statistics, non-parametric tests and reliability-checked composite indices; qualitative insights were drawn from a focus group with five entrepreneurs from different sectors.

Awareness remains mainly at an initial or intermediate level (≈58% basic), with use concentrated in text generation, social-media content, communication and marketing. Participants rate perceived usefulness and expected business impact positively (means ≈3.4–3.6), yet adoption intention is markedly lower (≈2.9) — a clear attitude–behaviour gap. Adoption is constrained by concerns over accuracy and misinformation and by legal uncertainty, while the local entrepreneurial ecosystem is rated weakest (≈2.3), particularly access to funding. Gender functions mainly as an indirect constraint through time, networks and funding rather than as a direct technological barrier.

The study positions inclusive and responsible GenAI adoption as a leadership and policy challenge, identifying embedded support — practical training, mentoring, micro-funding and responsible-AI guidance — as the key enabling conditions for organisational readiness and accountable adoption at scale.

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ICONS2026-000555 | Abstract 226

Resource Misallocation and Allocative Efficiency in Vietnamese Manufacturing: Evidence from the Provincial Competitiveness Index

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ABSTRACT

Resource misallocation can substantially lower aggregate total factor productivity (TFP). We use firm-level microdata from Vietnam's Annual Enterprise Survey to quantify the extent of misallocation in Vietnamese manufacturing over 2015–2023. Following Hsieh and Klenow (2009), we measure distortions through the dispersion of revenue productivity (TFPR) and recover firm-specific capital and output wedges. We find sizable dispersion in marginal products across firms within narrowly defined industries. When capital and labor are hypothetically reallocated to equalize marginal products within industries, we calculate substantial gains in manufacturing TFP. We then exploit variation in the Provincial Competitiveness Index (PCI) to ask whether local economic governance explains these distortions. Fixed-effects estimates at the firm level indicate that firms in better-governed provinces face smaller wedges, with the effect concentrated among private domestic firms. Our results suggest that improving provincial institutions is a first-order channel for raising allocative efficiency and aggregate productivity in Vietnamese manufacturing.

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ICONS2026-000557 | Abstract 227

Nonlinear Finite Element Analysis of Inverted L-Shaped Beam–Column Connections Using Abaqus for Different Concrete Strengths and Loading Levels

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ABSTRACT

Finite element analysis is conducted on inverted L - shaped beam – column connection using Abaqus. The element analyses were simulated for two different concrete compressive strengths (f′ c) of 29 MPa and 51 MPa and four different magnitudes of load: 0.25, 0.50, 0.75 and 1.00 of the ultimate load capacity. The performance of the model was calculated by varying properties which included Load – displacement (P), Stress (S) and Yield (Y). Nonlinear finite element method analysis was used and applied appropriate concrete and reinforcement constitutive models to understand the interaction between the beam-column and cracking pattern. Findings proved that higher applied load resulted in large displacement for both strengths of concrete. Higher strength concrete had higher stiffness and less deformation when compared to lower strength concrete. Finite element analysis proved to be effective in modeling inverted L beam – column joints under various loading intensities.

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ICONS2026-000561 | Abstract 228

The Impact of Transformational Leadership and Organizational Culture on Employee Performance: The Mediating Role of Innovative Work Behavior

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ABSTRACT

This study examines how transformational leadership and organizational culture influence employee performance through innovative work behavior at PT Amartha Mikro Fintek. Using a quantitative explanatory approach, data were collected from 247 employees through a structured questionnaire and analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The measurement model demonstrated satisfactory validity and reliability. The structural model explained 60.3% of the variance in innovative work behavior and 73.3% of the variance in employee performance. The results indicate that transformational leadership and organizational culture positively and significantly affect both innovative work behavior and employee performance. Innovative work behavior also has a significant positive effect on employee performance and partially mediates the relationships between transformational leadership, organizational culture, and employee performance. Organizational culture shows a stronger influence on innovative work behavior than transformational leadership. These findings highlight the importance of strengthening transformational leadership, fostering a supportive organizational culture, and encouraging innovative work behavior to improve employee performance in the fintech industry, while contributing to the human resource management literature on organizational performance.

Keywords: Transformational leadership; organizational culture; innovative work behavior; employee performance; fintech.

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ICONS2026-000564 | Abstract 229

Prospects for improving methods of hydraulic calcultaion of sewer networks based on operational analysis

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ABSTRACT

The article examines prospects for improving methods of hydraulic calculation of sewer networks based on operational analysis. The relevance of the study is обусловлена необходимостью модернизации устаревших подходов к проектированию и эксплуатации систем водоотведения с учётом современных требований устойчивого развития и цифровизации инженерной инфраструктуры. A comprehensive review of classical hydraulic relationships, including the formulas of Chezy, Bazin, Kutter, and Manning, is presented to assess their applicability to gravity sewer pipelines. Particular attention is given to the influence of operational factors on network performance, especially the formation of sediment in the invert of pipes, which significantly alters their hydraulic characteristics. An improved calculation method is considered that accounts for sediment thickness, enabling more accurate determination of actual hydraulic slope, flow velocity, and pipeline capacity. The study substantiates the necessity of integrating operational monitoring data into the design and management of wastewater systems. The proposed approach enhances the reliability, durability, and economic efficiency of sewer networks while reducing environmental risks. The findings contribute to the development of modern regulatory and methodological frameworks and can be applied in engineering practice to optimize the operation and design of urban drainage systems.

