CIE53 Program at a Glance

20-23 October 2026 | Khalifa University, Abu Dhabi, UAE

Live schedule from cie2026.science

Time	Day 1 | Tue, 20 Oct	Day 2 | Wed, 21 Oct	Day 3 | Thu, 22 Oct	Day 4 | Fri, 23 Oct
08:00	Registration 08:00-09:00	Registration	Registration	Registration
08:30		Keynote Speech 3 08:30-09:15	Keynote Speech 5 08:30-09:15	Closing Ceremony 08:30-09:15
09:00	Opening Ceremony	Short Break	Short Break	Short Break
09:30	Keynote Speech 1 09:30-10:15	Meet the Editors Panel 09:30-10:15	Parallel Technical Sessions V 09:30-11:00	Optional Industrial Visits 09:30-12:30
10:00	Coffee Break	Coffee Break		
10:30	Parallel Technical Sessions I 10:45-12:15	Parallel Technical Sessions III 10:45-12:15		
11:00			Coffee Break	
11:30			Doctoral Student Forum 11:30-12:15	
12:00	Lunch 12:15-13:30	Lunch 12:15-13:30	Lunch 12:15-13:30	
12:30				Break / Networking 12:30-13:15
13:00				
13:30	Keynote Speech 2 13:30-14:15	Keynote Speech 4 13:30-14:15	Industry Talk 13:30-14:15	Lunch / Networking 13:15-15:00
14:00	Short Break	Short Break	Short Break	
14:30	Parallel Technical Sessions II 14:30-16:00	Parallel Technical Sessions IV 14:30-16:00	Parallel Technical Sessions VI 14:30-16:00	
15:00				
15:30				
16:00			Coffee Break	
16:30			Poster Session 16:30-18:15	
17:00				
17:30				
18:00			Transfer to Gala Dinner Location 18:15-19:00	
18:30				
19:00			Gala Dinner & Conference Awards 19:00-22:00	
19:30				
20:00				
20:30				
21:00				
21:30				

SUPPORTERS

abu dhabi Convention & Exhibition Bureau

hexaly

جامعة خليفة Khalifa University

Full Schedule

Session times, rooms, speakers, and accepted talks from the live conference database.

Day 1 | Tuesday, 20 October 2026

08:00-09:00

Registration
Room: Khalifa University Auditorium

09:00-09:30

Opening Ceremony

09:30-10:15

Keynote Speech 1

10:15-10:45

Coffee Break

10:45-12:15

Parallel Technical Sessions I

12:15-13:30

Lunch

13:30-14:15

Keynote Speech 2

14:15-14:30

Short Break

14:30-16:00

Parallel Technical Sessions II

Day 2 | Wednesday, 21 October 2026

08:00-08:30

Registration

08:30-09:15

Keynote Speech 3

09:15-09:30

Short Break

09:30-10:15

Meet the Editors Panel

10:15-10:45

Coffee Break

10:45-12:15

Parallel Technical Sessions III

12:15-13:30

Lunch

13:30-14:15

Keynote Speech 4

14:15-14:30

Short Break

14:30-16:00

Parallel Technical Sessions IV

Day 3 | Thursday, 22 October 2026

08:00-08:30

Registration

08:30-09:15

Keynote Speech 5

09:15-09:30

Short Break

09:30-11:00

Parallel Technical Sessions V

11:00-11:30

Coffee Break

11:30-12:15

Doctoral Student Forum

12:15-13:30

Lunch

13:30-14:15

Industry Talk

14:15-14:30

Short Break

14:30-16:00

Parallel Technical Sessions VI

16:00-16:30

Coffee Break

16:30-18:15

Poster Session

18:15-19:00

Transfer to Gala Dinner Location

19:00-22:00

Gala Dinner & Conference Awards

Day 4 | Friday, 23 October 2026

08:00-08:30

Registration

08:30-09:15

Closing Ceremony

09:15-09:30

Short Break

09:30-12:30

Optional Industrial Visits

12:30-13:15

Break / Networking

13:15-15:00

Lunch / Networking

Detailed Program

Session information, talk abstracts, authors, affiliations, and invited-speaker biographies.

Keynote and Invited Talks

KEYNOTE

The HPC–AI Convergence: Accelerating Innovation in the Exponential Age

Dr. Horst D. Simon
ADIA Lab, Abu Dhabi

ABSTRACT

High-performance computing (HPC) and artificial intelligence (AI) are no longer separate technological domains. They have converged into a mutually reinforcing ecosystem that drives exponential progress. Modern AI depends fundamentally on HPC architectures, parallelism, and system-scale optimization. At the same time, traditional HPC applications increasingly integrate machine learning and AI-driven models to enhance prediction, accuracy, and efficiency. This convergence is reshaping both fields and accelerating innovation across science, industry, and the digital economy.

This presentation traces the evolution of HPC from its origins in large-scale scientific simulation to its central role in enabling today's AI revolution. It highlights how advances in semiconductors, large-scale data infrastructure, and algorithmic innovation have created a powerful feedback loop that fuels rapid capability growth. Landmark efforts such as the U.S. Exascale Computing Project and global benchmarking through the TOP500 reflect the extraordinary scaling required for modern AI workloads.

As computing demand grows at an exponential pace, sustainability and energy efficiency have become essential design considerations. Future progress will depend on novel accelerators, energy-aware architectures, hybrid cloud/HPC environments, and deeper co-design of hardware, software, and algorithms.

In the Exponential Age, the fusion of HPC and AI forms the computational backbone for scientific discovery, industrial transformation, and emerging digital economies. Sustained investment in this converged ecosystem is therefore imperative to shape and power the next generation of technological breakthroughs.

SPEAKER BIOGRAPHY

Dr. Horst D. Simon is an internationally recognized expert in high-performance computing and computational science, with over four decades of experience in parallel algorithms and large-scale numerical methods. After completing his Ph.D. in Mathematics at UC Berkeley, he held leadership roles across academia (Stony Brook, UC Berkeley), industry (Boeing, SGI), and national research labs (NASA Ames, Lawrence Berkeley Lab. At Berkeley Lab, he directed NERSC and served as Deputy Lab Director, earning two prestigious Gordon Bell Prizes and co-editing the biannual TOP500 list of supercomputers. Since 2023, Dr. Simon has been the founding Director of ADIA Lab in Abu Dhabi, spearheading cutting-edge research in computational and data science. He continues to advance scalable algorithms that address complex scientific and societal challenges.

KEYNOTE

Harnessing the Potential of Operations Research to Optimize Health Policy and Medical Decisions: Lessons from Cancer Screening

Prof. Dr. Oguzhan Alagoz
University of Wisconsin-Madison, USA

ABSTRACT

TBA

SPEAKER BIOGRAPHY

Oguzhan Alagoz is Procter & Gamble Bascom Professor of Industrial and Systems Engineering and Population Health Sciences at the University of Wisconsin-Madison. His research interests include stochastic optimization, medical decision making, completely and partially observable Markov decision processes, simulation, risk-prediction modeling, and health technology assessment. He served as a member of ISPOR-SMDM Modeling Good Research Practices Task Force which developed recommendations for good modeling practices in state-transition modeling for the evaluation of health care decisions in 2012. He is also co-leading the University of Wisconsin Breast Cancer Simulation Model, a member of the National Cancer Institute's Cancer Intervention and Surveillance Modeling Network (CISNET), that was used to inform national breast cancer

screening guidelines in the US in 2016 and 2024. He is currently serving as an associate editor for Operations Research. He previously served as the editor-in-chief of IISE Transactions on Healthcare Systems Engineering, the flagship journal of IISE in the area of healthcare systems engineering and on the editorial board of Medical Decision Making and IISE Transactions. He is an elected fellow of IISE. He published over 110 refereed journal articles throughout his career. His research has been recognized with numerous awards, including the IISE David F. Baker Distinguished Research Award, the premier research award from IISE, a CAREER Award from the National Science Foundation, the IISE Outstanding Young Industrial Engineer in Education Award, and several Best Paper Awards from INFORMS.

KEYNOTE

Prof. Dr Samir Elhedhli
University of Waterloo, Canada

SPEAKER BIOGRAPHY

Samir Elhedhli is a Professor in the Department of Management Science and Engineering at the University of Waterloo, specializing in Data Analytics and Optimization. He has held research grants from NSERC, SSHRC, CFI, OCE, and MITACS, and has collaborated with industry partners in manufacturing, robotics, healthcare, logistics, supply chain management, and airline operations. His work has appeared in scientific journals such as Management Science, Mathematical Programming, Manufacturing and Service Operations Management, INFORMS Journal on Computing, IISE Transactions, Computers and Industrial Engineering and the European Journal of Operational Research, among others. Professor Elhedhli is a former President of the Canadian Operational Research Society, former Editor-in-Chief of its flagship journal, Information Systems and Operational Research, and former Chair of the University of Waterloo's Department of Management Sciences.

KEYNOTE

Circular Intelligence – Business models, data-driven optimization, and coordination

Prof. Dr. Stefan Minner
TUM School of Management, Technical University of Munich

ABSTRACT

Merging two popular streams of industry challenges and their research areas, artificial intelligence and circular economy, brings new opportunities for production economics. The additional complexity when moving from linear to circular business models, the multi-sourcing nature of repair, refurbish, and remanufacturing strategies, and the increased variability and uncertainty in circular supply chains require adjustments of traditional stochastic and data-driven decision models, and can use artificial intelligence for complexity reduction, advanced learning, and automation of decision-making. We present different data-driven prediction and prescription models and respective solution algorithms to support circular intelligence.

SPEAKER BIOGRAPHY

Stefan Minner is a Full Professor for Logistics and Supply Chain Management at the School of Management, Technical University of Munich (TUM) and a core-member of the Munich Data Science Institute (MDSI). Currently, he is the acting Vice Dean of Research and Innovation at TUM School of Management. His research interests using methods of operations research, artificial intelligence and machine learning are in global supply chain design, transportation optimization and inventory management. His work was published in many peer-reviewed journals, including Management Science, Manufacturing & Service Operations Management, Operations Research, Production and Operations Management, Transportation Science, Transportation Research Part B, and European Journal of Operational Research. He serves on several editorial boards of logistics and operations research journals. Currently, Stefan Minner is the Editor-in-Chief of the International Journal of Production Economics. Stefan Minner is a fellow of the International Society for Inventory Research (ISIR) and the International Foundation of Production Research (IFPR). He received the PhD supervisory award at TUM School of Management in 2024 and the Science Award for his lifetime achievements by the German Operations Research Society in 2025.

KEYNOTE

If Machines Exceed Us: Operations Research and Analytics at an Inflection Point

Prof. Dr. Tinglong Dai
Johns Hopkins Carey Business School, USA

ABSTRACT

Artificial intelligence is changing not only the tools of operations research and analytics, but the nature of the problems we take to be solvable. Generative AI, for all its power, does not come with an internal representation of rules, constraints, or risk. Operations research and analytics supply what is missing: the discipline that turns intelligence into decision.

In this talk, I argue that as AI becomes more autonomous, our field becomes more—not less—essential. OR and analytics

provide explicit objectives, enforceable constraints, and verifiable guarantees that generative models alone cannot provide. I will also discuss how rising autonomy shifts our work from optimizing decisions to designing decision-making systems, coordinating increasingly agentic AI systems, and contributing to the safety of advanced AI systems, including the long-run challenge of artificial superintelligence.

SPEAKER BIOGRAPHY

Dai is the Bernard T. Ferrari Professor at the Johns Hopkins Carey Business School. He also holds faculty appointments at the Johns Hopkins Data Science and AI Institute and the School of Nursing. He is a member and faculty chair of the Johns Hopkins University Council and serves on the leadership team of the Hopkins Business of Health Initiative. He co-leads the Bloomberg Distinguished Professorship Cluster on Medical Artificial Intelligence.

A renowned expert in AI, supply chains, and healthcare, Professor Dai has been quoted hundreds of times in the media, including CNN, New York Times, NPR, Wall Street Journal, and Washington Post, and has appeared on BBC News, CNBC, and PBS. In 2021, Poets & Quants named him one of the World's Best 40 Under 40 Business School Professors.

His research spans healthcare operations, human–AI interaction, global supply chains, and the marketing–operations interface. His work has been published in leading journals such as Management Science, M&SOM, Marketing Science, Operations Research, Journal of Marketing Research, NEJM AI, and npj Digital Medicine.

He serves as Associate Editor for Management Science, M&SOM, npj Digital Medicine, Service Science , Health Care Management Science, and Naval Research Logistics; sits on the Editorial Board of Marketing Science; and is Senior Editor for the INFORMS Journal on Data Science and Production and Operations Management. In 2023, he was elected Vice President of Marketing, Communications, and Outreach for INFORMS. He co-edited the Handbook of Healthcare Analytics (Wiley, 2018), and currently co-eds AI in Supply Chains: Perspectives from Global Thought Leaders (Springer, 2025). He joined Carey in 2013 after earning a PhD in Operations Management and Robotics from Carnegie Mellon University.

Additional Presentation Abstracts

PAPER 7

Blockchain-Enabled Digital Product Passports for Multi-Tier Social Compliance: Toward Ethical and Transparent Global Supply Chains

Roshanak Davallou, Anirudh Subramanyam and Omid Fatahi Valilai

Presenter: Roshanak Davallou

ABSTRACT

Global multi-tier supply chains face persistent social compliance risks, such as child labour and unsafe working conditions, because upstream supplier data is fragmented and difficult to verify. This paper proposes a socio-technical Digital Product Passport extension that encodes multi-tier social compliance attributes while explicitly supporting suppliers with low digital maturity through lightweight, evidence-based onboarding. The architecture integrates DPP data structures with ERP-triggered workflows and rule-based Robotic Process Automation to automate screening, documentation cheques, and escalation logic. For integrity and non-repudiation, a permissioned blockchain logs compliance decisions and anchors cryptographic commitments of off-chain evidence under access control. The framework is assessed through analytical and structural evaluation of decision determinism, rule consistency, and inter-layer coherence. Validation focuses on verifying that rule-based screening outcomes remain logically stable under incomplete, ambiguous, and heterogeneous supplier data conditions. The developed model illustrates that DPPs can be modelled as active compliance workflow components, not only traceability artefacts, by enabling structured evidence acquisition, rule-based classification, and auditable decision support across multi-tier supplier ecosystems.

PAPER 8

Stochastic Multi-Level Optimization for Integrated Production, Pricing, and Hedging in Aluminum Extrusion Manufacturing

Konstantinos Petridis

Presenter: Konstantinos Petridis

ABSTRACT

Existing Sales and Operations Planning (S&OP) models typically address production, pricing, and risk- management decisions in isolation, limiting their effectiveness under commodity price uncertainty. This paper presents a stochastic mixed-integer linear programming framework that integrates decisions across multiple levels—strategic (network design, supplier selection), tactical (multi-stage production, workforce allocation, inventory positioning), and financial (dynamic pricing with

LME pass-through, commodity hedging)—within a unified optimization model for aluminum extrusion manufacturing. This multi-level integration enables coordinated responses that exploit cross-functional trade-offs unavailable to sequential approaches: building inventory during low-cost periods, adjusting prices dynamically with London Metal Exchange movements, and calibrating hedge positions to anticipated demand. Computational experiments demonstrate that the integrated approach improves expected profit by 14%, reduces margin volatility by 62%, and eliminates margin violations under extreme scenarios including pandemic disruptions and commodity price crashes.

PAPER 9

Prioritizing the Adoption and Use of Generative AI in Mechanical Engineering Education: An RII-Based Study

Mohannad Alghazo, Vian Ahmed and Zied Bahroun
Presenter: Mohannad Alghazo

ABSTRACT

The rapid advancement of Generative Artificial Intelligence (GAI) has created new opportunities and challenges for engineering education, particularly in Mechanical Engineering Education (MEE). This study investigates the adoption and use of GAI in MEE. Drawing on a literature review and semi-structured interviews with faculty members and students, key enablers, challenges, strategies, and psychological factors influencing GAI adoption were identified. Survey data were subsequently analysed using the Relative Importance Index (RII) to prioritize the factors perceived as most influential by both stakeholder groups. The findings indicate that strategy-related factors, particularly institutional governance and clear policies for GAI use, were prioritized by both faculty members and students. Pedagogical and ethical considerations were perceived as more influential than technical barriers. Furthermore, students perceived GAI to be most valuable for technically intensive tasks, including design, simulation, and coding, whereas collaborative applications received the lowest priority. Overall, the findings provide evidence-based insights into the factors influencing GAI adoption and the areas in which students perceive the greatest value for its application, supporting the structured and pedagogically aligned integration of GAI within Mechanical Engineering Education.

PAPER 10

Assessing the Impact of Barriers and Dilemmas on Supply Chain Efficiency in the Manufacturing Sector

Rissa Yebra, Klint Allen Marinas, Ozen Rima Tiongson, Ellison Luke Gatus and Michael Calamba
Presenter: Rissa Yebra

ABSTRACT

Manufacturing is one of the biggest industries and supply chain is one of the key factors in staying competitive, however, it could be complex due to several externalities. The current study investigated operational struggles to shape logistics by balancing the complexity of risk management and how those decisions could affect the supplier relationship and how to mitigate problems due to constant market changes. A total of 200 respondents from the supply chain industry were surveyed using Structural Equation Modeling (SEM) to investigate the 10 latent variables. The results showed that technical and operational barriers make it challenging to stay sustainable, while economic difficulties and poor communication could result in management problems. The results corroborate the configurational and dynamic capabilities theories indicating that success depends on the organization’s internal capabilities on how they can easily address the market challenges.

PAPER 12

Optimizing Inventory Management in the Philippine Tropical Fabrics Textile Supply Chain

Ryan Evangelista, Klint Allen Mariñas, Charmine Sheena Saflor, Alana Gianne Mariñas and Michael Calamba
Presenter: Ryan Evangelista

ABSTRACT

The Philippine textile Industry faces significant contraction due to high power costs and foreign competition. This study focuses on Asia Textile Mills, Inc. (ATMI) and its transition toward sustainability using pineapple blended fabrics for pineapple leaf fibers (PALF) to comply withy the Philippine Tropical Fabric Law. Facing challenges in inventory costs and fluctuating demand, the research develops an optimized inventory management framework. Utilizing a quantitative approach, the study employs Time Series Analysis, Naïve Forecasting, and Moving Averages to align raw material procurement with market trends. Furthermore, it integrates ABC Analysis and Lean Principles to categorize inventory and reduce waste. Results demonstrate that driven forecasting and strategic supply chain integration significantly enhance operational efficiency, reduce overstocking, and bolster the global competitiveness of the local textile sector.

PAPER 19

Balancing Hype and Continuity: Optimizing Inventory Levels for ‘Elevated Basics’ through ABC Analysis and EOQ Modeling on La Creación’s Heavyweight Apparel Line

Franz Julian Ailes, Jerson Carl Arcena, Jhan Ceddrick Castro, Jeremiah Ross Malinis, Edrhon Jacob Velayo, Klint Allen Mariñas and Michael Calamba

Presenter: Edrhon Jacob Velayo

ABSTRACT

Hybrid streetwear brands face a unique problem when balancing inventory, and La Creacion struggles to manage the steady demand for their basic shirts while dealing with the erratic sales of their hand finished art products. To find a practical purchasing strategy, this study implemented the ABC Analysis to group their inventory. Calculations were made with the Economic Order Quantity and Reorder Point. The results have shown that the basic shirts are Class A items that bring in the most money and demand strict control alongside high safety stocks. Meanwhile, the high risk art pieces are categorized as Class C and require minimal stock to avoid high holding costs. By using an appropriate mathematical approach, local micro, small, and medium enterprises can stop relying on intuition and build highly responsive operations that protect the company’s cash flow and keep them financially secure.

PAPER 20

Frequency-Specialized Dual-Branch Anomaly Detection with Artifact Reconstruction for Semiconductor Visual Inspection

Akira Yasuda, Takuya Matsuzawa, Sota Yamaguchi, Koichi Sumiya and Sumika Arima

Presenter: Akira YASUDA

ABSTRACT

High-precision visual inspection of semiconductor optical devices is critical but challenged by the coexistence of local and global anomalies, alongside domain-specific imaging artifacts. This study proposes a frequency-specialized dual-branch anomaly detection framework integrated with domain-specific preprocessing to address these issues. First, a Masked Autoencoder (MAE)-based preprocessing module reconstructs peripheral shadow artifacts to eliminate boundary-induced false positives. Then, utilizing the Stationary Wavelet Transform (SWT), the method explicitly decouples defect signatures into frequency domains. Low-frequency components are routed to an MAE-based global branch, while high-frequency components are processed by a Reverse Distillation (RD++)-based local branch. Experimental results on an industrial dataset demonstrate that the proposed method achieves an AUROC of 0.9837 and an AP of 0.9701, significantly outperforming the baselines. By attaining a 100% detection rate for well-defined local defects, the framework demonstrates its high reliability for strict industrial quality control where minimizing false negatives is paramount.

PAPER 23

Adoption of Generative AI Tools in Higher Education: Evidence from Kuwait University

Zainab M. Alqenaei and Hanady M. Abdulsalam

Presenter: Zainab M. AlQenaei

ABSTRACT

Following the unprecedented military attacks on Kuwait that have started in February 2026, the educational sector, along with other systems, have been compelled to implement swift emergency measures to maintain continuity. As a result, classes and examinations have transitioned to an online format. Throughout this challenging period, students have adapted by utilizing advanced Generative Artificial Intelligence (GenAI) tools to complete their coursework. This adaptation not only demonstrated the education system’s resilience but also underscored the evolving role of technology in academic processes. This study explores the adoption of GenAI tools among students at Kuwait University through an extended Technology Acceptance Model (TAM) that incorporates ethical factors. A cross-sectional online survey was conducted, gathering 390 responses with majority from undergraduate students in their first two years across various colleges. Quantitative analyses have confirmed the core TAM relationships, showing that both perceived ease of use and perceived usefulness positively influenced students’ attitudes toward using GenAI tools. These attitudes, in turn, shaped behavioral intentions and ultimately led to actual use of the tools. Further mediation analysis revealed that students’ personal norms fully mediate the relationship between ethical awareness of consequences and attitudes toward using GenAI tools. Most importantly, ethical awareness affects the adoption of GenAI tools indirectly via personal norms. The implications of this study contribute to both theoretical understanding and practical application of AI adoption in higher education, particularly during periods of crisis. The findings offer valuable insights for policymakers and academic lecturers aiming to integrate GenAI tools into learning environments.