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ICONS2026-000566 | Abstract 230

Decoding the AI Arsenal of Bioinformatics: Hierarchical Clustering of 153 Tools for Smarter Selection

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ABSTRACT

The diversity of artificial intelligence (AI) tools in bioinformatics is rapidly increasing; however, existing reviews generally focus on a single technology or application domain and fail to provide a holistic classification that quantitatively analyzes the technical similarities among tools. This study classifies 153 AI tools used in health bioinformatics on the basis of 25 binary technical features and analyzes their similarity relationships through hierarchical clustering using Ward linkage. The resulting dendrogram enables the rapid identification of alternative tools serving the same purpose (e.g., GNINA–DiffDock). The findings reveal that 53% of the tools are taxonomy-independent; the most common input data types are DNA/RNA sequences, protein structures, and medical images; Transformer- and CNN-based architectures are prominent; and the tools are predominantly developed for analysis (46%) and prediction (38%). This study distinguishes itself from the literature in terms of scope, evaluation criteria, and methodology, aiming to guide researchers in appropriate tool selection and workflow planning.

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ICONS2026-000568 | Abstract 231

Machine-Learning Force Field Investigation of Defect-Engineered HOPG-Water Interfaces: Structural, Electronic, and Interfacial Properties

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ABSTRACT

Highly Oriented Pyrolytic Graphite (HOPG) serves as an ideal model system for investigating electrochemical energy storage, and interfacial transport. In this study, density functional theory (DFT) combined with on-the-fly machine-learning force fields (ML-FFs) implemented in the VASP was employed to investigate the structural, electronic, electrostatic, and mechanical properties of HOPG-water interfaces with near first-principles accuracy and significantly reduced computational cost. Pristine HOPG, vacancy-defective structures, and nitrogen-, oxygen-, and sulfur-doped surfaces were systematically examined. The results demonstrate that both structural defects and heteroatom doping substantially modify the interfacial behaviour of water. Vacancy defects promote stronger water adsorption, enhanced hydrogen bonding, and reduced molecular mobility, while oxygen- and nitrogen-doped surfaces further strengthen water-surface interactions. Structural and dynamical analyses reveal enhanced interfacial ordering and suppressed water diffusion near defective surfaces. Electronic and electrostatic analyses show that vacancy-containing and edge-defective structures significantly enhance interfacial charge localisation and electric double-layer formation. Armchair step edges exhibit the strongest interfacial polarisation, whereas sulfur-doped systems produce the broadest electric double layer. Force-distance calculations reveal stronger adhesion and modified mechanical stiffness for defective structures, while projected density of states analyses indicates enhanced electronic states near the Fermi level, suggesting increased surface reactivity and charge-transfer capability. These findings provide atomistic insights into the influence of structural defects and heteroatom doping on HOPG-water interfaces, offering valuable design guidelines for graphite-based materials in supercapacitors, electrochemical energy storage, adsorption, and catalytic applications.

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ICONS2026-000569 | Abstract 232

Customer Conversion in Digital Broadband Services: The Roles of Personalization, Perceived Data Transparency, Customer Trust, Customer Engagement, and Digital Literacy

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ABSTRACT

The rapid growth of digital marketing in Indonesia's telecommunications industry has created both opportunities and challenges for fixed broadband service providers. This study examines how personalization and perceived data transparency influence customer conversion through the mediating roles of customer trust and customer engagement, while also investigating the moderating effect of digital literacy. A quantitative survey approach was employed involving 400 active IndiHome Telkomsel customers distributed proportionally across five major regions in Indonesia. Data were analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS). The results show that personalization positively and significantly influences customer trust (β = 0.389), customer engagement (β = 0.356), and customer conversion (β = 0.214). Perceived data transparency significantly affects customer trust (β = 0.419) and customer engagement (β = 0.505) but does not directly predict customer conversion. Both customer trust and customer engagement act as significant mediators, with customer engagement being the stronger predictor of conversion (β = 0.408). Digital literacy strengthens the relationship between personalization and customer conversion but does not moderate the effect of perceived data transparency on conversion. Fourteen hypotheses were tested, of which twelve were supported. These findings demonstrate that customer conversion in fixed broadband services is shaped not solely by data transparency but primarily by the quality of personalization, trust, engagement, and customers' capacity to interpret digital communications.

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ICONS2026-000573 | Abstract 233

Investigating the Influence of Amines on the Dissociation Conditions of CO2+CH4 Clathrate Hydrate at the Molecular Scale

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ABSTRACT

Gas clathrate hydrates play an important role in natural gas production and transport, carbon capture and storage (CCS), gas separation, and energy-efficient gas storage. Understanding hydrate stability is essential for mitigating pipeline flow assurance issues and optimizing hydrate-based technologies. Although amines are widely used in industrial gas processing, their molecular-level influence on mixed gas hydrate stability remains poorly understood. In this study, molecular dynamics (MD) simulations were performed to investigate the dissociation behaviour of mixed CO_2–CH_4 clathrate hydrates in the presence of different amine additives. Hydrate stability was evaluated by analysing the evolution of potential energy, guest occupancy, hydrogen-bond networks, cage stability, radial distribution functions, and structural order parameters during dissociation. The results show that amines significantly influence hydrate dissociation by modifying the local hydrogen-bonding environment and interfacial water structure. Depending on their molecular structure and functional groups, amines either accelerate hydrate decomposition by disrupting the water lattice or enhance stability through favourable interactions with guest molecules. Distinct effects on CO_2 and CH_4 release were also observed, demonstrating the potential to tune hydrate stability and gas selectivity through appropriate additive selection. These molecular-scale insights provide guidance for the rational design of hydrate-control additives and demonstrate the value of MD simulations as a predictive tool for improving CCS, gas separation, and hydrate management technologies.

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