PAPER 24

Factors Affecting Customer Intentions to Use Grab Trike in Zamboanga City, Philippines: An Integrated Analysis Approach

Anna Pearl Iglesia, Klint Allen Mariñas and Michael Calamba
Presenter: Anna Pearl B. Iglesia

ABSTRACT

This study examined the factors that motivate commuters in Zamboanga City to utilize Grab Trike, a recently introduced app-based micro-mobility service. The study utilized the use of the Perceived-Risk Theory with the integration of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT-2) to reach a deeper understanding of a user-commuter behavior. It examined how people's tendency to try the service is influenced by several factors, including its perceived benefits, individual motivation, social influence, and incorporated risk concerns. To identify the critical factors impacting adoption and to shed light on how commuter decisions are influenced by technology and trust, the study employed Structural Equation Modeling (SEM) to show these interactions. An online questionnaire was used to collect surveyed information from 350 qualified participants. The results showed that the Intention to Use (ITU) Grab Trike was significantly impacted by Subjective Norm (SN), Perceived Behavioral Control (PBC), and Attitude Toward Use (ATU). The results also showed that consumers' favorable opinions regarding utilizing the facility were strengthened by motivational factors such as Performance Expectancy, Effort Expectancy, Hedonic Motivation, Price Value, Habit, and Social Influence. The results also emphasized how these attitudes are shaped by perceived risks, including time, money, performance, social, and physical dangers. It is interesting to note that users' preexisting beliefs eased the effects of these threats rather than merely acting as obstacles. Put differently, those who already had a favorable opinion of Grab Trike were less likely to be worried about things like cost, safety, or imaginable inconvenience. Finally, the study sheds light on how social influences, perceived risk, and motivation all have an equal impact on whether new transportation options are accepted in a developing city. To assist the city's objective of creating a more sustainable transportation system, the findings provide Grab, local government entities, and urban transport planners with useful advice on how to improve safety etiquette, pricing systems, and community trust.

PAPER 27

NUDGE-GESI: An Experimental Platform for Testing Digital Nudges for Gender Equality and Social Inclusion in Qatar Using Eye Tracking

Evren Tok and Alaa Zyuid
Presenter: Dr.Alaa Farhan Ziyud

ABSTRACT

This study introduces the NUD-GESI platform, a customized social media simulation to encourage Gender Equality and Social Inclusion (GESI) in the sociocultural context in Qatar. Built on top of the Gorilla Text Builder, it is used to manipulate text stimuli in real-time in environments similar to popular ones, including support for the Arabic language and culturally appropriate filters. Grounded in behavioral science, the platform incorporates co-designed digital nudges such as framing effects and social proof to promote prosocial, inclusive interactions between Arab youth. Its has its scalable, cloud-based infrastructure to support large-scale controlled experiments, pushing the research on digital behaviors and inclusion in society. By bringing together technology and behavioral insights, NUD-GESI provides policymakers, researchers and social media platforms with a powerful tool to harness the power of digital interventions in order to achieve positive social outcomes across different cultural contexts.

PAPER 33

Sustainable CIGS-Based Helmet-Mounted Photovoltaic System with GPS/IMU Sensor Fusion Using UKF: A Simulation-Based Case Study of Food Delivery Riders in Saudi Arabia

Noura Homedi, Lama Mujairdi and Asrar Makin
Presenter: Lama Essa Mujairdi

ABSTRACT

The rapid growth of food delivery services has increased safety concerns for delivery riders who frequently rely on smartphones for navigation while driving. This study proposes a smart helmet system designed to enhance rider safety and operational efficiency by providing hands-free navigation assistance. The helmet integrates GPS and IMU sensors whose measurements are fused using the Unscented Kalman Filter (UKF) to improve positioning accuracy and maintain short-term motion estimation during temporary GPS signal loss. Navigation instructions are delivered through a bone conduction audio system, allowing riders to receive guidance without blocking environmental sounds. To support system sustainability, a lightweight CIGS photovoltaic panel is integrated on the helmet to harvest solar energy and power the embedded electronics. Photovoltaic performance was evaluated using PVsyst based on solar irradiation data for Jeddah, Saudi Arabia, considering three tilt angles (0°, 15°, and 30°). The results demonstrate the feasibility of integrating wearable photovoltaic systems with

intelligent sensing technologies for safer urban food delivery operations.

PAPER 34

Optimal Vehicle Scrapping Decisions of Consumers in Presence of Secondary Markets - Dynamic Programing Approach

Sahil Sahil and S P Sarmah
Presenter: Sarada Prasad Sarmah

ABSTRACT

Vehicle scrappage programs serve a dual purpose of promoting the automobile industry and reducing vehicular emissions. However, the success of scrappage programs depends on consumer participation. In this study, we examine the optimal policy for consumer participation in vehicle scrapping programs, emphasizing the cost incurred by consumers as a key determinant of voluntary engagement. We develop a dynamic optimization model to minimize the costs consumers incur during vehicle ownership. Our findings suggest that frequent drivers derive greater benefits from participation, and monetary incentives provided by policymakers encourage earlier vehicle scrappage. Additionally, we assess an optimal scrappage policy in which the replacement vehicle is an electric vehicle, in the presence of secondary markets. We found that vehicle scrapping programs are effective in secondary-market-dominant regions only if consumers are offered varying subsidies for scrapping their vehicles. Results indicate that replacing an aging vehicle with an electric vehicle offers a cost-efficient alternative by reducing overall lifecycle vehicle expenses. These insights provide a framework for policymakers to design effective subsidy structures, based on the region's secondary-market penetration, that enhance consumer participation. Specifically, implementing heterogeneous subsidies—structured as a varying function of vehicle age—can accelerate consumer engagement in vehicle scrapping programs, thereby maximizing policy effectiveness.

PAPER 35

GUARDIAN: An Operational Multi-LLM Orchestration Platform for Trustworthy AI-Assisted Governance Evaluation

Andrew Vance and Taylor Vance
Presenter: Andrew Steven Vance

ABSTRACT

Artificial intelligence is increasingly used to evaluate governance frameworks, cybersecurity readiness, and emerging technology policies. However, organizations increasingly rely on AI-generated assessments without visibility into how different language models interpret identical governance artifacts. This paper presents GUARDIAN (Governance Using AI, Risk Detection, Intelligence Analytics, and Norms), a consensus-based, multi-LLM orchestration platform that evaluates AI-generated governance assessments. Integrating multiple Western-trained and Arabic-first language models, GUARDIAN provides consensus analysis, identifies interpretive divergence, detects bias and prompt-poisoning, and preserves traceable evidence supporting AI-assisted decision making. Implemented using AWS, FastAPI, PostgreSQL, and Streamlit, the platform supports standalone deployment or API integration with existing government and enterprise systems. Operational testing demonstrated systematic interpretive differences between Western-trained and Arabic-first models, illustrating the value of transparent evaluation of AI-generated governance assessments across diverse cultural and regulatory environments.

PAPER 37

Dynamic Detection System for Hazardous Behavior based on the Integration of Gaze and Posture Information from LiDAR Data

Sota Kimpara, Miku Kikkawa, Kojiro Ohara and Sumika Arima
Presenter: Miku Kikkawa

ABSTRACT

While crane operations in manufacturing are inherently high-risk, safety monitoring remains predominantly manual -even when supported by video surveillance- and this approach has proven insufficient to reduce industrial accident rates. To address this limitation, this study proposes a smart monitoring system using RGB-D data to automatically detect hazardous behaviors: "Distraction" and "Contact". For the Distraction detection, the system integrates YOLO-face, Gaze360, and LiDAR data to quantify 3D attention clusters, prioritizing distracted gaze during load movement to reduce false alarms. For the Contact detection, YOLO-Pose and ByteTrack enable consistent 3D coordinate tracking of operators and loads, approximating the load as a geometric model to identify physical proximity. This novelty lies in achieving robust 3D behavior understanding using a single monocular RGB-D sensor in dynamic environments. Experimental results demonstrate the feasibility of the proposed framework, providing a foundation for future real-time industrial safety monitoring.

PAPER 38

Independent and shared resources in a workforce-integrated flexible manufacturing system

Kombaya Touckia Vital Jesus, Audeon Esther and Paredes-Astudilo Yenny Alexandra
Presenter: KOMBAYA or PAREDES ASTUDILLO

ABSTRACT

Incorporating human workforce into flexible manufacturing systems is essential for maintaining companies' competitiveness. Fully automated systems restrict flexibility, whereas the workforce could be considered to improve it : humans can learn, understand, and adapt. This paper studies a flexible manufacturing system that incorporates human operators and considers two variants of a problem : independent resources (two operators assigned to separate stations requiring workforce) and shared resources (one operator assigned to both stations). The objective is to evaluate their impact on system performance, including workforce-related indicators. A deterministic approach based on mathematical models is proposed for small and mid-sized instances, while a simulated annealing algorithm is used for larger instances. Initial solutions for the latter are generated using the NEH heuristic. The computational results show that independent resources lead to unbalanced workloads, whereas shared resources increase the makespan by 12.91% in average.

PAPER 40

From Data to Policy: A UTAUT-Based Decision Framework for Sustainable ChatGPT Integration in Computer Science Education

Mohammed Alshehhi
Presenter: Mohammed Alshehhi

ABSTRACT

Higher education institutions face urgent decisions about integrating generative AI tools such as ChatGPT into Computer Science (CS) curricula, yet most policy responses remain reactive rather than evidence-based. Applying the Unified Theory of Acceptance and Use of Technology (UTAUT), this study tests whether Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), and Facilitating Conditions (FC) predict CS students' Behavioural Intention (BI) to use ChatGPT as a learning copilot. A cross-sectional survey of undergraduates in CS, Cyber Security, Data Science, and Software Engineering programs (N = 325) was analysed using PLS-SEM with bootstrapping. The model explained 84.2% of variance in BI. PE was the dominant predictor ($\beta = 0.627$, $p < .001$) and FC a meaningful secondary driver ($\beta = 0.324$, $p < .001$); EE and SI were non-significant in this post-adoption sample. Findings inform a four-pillar policy framework for sustainable institutional AI integration in CS programs.

PAPER 41

Data-Driven KPI Prioritization for Poultry Meat Supply Chain Performance and Farmer Sustainability

Muhammad Kevin Alfirdaus, Elisa Kusrini, Winda Nur Cahyo and Imam Djati Widodo
Presenter: Muhammad Kevin Alfirdaus

ABSTRACT

This study develops a data-driven performance measurement framework for the poultry meat supply chain to support operational decisions and farmer sustainability. A descriptive quantitative case study was conducted at Pawon Ayu, Kartasura, Indonesia, using observations, interviews, documentation, focus group discussions, and Analytical Hierarchy Process (AHP). Seven collaborative data groups were identified: demand, stock, production, distribution, sales, financial, and logistics. Demand emerged as the top priority (0.4087), followed by stock (0.2206) and production (0.1266). Key indicators include poultry consumption, meat availability, and daily production volume. A traffic light system translates inventory KPIs into actionable signals for decision-making. Validation through multi-stakeholder discussions confirms alignment between prioritized indicators and real operational practices. The framework enhances data transparency, supports collaborative dashboards, and enables faster, more informed decisions across the supply chain.

PAPER 42

A Link Level Joint Optimization Model for Train Timetabling and Maintenance Task Scheduling

Goutam Sen and Sanjay Kalsangra
Presenter: Goutam Sen

ABSTRACT

In this paper, we consider the problem of scheduling the trains in the event of planned maintenance blocks in a Railway network. We need to generate appropriate dispatching plans to reconsider the affected train movements in order to minimize the overall delay experienced by commuters. This paper proposes an alternative approach in which the train timetable is

made to accommodate the preventive maintenance schedule in order to avoid the exercise of rescheduling the original timetable during the maintenance time windows. This will also help to improve the commuting experience since the passengers usually relate the quality of service directly to the timetable without being aware of the in-built provisions for maintenance work. This problem is a part of the Railway challenge published by the Railway Application Section (RAS) of INFORMS in 2016. We provide a link-level model to optimize the joint problem of train timetabling and maintenance scheduling in a given network. The output is a timetable that minimizes the travel time of all trains while respecting several operational constraints and maintenance needs. We develop a Binary Integer Linear Programming (BILP) formulation and validate our model with a toy instance.

PAPER 43

AI-driven sustainable cold chain management strategic roadmap in the processing food industry in Vietnam: A data-driven approach

Nguyen Do-Nhu-Loan, Bui Tat-Dat and Tseng Ming-Lang
Presenter: Do-Nhu-Loan Nguyen

ABSTRACT
Adopting artificial intelligence (AI) into sustainable cold chain management (SCCM) implementation is an important strategy to control real-time temperature, maintain product quality, and increase the cold chain performance and effectiveness. However, most previous research offers individual insights and lack of comprehensive research to support SCCM management implementation with AI integration. Therefore, this study build a AI-driven SCCM framework and explore the interrelationship among attributes to illustrate the important impact in practicing SCCM. Nevertheless, AI-driven SCCM implementation is a complex process that can challenge firms in sustainable practices and operating smart procedures. Thus, this study adopts diffusion of innovation theory to explore the dynamic impact on AI implementation in the SCCM process and improve firms' performance. To increase the accuracy and dependability of results, this study employs combination of various methods, including content analysis, entropy weight method, fuzzy delphi method, exploratory factor analysis, fuzzy synthetic evaluation and decision-making trial evaluation laboratory. The findings provides a systematic analysis to design suitable strategies and increase the SCCM performance by identifying the causal aspects, including autonomous intelligent agent implementation, resilient supply chain planning, low-carbon network competence, and smart cold chain operations. Besides, practical implication is suggested based on the top important criteria, including green packaging, reinforcement learning, inventory optimization, predictive control, distribution planning.

PAPER 44

Optimising the Integration of Floating Hospital with On-land Health Services

Paulina Kus Ariningsih, Fran Setiawan, Titi Iswari, Carles Sitompul and Fadillah Ramadhan
Presenter: Paulina Kus Ariningsih

ABSTRACT
Floating hospital is essential health services in archipelagic countries to cover the remote islands area. However, the current research is still focused on the optimisation the disaster or epidemic conditions leaving the opportunity of integration with on-line health services. Therefore, this research aims to develop a multi period Mixed Integer Linear Programming (MILP) optimisation model for resource allocation for floating hospital in the integration with on-land health facilities considering strategic and tactical decisions of service coverage, equity and operational efficiency using multimodal transportation to ensure affordability and equity of the services across regions. The model is implemented in the dataset inspired by the healthcare conditions in remote archipelagic of Indonesia. Managerial implications and future research opportunities are also presented

PAPER 47

Policy Stress Testing of Humanitarian Relief Networks under Disruption: A Preference-Guided Multi-Objective Optimisation Approach

Ismail Ali
Presenter: Ismail M. Ali

ABSTRACT
Disrupted humanitarian supply chains require decisions that are fast, interpretable, and robust to operational deterioration. This paper develops a policy stress-testing framework for relief-network planning under disruption by transforming multi-objective optimisation outputs into policy classes that can be compared under different operating scales. A scenario-based humanitarian supply chain model is solved using a preference-guided extension of NSGA-II, and the resulting non-dominated solutions are translated into lean, balanced, and resilient policy classes. Three test cases are considered, representing local, regional, and corridor-level relief operations. The numerical study shows that preference-guided search consistently identifies policies with better service continuity and lower resilience loss than classical baselines, while the graphical stress-testing analysis clarifies the trade-off between additional cost and service protection. The study

demonstrates how disruption data can be converted into policy-relevant insight for humanitarian logistics planning.

PAPER 50

A Reliability-aware Reinforcement Learning-based method for Budget-constrained Sourcing and Distribution under Multiple Uncertainties

Zhongyi Chen and Xiaoping Li
Presenter: Zhongyi Chen

ABSTRACT

As a pivotal intermediary in the supply chain, retailers must undertake two key responsibilities: fulfilling customer demands and sourcing from suitable suppliers. However, in increasingly complex supply chains, both stochastic customer demands and stochastic supplier disruptions present retailers with new challenges in fulfilling these responsibilities. This paper studies a budget constrained sourcing and distribution problem for a retailer under multiple uncertainties. Customer demands arrive stochastically, while suppliers may suffer stochastic disruptions and uncertain recovery processes. To minimize total demand tardiness under a limited sourcing budget, a reliability aware reinforcement learning method is proposed. The method integrates reliability theory with reinforcement learning through three modules. A reliability aware heuristic strategy evaluates suppliers and provides robust strategies. An enhanced learning component generates intelligent dynamic policies. A decision fusion training architecture adaptively combines heuristic and learned decisions according to real time system conditions. Numerical experiments under four uncertainty scenarios show that the proposed method achieves higher cumulative rewards than representative reinforcement learning methods and lower tardiness than competing methods for similar problems.

PAPER 53

Proactive Scheduling for Production Spike Mitigation in Semiconductor Manufacturing

Ke Li, Kodai Fujita, Chengding Mao, Tomoya Iwasaki and Sumika Arima
Presenter: KE LI

ABSTRACT

This study investigates proactive scheduling for production spike mitigation in semiconductor manufacturing under temporary capacity fluctuation caused by production machine failures and recoveries. A phase-dependent control framework is developed with two mechanisms: machine allocation control and release control. Machine allocation control switches policies across production phases to reduce queue-time constraint (Q-time) violations and inter-product imbalance, while release control adjusts release quantities during predicted degradation periods to limit work-in-process (WIP) accumulation and waiting-time violations. Degradation periods are identified using either a data-driven failure-probability model based on machine data or a Weibull-based probabilistic model. Performance is evaluated in terms of throughput, cycle time, waiting time, variability, and rework rate. Both proactive strategies outperform the reactive baseline. Moreover, the data-driven approach reduces cycle time, waiting time and rework while maintaining stable throughput. These results demonstrate that degradation-aware proactive scheduling can mitigate production spikes and improve operational performance in non-stationary semiconductor manufacturing environments

PAPER 54

Syntactic Variety, Behavioural Collapse: A Pre-registered Decision-Trace Audit of LLM-Generated Combinatorial Heuristics

Achraf Ghorbel, Nourchène Elleuch Ben Ayed, Nassim Tinkicht, Mahdi Jemmali, Majed Bouchahma and Osama Hosam
Presenter: Majed Bouchahma

ABSTRACT

LLM-driven heuristic design frameworks, including FunSearch, EoH, ReEvo, and their successors, often treat independently sampled code outputs as a diverse candidate pool, with diversity assessed at the codehash or token-edit level. Whether this syntactic variation translates into behavioural diversity has not been tested directly. We report a pre-registered audit of 900 heuristic implementations generated by three 7Bclass open-weight code-specialised models on two NP-hard problems, 0/1 knapsack and one-dimensional bin packing, under a five-level prompt ablation from canonical labelling to full adversarial domain anonymisation. The Output Trajectory Signature (OTS), a decision-trace equivalence framework applied to a fixed nine-instance battery, reveals severe behavioural compression: 278 syntactically distinct knapsack implementations reduce to eight OTS classes (IDR = 34.75; 95% CI [21.88, 44.00]), and 126 bin-packing implementations reduce to thirteen (IDR = 9.69; 95% CI [6.08, 9.75]). Canonical labelling produces a directional shift in textbook-baseline matching for bin packing (PAI = 0.171), although its bootstrap interval spans zero; the canonical-adversarial distributional test remains underpowered. Behavioural convergence persists under full adversarial anonymisation, suggesting a structural prior that survives surface-level domain re-skinning. Code-hash diversity substantially overstates the effective behavioural coverage of

LLM-generated heuristic pools; behavioural equivalence auditing should therefore precede claims of heuristic diversity, novelty, or prompt-induced exploration.

PAPER 55

Towards Accurate Wind Speed Forecasting: A Comparative Analysis of Classical Time Series and Deep Learning Models Under Varying Noise Levels

Ahmed Abughali, Mohamad Alansari, Ameena Saad Al-Sumaiti and Maher Maalouf
Presenter: Ahmed Abughali

ABSTRACT
The increasing penetration of renewable energy sources has introduced significant variability into modern power systems, making accurate short-term forecasting essential for reliable planning and operation. Among renewable resources, wind energy is particularly challenging due to its strong intermittency and nonlinear temporal behavior. This study presents a comparative evaluation of classical statistical and deep learning models for short-term wind speed forecasting, including Moving Average (MA), Simple Exponential Smoothing (SES), Double Exponential Smoothing (DES), Triple Exponential Smoothing (TES), Autoregressive Integrated Moving Average (ARIMA), and Long Short-Term Memory (LSTM). The models are assessed using a real-world wind speed dataset from California covering the years 2021--2022 at a 5-minute resolution. To ensure a fair comparison, model hyperparameters are tuned using a rolling-window validation framework, after which final performance is reported on a 30\% hold-out test set. In addition, robustness is investigated under different additive white Gaussian noise (AWGN) levels. The results show that LSTM achieves the best overall forecasting accuracy, while ARIMA remains highly competitive and robust under noisy conditions, which shows the importance of modeling temporal dependence and noise resilience for reliable short-term wind speed forecasting.

PAPER 56

An Expert-Driven Multi-Criteria Decision Support Framework for Bidirectional Buyer–Supplier Evaluation

Youssef Elsherif, Marwan Elsehly, Zahraa Bakr, Omar Abdelghany and Zakaria Yahia
Presenter: Zakaria Yahia

ABSTRACT
In contemporary supply chains, supplier selection has been extensively studied using Multi-Criteria Decision-Making approaches, while the evaluation of buyers from the supplier’s perspective remains comparatively underexplored. This study proposes an expert-driven multi-criteria decision support framework for bidirectional buyer–supplier evaluation that formalizes both supplier and buyer assessment within a unified structure. Industry experts from FMCG sector were surveyed to identify and weight evaluation criteria using direct weighting and Analytic Hierarchy Process (AHP) pairwise comparisons. The framework integrates AHP, TOPSIS, and VIKOR to comparatively evaluate ranking behavior under different organizational contexts. In addition, the model distinguishes between binary qualification criteria and weighted performance criteria to better reflect real industrial decision practices. The proposed framework is implemented within an interactive decision-support system and evaluated through multiple comparative

PAPER 57

Digital–Circular Integration in Construction: A Pathway-Based Analysis from the UAE

Than'a Alsaoudi, Adolf Acquaye, Shahad Alhosani and Malik Khalfan
Presenter: Shahad Alhosani

ABSTRACT
The construction industry is increasingly adopting digital technologies to support circular economy (CE) practices; however, the effective integration of these approaches in practice remains unclear. This paper examines digital–circular integration as a pathway dependent process within the construction industry in the United Arab Emirates (UAE). Drawing on semi-structured interviews with nine industry experts, the study employs a qualitative, process-oriented approach to explore how integration evolves throughout the project lifecycle and how organizational and project conditions influence its development. The findings identify three integration pathways: intentional, emergent, and hybrid. Strategic decisions and regulatory requirements drive intentional pathways, emergent pathways arise through learning during project execution, while hybrid pathways combine early planning with adaptive implementation. The results show that integration outcomes are shaped primarily by leadership, timing, governance, and organizational alignment rather than by technological capability alone. By conceptualising integration as a dynamic, pathway dependent process, the paper advances understanding of how digital and circular strategies can be more effectively aligned and provides practical insights for achieving more consistent and scalable implementation.

PAPER 59

System Reliability Analysis of Correlated Multi-Asset Stop-Loss Positions Using FORM, Ditlevsen Bounds, and Sobol Attribution

Bassem Saassouh

Presenter: Bassem Saassouh

ABSTRACT

Standard per-asset risk tools do not aggregate correlated failures into a single system-level breach probability with design-point scenarios and factor attribution. This paper formulates the multi-asset stop-loss problem as a six-dimensional series-system reliability problem at the terminal horizon. Three correlated loss shocks and three uncertain volatilities enter through the Nataf transformation. FORM locates the component design points and Ditlevsen bounds bracket the system failure probability. On an illustrative Gold--Silver--Bitcoin case study at a one-week horizon, FORM-based inclusion--exclusion gives 0.228 against Monte Carlo 0.223. The assumed correlation reduces the union probability by 4.8 percentage points relative to independence. Failures cluster rather than become universally less likely. A Sobol decomposition attributes about 55 percent of Silver's stop-breach variance to a latent factor aligned with Gold's shock. The three volatility uncertainties together contribute below 1 percent of system-margin variance.

PAPER 60

Income Inequality and Stakeholders' Perceptions of Public Health Care System Efficiency in India: A Social Determinants Perspective

Vipin Raj P G, Shalini M Nair, Balagopal G Menon and Praveensal C J

Presenter: VIPIN RAJ P G

ABSTRACT

The present study aims to compare the valuation of public health care systems' performance efficiency from stakeholders' perspective categorized based on their income. Questionnaire data were analyzed using structural equation modeling. Data analysis indicated that stakeholders across both income groups positively associated health care quality, adequacy of facilities, and professional competency with the performance efficiency of public health care systems. In contrast, 'trust' demonstrated a negative association, which is a counterintuitive behavior, with perceived performance efficiency in both income groups. The observed negative association between trust and perceived system performance, particularly among high-income stakeholders, may be interpreted through the lens of cognitive dissonance, wherein expectations shaped by private-sector experiences conflict with perceptions of public health care delivery.

PAPER 61

Joint Fleet Sizing and Tactical Routing for Aerial Wildfire Suppression under Wind Uncertainty

Yujun Fan and Qiuhong Zhao

Presenter: Yujun Fan

ABSTRACT

We study the joint problem of fleet sizing and tactical deployment in aerial wildfire suppression under wind uncertainty. The strategic decision selects a heterogeneous fleet of helicopters, amphibious water scoopers, and land-based airtankers, and assigns these airframes across operational bases. The tactical decision routes each airframe over a type-specific time-space-state network and schedules water and retardant drops, forming a contiguous containment line anchored to non-flammable terrain. We formulate the problem as a two-stage stochastic integer program in which the second stage couples a wind-driven cellular-automaton fire model with a multi-commodity routing problem and a discrete control-line construction problem. Wind scenarios are sampled from a regime-switching vector autoregression with Gaussian-process spatial downscaling that captures temporal regime persistence and spatial coherence of the wind field. We solve the program by an exact integer L-shaped decomposition strengthened by monotonicity-based dominance cuts that certify entire down-sets of the binary fleet lattice per scenario evaluation, with each scenario subproblem evaluated as a compact mixed-integer program. Computational experiments on a calibrated multi-type instance show that the cost-minimising fleet pairs a single helicopter as an early-response unit with three land-based airtankers as a perimeter-installation unit, exploiting the complementary roles of temporary water suppression and permanent retardant lines while satisfying airspace non-overlap constraints.

PAPER 62

Data-Driven Robust Fleet Assignment with Contextual Demand Uncertainty: A Budgeted Uncertainty Approach

Qiuhong Zhao and Jun Huang
Presenter: Jun Huang

ABSTRACT

Fleet assignment choices influence passenger booking behavior, but conventional robust optimization overlooks this decision-demand dependency, leading to suboptimal revenue performance. This paper addresses this gap by proposing a data-driven contextual robust optimization framework for the fleet assignment problem (FAP) under demand uncertainty. Leveraging historical operational data, we construct a context-dependent demand prediction model in which both fleet assignment variables and ticket prices serve as fixed-design covariates. The demand uncertainty set is parameterized by a budget of uncertainty controlled by a protection level parameter, enabling a tunable trade-off between revenue maximization and robustness against demand fluctuations. The resulting model is formulated as a mixed-integer linear program (MILP). For large-scale instances, we propose a column-and-constraint generation (C&CG) algorithm enhanced with fix-and-optimize heuristics. Numerical experiments on real-world airline data demonstrate that our contextual robust model outperforms deterministic and non-contextual robust benchmarks, improving worst-case revenues by 12–18% with acceptable computational overhead.

PAPER 63

Constructive heuristics and simulated annealing for identical parallel machine scheduling with DeJong learning effect and interval wise energy limits

Moaaz Alshehadat, Mahdi Jemmali and Lotfi Hidri
Presenter: Moaaz Al Shehadat

ABSTRACT

This paper studies an identical parallel-machine scheduling problem with DeJong’s learning effect and interval-wise energy limits. Each job has a nominal processing time and a power rate. Processing times are position dependent and decrease according to DeJong’s learning model, while the total energy consumption within each interval must remain below a predefined limit. The objective is to minimize the makespan while maintaining energy feasibility. Three constructive heuristics are considered: Modified Longest Time First (MLTF), Modified Shortest Time First (MSTF), and Random Scheduling (RS). In addition, Simulated Annealing (SA) is applied as an improvement method initialized from the feasible MLTF schedule. The computational study is based on a benchmark of 5760 generated instances. The methods are evaluated using number of wins, average relative gap, and runtime. Computational results show that SA achieved the strongest overall performance, obtaining 3072 wins (53.34% win rate) and the lowest average relative gap of 0.035976. Among the constructive heuristics, MSTF achieved the strongest baseline performance.

PAPER 64

Coordinating Emission Reduction in a Multi-Supplier Green Supply Chain

Hexin Wang
Presenter: Hexin Wang

ABSTRACT

This paper studies coordination of emission reduction in a green supply chain with one manufacturer and multiple heterogeneous suppliers. Suppliers bear abatement investment costs while the demand benefit from a greener final product is shared across the channel. We develop an analytical game model with endogenous retail pricing and fixed abatement investment costs. The results show that decentralized decisions reduce total supply chain profit and misalign abatement incentives but may induce higher abatement than the centralized benchmark when high-margin low-cost suppliers over-invest in abatement capability. We then design two second-best overlay contracts cost sharing and manufacturer subsidy that operate on top of existing wholesale prices. The multi-supplier structure matters because the two contracts aggregate supplier heterogeneity differently and create cross-supplier demand spillovers. Numerical results compare both profit recovery and abatement proximity to the centralized benchmark.

PAPER 65

Retrieval-grounded robot program generation and simulation-based correction via Model Context Protocol

Zhichao Zhou, Siyuan Chen, Omkar Salunkhe, Ebru Turanoglu Bekar, Johan Stahre and Anders Skoogh
Presenter: Siyuan Chen

ABSTRACT

Flexible manufacturing requires industrial robots to be reprogrammed rapidly as product variants change. However, existing natural-language robot programming workflows often stop at text-level generation or retrieval grounding, leaving execution-level failures in vendor-specific simulation environments insufficiently addressed. This paper presents a language-model-based workflow that generates, validates, and iteratively corrects ABB RAPID robot programs from natural language task descriptions. A dual-stream retrieval-augmented generation (RAG) pipeline grounds code generation in verified technical documentation and production templates, substantially reducing domain-specific errors produced by ungrounded language models. A custom Model Context Protocol (MCP) server connects the language-model client directly to ABB RobotStudio for automated code upload, simulation execution, and diagnostic feedback. The evaluation combines a 30-query retrieval benchmark, scoped code-generation checks, and RobotStudio case studies in a simulated pick-and-place manufacturing cell. The simulation loop exposes execution failures that static and semantic checks alone cannot catch, including suction release-height errors, unreachable placement targets, and configuration-dependent recovery motions. The results show how RAG and MCP can connect grounded code generation with executable feedback from industrial robot simulation software, reducing domain-specific errors and iteration effort while retaining expert setup and final supervision as necessary boundaries.

PAPER 69

Governance of Data-Based Technologies for Sustainable and Resilient Supply Chain Decision-Making: Large Language Models as an Illustrative Case

Mohammad Yaser Mofatteh and Omid Fatahi Valilai

Presenter: Mohammad Yaser Mofatteh

ABSTRACT

Data-based technologies are increasingly embedded in supply chain decision-making, where they transform distributed operational, environmental, and organisational data into forecasts, summaries, recommendations, and decision-support outputs. While these technologies can improve visibility, responsiveness, sustainability performance, and resilience, they may also amplify risks when outputs are inaccurate, opaque, weakly validated, or used without clear accountability. This paper develops a governance-oriented framework for data-based technologies in sustainable and resilient supply chain decision-making, with large language models used as an illustrative case. The framework is structured around four governance checkpoints: application context, regulatory sensitivity, model validation, and impact and feedback monitoring. The paper contributes a conceptual basis for integrating governance into data-supported decision processes and highlights the importance of human oversight, validation, auditability, and feedback learning in preventing risk escalation.

PAPER 74

A System Dynamics Model of Worker Fatigue and Cognitive Performance under Rotating Shift Schedules: A Policy-Oriented Approach

Dagoberto Castillo Giraldo, Karen Niño Mora and Laura Valentina Velásquez Castiblanco

Presenter: Dagoberto Castillo Giraldo

ABSTRACT

Personnel scheduling models in industrial engineering typically represent fatigue as a static counter computed from schedule structure, ignoring the time-dependent dynamics of homeostatic sleep debt and circadian-modulated recovery documented in the biomathematical literature. This paper proposes a system dynamics model that integrates the two-process homeostatic-circadian formulation, circadian-phase-dependent sleep efficiency, and chronotype heterogeneity within an explicit stock-and-flow structure with two feedback loops. The model is implemented in Vensim with hourly resolution and applied to four canonical shift patterns under three chronotypes. The contribution is methodological: it brings the system dynamics framework to a problem domain dominated by closed-form ODE models and provides a transparent policy-evaluation tool aligned with the conference theme From Data to Policy.

PAPER 75

Toward a conceptual model for evaluating the transparency of data collection: an exploratory study applied to e-commerce websites in France

Sarah Zohra Makhloufi and Lamia Berrah

Presenter: Sarah Makhloufi

ABSTRACT

Transparency is a central requirement in personal data governance, yet users are frequently exposed to legal disclosures they do not understand. This paper conceptualises transparency as a dual construct: a structural dimension, covering the formal conditions of information provision, and a cognitive dimension, addressing observable conditions for comprehensibility. Within the GDPR and the WP260 guidelines, a conceptual evaluation model is operationalised through a generic grid of 24 observable criteria organised around these two dimensions. It is applied to an exploratory audit of 20

e-commerce websites across five sectors in France, conducted between January and March 2026. The audit yields an overall transparency score of 90.7%, with a structural score of 95.4% and a cognitive score of 86.0%. This gap indicates that legal compliance alone is insufficient to guarantee genuine intelligibility. The framework is designed to support reproducible assessment through explicit criteria and scoring rules, and to be transferable beyond e-commerce to any digital environment where personal data are collected and disclosed.

PAPER 76

A Resource-Based View Analysis of Generative AI for Sustainable Supply Chain Planning

Afef Saihi, Zied Bahroun and Maya Hendawy
Presenter: Afef Saihi

ABSTRACT
Supply chain planning coordinates demand, sourcing, inventory, capacity, logistics, and disruption response across complex supply networks. Sustainability pressures have expanded planning beyond cost and service performance to include environmental performance, resilience, social and ethical responsibility, transparency, and accountability. At the same time, organizations are exploring Generative Artificial Intelligence (GenAI) to support scenario generation, knowledge synthesis, decision explanation, and natural-language interaction with planning systems. Drawing on the Resource-Based View (RBV), this paper examines how GenAI technological resources and associated organizational capabilities can contribute to competitive advantage in sustainable supply chain planning. The study analyzes five resources: large language models, retrieval-augmented generation, GenAI-enabled optimization and decision analytics, multi-agent GenAI systems, and knowledge graphs. It also examines six capabilities, including GenAI proficiency, data governance, sustainability-aware planning, ethical oversight, human-AI collaboration, and cross-functional learning. The analysis argues that GenAI creates value when embedded within firm-specific knowledge, data, governance routines, and human expertise.

PAPER 79

AaSoM: A Novel Unified Spatial-Temporal Motion Framework using Multi-Head Attention and BiGRU for Indian Sign Language Recognition

Priyanka Suresh, Hari Kumar Reddy B, Vansh Gupta, Madhusmita Das and K L Sai Prasad
Presenter: Priyanka Suresh

ABSTRACT
Sign language is considered a spatial-temporal representation of patterns, where curvature, acceleration, and dynamic intensity play major roles. However, existing self-supervised skeleton-based sign language recognition (SLR) methods primarily depend on static joint configurations and first-order derivatives, limiting motion-capture from higher-order motion derivatives. In this paper, we propose an Attention-adaptive Second-order Motion (AaSoM) framework, a hybrid Attention-BiGRU architecture for Indian Sign Language (ISL) recognition that operates on three-stream skeletal kinematics (pose, velocity and acceleration), extracted using MediaPipe and concatenated to a unified spatial-temporal representation. Our proposed approach enriches skeletal representation and captures salient inter-joint dependencies that demonstrate robust temporal modeling with strong generalization across the datasets used. The performance of our AaSoM framework is evaluated using loss function, and accuracy metric. Our experimentation achieved a testing accuracy of 89.14% and reduced loss across 50 epochs. Along with this we have compared our framework with other state-of-the-art models. Thus our findings highlight the need for a higher-order dynamics (second-order) in skeleton-based (spatial-temporal) self-supervised SLR learning.

PAPER 84

Energy-Efficient Identical Parallel-Machine Scheduling with Time-of-use Costs to Minimize Makespan

Abdelaziz Bin Darwish and Mahdi Jemmali
Presenter: Mehdi Jammali

ABSTRACT
We study the scheduling of jobs on identical parallel machines billed under a time-of-use electricity tariff, with the goal of minimizing the completion time of the last job while keeping the total energy cost within a fixed budget. The duration of a job shortens with its position on a machine, following a DeJong learning curve. On 60 benchmark instances we compare nine methods: a weak reference rule, five classical heuristics (list scheduling, longest-processing-time assignment, price-aware insertion, simulated annealing, and a genetic algorithm), and three reinforcement-learning policies trained with the learning effect active. When only the completion time matters, the strong heuristics closely rival the learned policies at a fraction of their running time. Under an active energy budget, however, the strong heuristics lose feasibility almost everywhere, and the energy-aware methods, led by the learning-based policies, deliver the lowest feasible completion time.

PAPER 85

A Mathematical programming approach for solving Heterogeneous-Drone assisted Electric vehicle routing-based last-mile delivery problems

Mohammad Humyun Fuad Rahman, Ruhul Sarker and Saber Elsayed
Presenter: Mohammad Humyun Fuad Rahman

ABSTRACT
This paper studies a sustainable last-mile delivery problem, which is one of the most complex vehicle routing problems. The problem consists of customer parcel allocation and the routing of an electric vehicle and a heterogeneous fleet of drones to distribute parcels to customers. To optimize this problem, a Mixed-Integer Linear Programming (MILP) model is formulated with the objective of minimizing the total weighted tardiness. The model is solved using an exact approach with the CPLEX optimization solver on nine realistic problem instances ranging from 5 to 15 customers. Numerical results show that parcel delivery planning with multiple heterogeneous drones and a single EV provides better solutions than single drone-EV combinations.

PAPER 86

Automated Tool Validation Framework for Tooling Consistency and Workflow Standardization in Siemens NX CAM

Joel Canada and Mark Christian Manuel
Presenter: Joel Bacani Canada

ABSTRACT
This study presents an automated tool validation framework developed within Siemens NX CAM using NX Open Python scripting to improve tooling consistency and workflow standardization in CNC programming environments. The framework integrates sequential tool renumbering, duplicate tool detection, diameter validation, material classification, and unused-tool cleanup through rule-based automation logic. The implementation was evaluated using multiple CAM files with varying tooling complexity through before-and-after validation analysis. Initial results demonstrated improvements in tooling-data organization, reduction of duplicate-tool conditions, and enhanced workflow consistency. The proposed framework supports digital manufacturing and intelligent manufacturing initiatives by reducing repetitive manual verification tasks and improving tooling-data reliability within CAD/CAM workflows.

PAPER 88

A Framework for Coordinated Multi-Agent Reasoning with Dynamic Quality Assurance: Theory and Application to Legal Analysis

Osama Hosam, Achraf Ghorbel, Nassim Tinkicht and Nourchène Elleuch Ben Ayed
Presenter: Osama Hosameldeen

ABSTRACT
The intersection of artificial intelligence and complex reasoning tasks demands systems that can integrate diverse expertise while maintaining rigorous quality standards. This paper introduces a novel framework for coordinated multi-agent reasoning that addresses three fundamental challenges: maintaining analytical consistency across specialized agents, dynamically validating output quality without human intervention, and optimizing resource allocation across reasoning tasks. While demonstrated in the legal domain—specifically through a multi-agent system for patent infringement analysis—the framework's principles are domain-agnostic. The key theoretical contributions include a formal model of context-chaining that enables agents to build upon prior analyses while preserving specialized perspectives, and a multi-dimensional quality metric comprising coherence, groundedness, completeness, and structure that achieves 0.84 correlation with human expert judgments. Empirical evaluation shows that persona-based specialization yields 23% higher quality scores than single-agent baselines, context chaining contributes an additional 11% improvement, and iterative validation boosts reliability by 31%. From these results we derive three generalizable design principles for multi-agent reasoning systems: the specialization-consistency trade-off, the quality-cost frontier, and validation-driven optimization. These principles provide a blueprint for building AI systems capable of expert-level analysis across domains such as medicine, finance, and engineering.

PAPER 89

From Infrastructure to Networks: The Role of Supply Chains in Oman’s Trade Development

Alla Al Balushi and Meilinda Maghfiroh
Presenter: Meilinda Fitriani Nur Maghfiroh

ABSTRACT
In the Sultanate of Oman, the logistics sector is considered one of the most significant industries due to the country’s strategic location at the crossroads of major international trade corridors. This paper examines the impact of logistics and

supply chain management (LSCM) on enhancing Oman's trade connectivity, with particular reference to logistics infrastructure, IT integration, policies, and best practices. A quantitative research design is employed, incorporating statistical techniques such as correlation and regression analysis, alongside the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method, to identify and evaluate the causal relationships between variables. The findings highlight the need to address infrastructure gaps, strengthen technology adoption, and foster multi-stakeholder engagement to fully realize Oman's potential as a logistics hub. Accordingly, developing and implementing targeted measures are essential to leverage Oman's geographical advantage, improve trade facilitation, enhance competitiveness, and support economic diversification. The results of this study provide valuable insights for policymakers and industry stakeholders, offering recommendations to advance the performance of Oman's logistics sector while contributing to the achievement of sustainable development goals.

PAPER 90

Breaking the Eye-Level Advantage: An Eye-Tracking Study of Partitioned Retail Shelf Displays

Nourseen Newegy, Mohamed El-Baz, Yousif Allam, Mariam Sarhan, Mohamed Gergawi and Amr Eltawil
Presenter: Amr Mohamed Bahgat Hassan Eltawil

ABSTRACT
Standard retail shelf configurations impose unequal attention patterns, with eye-level products consistently attracting disproportionate gaze, while items on upper and lower shelves remain perceptually disadvantaged. This study examines whether physical shelf partitioning can reduce this positional bias by assigning each product to a bounded display compartment hence, redistributing fixation behavior uniformly across shelf levels. A controlled laboratory experiment using replica retail shelves and head-mounted eye-tracking compared fixation counts and durations across standard and partitioned configurations of a small home appliance display, while counterbalanced presentation and product rotation were used to isolate structural effects. The standard configuration produced a clear attention hierarchy, with statistically significant differences across shelf levels. In contrast, the partitioned design yielded statistically balanced fixation behavior across levels, with the bottom shelf showing the largest absolute gain. The findings suggest that structural partitioning enhances visual balance through common-region cues, offering practical implications for retail merchandising and shelf-space management.

PAPER 91

From Conceptual Promise to Operational Reality: Supply Chain Professionals' Perspectives on Blockchain Dispute Resolution

Marianna Riabova
Presenter: Marianna Riabova

ABSTRACT
Supply chain disputes constitute a major operational challenge for modern organizations because of the increasing complexity, globalization and interdependence of supply networks. Blockchain-based dispute resolution has been conceptually presented as a promising solution able to improve transparency, traceability, trust and automation. However, empirical evidence regarding managerial perceptions and organizational readiness remains limited. This paper addresses this gap through 19 semi-structured interviews with supply chain professionals. The findings show that adoption of blockchain-based dispute resolution remains extremely limited. Supply Chain managers, however, recognize its potential for standardized data-intensive disputes, especially billing, freight audit and delivery verification, but underline technological, legal, organizational and relational barriers. The paper argues that hybrid human-centered mechanisms are more realistic than fully autonomous blockchain arbitration in the short term.

PAPER 93

Sustainable Learning Modes in Higher Education: An AHP-Based Multi-University Study

Pieve Serenity Pancho, Klint Allen Marinas and Benedict Banaag
Presenter: Benedict B. Banaag

ABSTRACT
Universities are increasingly exploring learning delivery systems that support both educational effectiveness and sustainability. This study evaluates student preferences for different learning modes using the Analytic Hierarchy Process (AHP) to identify the most suitable learning delivery approach in higher education. Data were collected from students across multiple universities and analyzed using five criteria: learning effectiveness, cost, flexibility, interaction, and technology. The results indicate that learning effectiveness and cost are the most influential factors in learning mode selection. Among the evaluated alternatives, face-to-face learning obtained the highest preference, followed by blended learning, Tri-X, and ubiquitous online experience (UOX). While traditional classroom learning remains highly valued, flexible and hybrid learning

approaches offer opportunities to support more sustainable educational systems by reducing commuting requirements and optimizing institutional resources. These findings provide insights for universities seeking to design learning delivery systems that balance student preferences with sustainable and adaptive higher education practices.

PAPER 94

Consumer Preferences for Sustainable Campus Dining Systems: A Conjoint Analysis Supporting Green University Infrastructure

Pieve Serenity Pancho, Klint Allen Marinas and Benedict Banaag
Presenter: Pieve Serenity SJ. Pancho

ABSTRACT

Universities are increasingly expected to encourage sustainable practices not only through academic programs, but also through day-to-day operations like campus meals. This study employs conjoint analysis to analyze how students evaluate sustainable food alternatives in cafeterias at various universities. The food profiles evaluated by 219 respondents varied in terms of vendor transparency, sustainability commitment, packaging type, and source. The findings indicate that sustainability commitment and packaging type had the greatest impact on overall preference. Recyclable and biodegradable packaging received the highest ratings, while high sustainability commitment and plant-based sourcing were rated lower. According to these findings, students are more open to sustainability programs that appear familiar and practical than those that are excessively difficult. This study gives guidance to campus food service providers intent on hitting a balance between environmental objectives and customer acceptance, as well as highlighting how sustainability signals influence food-related decisions in institutional contexts.

PAPER 95

Induction Machine Equivalent Circuit Parameter Estimation from Online External Measurements

Ahmed Alturas, Bashar Zahawi, Shady Gadoue and Mohammed Elgendy
Presenter: Bashar Zahawi

ABSTRACT

The parameters of the induction machine per-phase equivalent circuit (T-model) have been shown not to be uniquely identifiable from online external measurements of steady-state speed, stator currents and voltages, due to T-model redundancy. This paper presents a new model-based online parameter identification technique which overcomes the non-identifiability problem associated with the T-model, eliminating the possibility of obtaining incorrect parameter sets that satisfy the model solution. The proposed method uses a combination of the steady-state induction machine equivalent circuit (T-model) and the inverse Γ-model, which has been shown to be uniquely identifiable from external measurements, in conjunction with an optimization algorithm to estimate the induction machine T-model equivalent circuit parameters. The structural identifiability of the proposed combined technique is analytically confirmed using a transfer function analysis. The performance of the proposed parameter identification method is experimentally demonstrated using a 400 V, 1.1 kW, inverter-fed, three-phase induction motor.

PAPER 96

SA-FPR: Stage-adaptive focus-pair revision for consistency convergence in LLM-assisted AHP judgment elicitation

Bingran Yao, Jin-Xing Hao and Ghilas Midoun
Presenter: Bingran Yao

ABSTRACT

Large language models offer a scalable means of supporting expert judgment elicitation in analytic hierarchy process decision making, but their pairwise judgments may still violate consistency requirements in comparison-intensive hierarchical tasks. This study develops a multi-agent iterative elicitation framework that treats inconsistency as an elicitation-stage convergence problem rather than a post hoc matrix repair task. To operationalize this framework, a stage-adaptive focus-pair revision mechanism is proposed to select revisable comparisons from inconsistent matrices, provide rule-based soft hints, and adjust revision priority and scope according to the current inconsistency regime. A CubeSat design-and-development risk assessment task is used for validation. Across twenty independent runs, all inconsistent revision trajectories converged monotonically to acceptable consistency, and the treated outputs preserved a decision-plausible high-priority risk layer. Compared with a Xu–Wei direct correction baseline, SA-FPR achieved comparable top-priority stability with substantially fewer pairwise judgment modifications, while retaining traceable focus-pair revisions and expert-side rationales.

PAPER 98

From smart gate mapping to Navigate app: A human-centred approach to seaport digital transformation

Juliana Basulo-Ribeiro, Ana Martins, Ezequiel Dias, Ricardo Baltazar, Carina Pimentel and Leonor Teixeira
Presenter: Juliana Basulo-Ribeiro

ABSTRACT

Digital transformation in ports requires more than the implementation of technological; it requires alignment between processes, people and technology. This study adopts a human-centred approach to analyse road gate operations at the Port of Sines during the transition to a Smart Gate ecosystem. A mixed methods approach combined process analysis, semi-structured interviews with nine transport companies, a questionnaire administered to 96 drivers, and preliminary validation of a mobile application prototype. The results highlight operational constraints related to infrastructure, communication, stakeholder awareness and systems interoperability. They also show that transport companies recognise the importance of digitalisation, despite differing readiness levels, whilst drivers show an overall positive attitude towards Smart Gate technologies. Based on these findings, the NaviGate app was conceptualised and validated as a user-centred digital solution to enhance communication, coordination and operational efficiency. The study contributes to understanding port digital transformation as a socio-technical, collaborative and progressive process.

PAPER 101

A Reinforcement Learning-Based Replenishment Policy for Perishable Inventory in Semiconductor Industry

Valeria Fichera, Jose Manuel Framinan and Antonio Costa
Presenter: Valeria Fichera

ABSTRACT

This study proposes a Reinforcement Learning-based replenishment strategy aimed at improving the responsiveness of a real-world case study from the semiconductor industry, operating in a complex environment characterized by perishable products, stochastic lead time, and minimum order quantity. The agent explicitly determines the optimal order quantity while managing product perishability. To validate the effectiveness of the proposed replenishment policy, it has been compared with the Smoothing Order-Up-To (SOUT) policy. Such comparison analysis is based on two performance measures, such as the fill rate and the amount of expired products. For the sake of fairness, the SOUT replenishment parameters were calibrated by means of a Response Surface Methodology analysis. An extensive experimental campaign was carried out and numerical results show the outperformance of the Reinforcement Learning over the SOUT by mitigating the effect of variability in the lead time, which in turn implies inventory cost reduction and fill-rate increase.

PAPER 102

A GIS-AHP Approach for Hospital Site Selection in Mubarak Al-Kabeer Governorate, Kuwait

Jenna Alqenaei and Ali Saeed
Presenter: Jenna Alqenaei and Ali Saeed

ABSTRACT

The purpose of this study is to identify suitable locations for a new hospital in Mubarak Al-Kabeer Governorate in Kuwait by integrating Geographic Information Systems (GIS) with the Analytic Hierarchy Process (AHP). Data were collected from a dataset containing spatial layers related to Kuwait, which underwent several GIS processes: layer selection and clipping, buffer analysis, union and indexing, rasterization, AHP weight calculation, and weighted overlay analysis. Criterion weights were determined using Saaty's scale and verified for consistency. The results indicate that Zone 1, located in the south-central portion of the governorate, represents the most suitable location. The sensitivity analysis confirms the robustness of the methodology across all weighting scenarios. These findings suggest that this data-driven approach provides replicable, evidence-based guidance for healthcare facility planning in Kuwait, in alignment with Kuwait Vision 2035.

PAPER 106

A System Dynamics Model for Analyzing Food Loss and Waste Generation in the Fruit and Vegetable Supply Chain

Nora Nisrina, Hasan Turan and Ruhul Sarker
Presenter: Nora Nisrina

ABSTRACT

Food loss and waste (FLW) in the fruit and vegetable (F&V) supply chain has become a global issue due to its significant economic and environmental impacts. The perishable nature of F&V products and seasonal production patterns contribute to high levels of FLW throughout the supply chain. This study develops a system dynamics model to analyze the dynamic

behavior of FLW generation within an F&V supply chain. The model captures the supply chain holistically in an end-to-end manner, from production and harvesting to retailing, while also incorporating FLW generation, and is represented through causal loop and stock and flow diagrams. Several scenarios, including different demand patterns and supply disruptions, were simulated. The results demonstrate that weather conditions, demand fluctuations, and supply disruptions significantly influence demand satisfaction and FLW generation over time. The proposed model also provides insights for improving supply chain sustainability and supporting decision-making for FLW reduction.

PAPER 108

Improved constructive heuristics for the permutation flowshop scheduling problem with time lag constraints

Victor Fernandez-Viagas, Antonio Costa, Daniele Pagano and Jose M Framinan
Presenter: Victor Fernandez-Viagas

ABSTRACT

This paper investigates the permutation flowshop scheduling problem subject to maximum and minimum time lag constraints with the objective of minimizing the makespan, a decision problem challenge frequently encountered in many manufacturing environments. This problem is known to be NP-hard, and a number of constructive heuristics have been proposed in the literature. By leveraging two problem-specific properties (i.e. reversibility and critical path), we propose four new constructive heuristics. The comprehensive computational evaluation carried out demonstrates that the proposed heuristics significantly outperform the existing ones in both solution quality and efficiency.

PAPER 109

Explainable Siamese Neural Networks for Prediabetes Prediction

Razan Easa Falah Alkhanbouli, Abdulla Mohammed, Pratyush Patro, Sara Bahlooq, Maher Maalouf, Ping Ji, Herbert Jelinek and Kinda Khalaf
Presenter: Razan Alkhanbouli

ABSTRACT

Diabetes is a chronic condition and global health challenge, while prediabetes represents a critical stage for preventing disease progression. As prediabetes affects millions worldwide, accurate and early risk prediction tools are needed beyond blood sugar levels or HbA1c. Identifying at-risk individuals can support timely lifestyle and clinical interventions using individualized, noninvasive clinical features. This study proposes a novel multiclass Siamese Neural Network (SNN) approach for prediabetes prediction. By learning complex feature relationships from multidimensional healthcare data, the SNN model achieved 78.2\% accuracy, 88.9\% specificity, and an AUC of 0.91 using the DiabHealth dataset. These results demonstrate its ability to improve diagnostic precision despite imbalanced data and limited labeled samples. The findings highlight the potential of SNN-based predictive models for early detection, including previously unrecognized prediabetes risk features. Variable importance identified autonomic nervous system testing, oxidative stress, and diet as leading predictors ahead of fasting blood glucose. Integrating AI-driven diagnostics can improve decision-making, reduce long-term complications, and strengthen diabetes prevention efforts.

PAPER 110

Real-Time Golf Swing Coaching via Pose Estimation and Reference-Based Quality Scoring on an Edge AI Device

Fatma Ramadan, Maryam Alkharji, Mariam Alratrout, Nadin Waleed, Kin Poon and Ubaid Ahmad
Presenter: Kin Poon

ABSTRACT

This paper presents a golf swing coaching system that evaluates movement quality and delivers real-time corrective feedback. The system was implemented entirely on an edge AI platform, eliminating reliance on cloud-based infrastructure to ensure low latency, improved data privacy, and reliable operation in offline environments. A structured computer vision pipeline is used where human pose data is extracted from live video using landmark detection, normalized to ensure consistency across users with different body proportions, and transformed into joint-angle representations for analysis. Movement quality is evaluated through comparison with multiple reference poses, enabling robust handling of natural variation in user performance. A finite-state model is used to segment motion into distinct golf swing phases, allowing context-aware feedback generation. By combining efficient geometric computations with lightweight models, the system demonstrates the practicality of a standalone Edge based solutions for real-time motion analysis and coaching applications.

PAPER 111

Strengthening Food Security through Optimized Import Diversification

Siddhartha Shakya, Himadri Khargharia, Dymitr Ruta, Asma Alawneh, Subey Dengur and Aisha Alshamsi
Presenter: Siddhartha Shakya

ABSTRACT
Ensuring food security is crucial to safeguarding national stability and the well-being of citizens. Diversifying food imports improves a country's resilience against sudden supply disruptions and mitigates risks associated with geopolitical uncertainties. In this paper, we address the problem of food import diversification, one of the very important aspects of food security. We build a mathematical model of import diversification and devise an optimization algorithm to determine the optimal strategy. Our methodology aims to maximize diversification while minimizing both costs and risks. The experimental results demonstrate that our approach generates a diverse set of policies, each optimized for different combinations of objectives, providing adaptable solutions for sustainable food security.

PAPER 112

Machine Learning Causal Forecasting for Hospital Pharmaceutical Demand: Evidence from Five French Hospitals

Denis Koala, Zakaria Yahouni, Gülgün Alpan and Djamal Si Mohand
Presenter: Zakaria YAHOUNI

ABSTRACT
Inaccurate pharmaceutical demand forecasting undermines hospital inventory management, causing drug shortages, overstocking, and avoidable logistics costs. Classical “World Healthcare Organization” methods, particularly the consumption method, rely solely on historical consumption data and cannot account for the operational context driving demand. This paper presents a machine learning-based causal forecasting framework applied to monthly medicine consumption data from five French hospitals. Using twelve operational features, including patient volumes, bed capacity, and staff levels, Random Forest and Artificial Neural Network models are trained and tested on ten medicines. Random Forest achieves a mean R^2 of 0.81 on the test set and substantially outperforms the WHO consumption method across all medicines. These results demonstrate the operational feasibility and accuracy gain of machine learning-based causal forecasting for hospital pharmaceutical supply chain management.

PAPER 115

Enhancing Energy Efficiency in UAE Buildings: A Decision-Making Model for Optimal Retrofit Selection

Noura Alkaabi, Alaa Alqaryuti, Ammar Hummieda, Malik Khalfan and Ahmad Mayyas
Presenter: Ahmad Mayyas

ABSTRACT
Buildings in hot climates are major electricity consumers because cooling dominates energy demand. This study evaluates retrofit strategies for an existing hotel in Abu Dhabi using DesignBuilder simulations and two multi-criteria decision methods: Analytic Hierarchy Process and Quality Function Deployment. Five measures were assessed: airtightness improvement, cooling set point adjustment, chiller performance enhancement, glazing upgrade, and wall insulation. The calibrated model achieved acceptable error values, with Normalized Mean Bias Error of 2.61%t and Coefficient of Variation of Root Mean Square Error of 4.88%. Results show that cooling set point adjustment provides the largest energy saving at 9.28%, followed by chiller improvement at 7.66%. Both decision methods ranked the temperature set point retrofit first, highlighting low-cost HVAC optimization as a practical retrofit priority.

PAPER 116

Synthetic Data for Digital Twins based Machine Learning Surrogate Models

Mehdi Jaoua, Ayoub Chihi and Amel Jaoua
Presenter: Amel Jaoua

ABSTRACT
Smart sensors, IoT connectivity, and predictive Machine Learning based Digital Twins can transform manufacturing and healthcare systems by enabling real-time data collection, analysis, and intelligent decision-making. For that purpose, training these ML algorithms on synthetic data generated from Discrete Event Simulation (DES) models is a highly promising solution. This paper presents two case studies in manufacturing and healthcare systems, demonstrating the capability of this technique to develop powerful ML surrogate models that can generate efficient estimates in near real-time. Results indicate that advanced preprocessing techniques are essential, particularly when the data exhibit strong skewness or multimodal behavior. The findings highlight that applying common data cleaning and transformation techniques to DES-generated synthetic data, already cleaned during input modeling, may hide valid variations crucial for preserving the dataset's integrity.

These results emphasize the need for further research in designing effective preprocessing pipelines that preserve the structure and variability of DES-generated synthetic data.

PAPER 117

Bi-objective supply chain network design using a new supply chain viability metric

Mouna Kchaou-Boujelben and Aida Jebali

Presenter: Mouna Kchaou-Boujelben

ABSTRACT

The resilience of a supply chain reflects its capability to withstand disruptions, adapt to changing conditions and recover its operational performance within an uncertain and dynamic environment. This capability has become essential for modern global supply chains that are continuously exposed to major risks such as natural disasters, geopolitical conflicts and pandemics. Resilience requires the implementation of cost-effective strategies to mitigate the impact of disruptions and support recovery processes. However, because resilience primarily focuses on maintaining or restoring performance following individual disruptions within a limited time horizon and a closed-system setting, it may be insufficient to address recurrent, long-lasting, and progressively escalating disruptions such as the Covid-19 pandemic. Consequently, supply chain viability has emerged as a new research paradigm that extends resilience by emphasizing long-term survivability as a strategic objective alongside profitability. In this context, the present study focuses on the design of viable supply chain networks that jointly optimize profitability and viability through the implementation of multiple resilience strategies including backup supply, supplier fortification and emergency inventory. Specifically, we propose a novel viability metric that captures long-term survivability by limiting the duration during which service performance remains below a specified target level across all disruption scenarios. To incorporate this metric into the decision-making process, we develop a bi-objective, stochastic, multi-period supply chain network design model that determines supplier selection and factory location decisions, while balancing profitability and viability objectives. A real-life pharmaceutical industry case study is then used to validate the proposed model and investigate the trade-off between profitability and viability.

PAPER 118

AI-Based Heart Failure Prediction: Reporting, Validation, and Deployment Gaps

Khaled Toffaha, Ahmed Saad, Michael A. Kortt, Mecit Can Emre Simsekler and Samer Ellahham

Presenter: Ahmed Saad

ABSTRACT

The rapid digital transformation and economic diversification taking place across the Gulf Cooperation Council (GCC) countries have been associated with significant changes in labor market dynamics. This study, using the United Arab Emirates (UAE) as a case example, has conducted a detailed analysis of shifting skill requirements. A mixed-methods approach was employed, combining quantitative analysis of over 6,000 job advertisements collected from LinkedIn between 2018 and 2024 across the engineering, healthcare, and finance and marketing sectors. The job descriptions were first processed using OpenAI's extraction tools, and then Latent Dirichlet Allocation (LDA) was applied to identify major skill clusters and track their changes over time. A comparative analysis was conducted to examine the trends in required skills over different years. A 25% increase in IT-related job postings was observed compared to earlier years, and more defined clusters related to programming and data analysis were detected in the recent data. In contrast, broader and less specific skill categories were found in the earlier listings. It was also found that Data Scientist, AI Engineer, and Digital Marketing Specialist were the most frequently advertised roles, together making up 30% of the postings. A clear shift was identified from job roles that mainly required soft skills to those that combine technical and interpersonal skills. Based on the results, a stronger focus on technical training in education programs is recommended, while continuing to support the development of soft skills, to better prepare the workforce for the evolving demands of the GCC job market.

PAPER 119

Labour Market in the United Arab Emirates

Alexander Wollenberg

Presenter: Alexander Wollenberg

ABSTRACT

The labour market of the United Arab Emirates (UAE) presents a unique case study characterized by a significant expatriate majority and a deliberate national policy of Emiratisation. This article examines the historical evolution, contemporary dynamics, and socio-economic impacts of Emiratisation, a strategic imperative aimed at increasing participation of UAE nationals in the private sector who have mostly been drawn to public sector employment. The article further explores the regulatory framework, key initiatives like NAFIS, and the implications of compliance issues. The article concludes with insights into how to cultivate a competitive, innovative, and sustainable national workforce.

PAPER 120

Determining the linkage between News-Derived Weather Disruption Evidence and a Port's Reliability

Zahra Jiryaei Sharahi, Omar Khadeer Hussain, Hamed Aboutorab, Pankaj Sharma and Ripon Chakrabortty
Presenter: Zahra Jiryaei Sharahi

ABSTRACT

This study proposes an integrated framework for identifying weather-disruption indicators by news intelligence in maritime transportation systems and ascertaining their impact on a port's operation. Port performance can be affected by many external and operational factors, including labor disputes, geopolitical tensions, infrastructure constraints, economic disruptions, and extreme weather conditions. This paper focuses on weather-related disruptions and examines how such events can be detected in unstructured news sources and their impact on port reliability performance. The framework combines keyword-based retrieval, large language model (LLM) classification, structured event extraction, and temporal reconstruction to convert online news into interpretable disruption indicators capturing event occurrence, type, impact, and timing. The impact of these indicators is then determined on a port's monthly reliability measures derived from vessel stay-duration records. The findings provide evidence that news-derived weather indicators can support the contextual interpretation of port reliability changes.

PAPER 121

A Cooperative Game of Spare Part Systems with Expedited Deliveries

Ulas Ozen
Presenter: Ulas Ozen

ABSTRACT

In this paper, we study the cooperative games between companies that pool their spare part inventory to maintain their equipment. Due to the high cost of service disruptions, any stockout is assumed to be satisfied by an expedited delivery. We firstly derive the performance measures used to formulate the long run average cost of running these spare parts systems and show that, in the long run, these performance measures are equivalent to those in classical spare parts system with backlogs. Afterwards, we show that the core of these games are non-empty by showing that proportional allocation is a population monotonic allocation scheme.

PAPER 122

A Circular Solar-Hydrogen Energy Optimization Framework for Abu Dhabi with Grid Dispatch

Pritam K Patro, Pratyush K Patro, Adolf A Acquaye and Sc Lenny Koh
Presenter: Pritam K Patro

ABSTRACT

The rapid expansion of solar photovoltaic capacity in Abu Dhabi presents a growing challenge of daytime energy surplus and grid curtailment. This paper proposes a circular solar-hydrogen energy optimization framework that transforms curtailed solar electricity (conventionally treated as waste) into a recoverable resource through green hydrogen production, storage, and nighttime re-electrification. The system integrates three distributed solar generation sources unique to the Abu Dhabi urban and coastal context: (i) building-integrated photovoltaic thin-film sheets applied to building envelopes and rooftops; (ii) offshore floating solar arrays positioned along the Abu Dhabi coastal shelf; and (iii) solar canopy domes installed over highway flyovers and bridge decks. Daytime surplus electricity is directed to polymer electrolyte membrane electrolysers for producing green hydrogen, which is stored and subsequently converted back to electricity via fuel cells during the evening and nighttime demand window, completing a 12-hour circular storage rotation. The dispatch strategy is formulated as a mixed-integer linear programming model that allocates generation across three operating modes (direct grid supply, hydrogen production, and hydrogen-to-power reconversion) while minimising curtailment and maximising net energy value delivered to the Abu Dhabi transmission grid. The circular economy principle is operationalised through a quantified waste-recovery key performance indicator, measuring the percentage of otherwise-curtailed solar energy recaptured through the hydrogen loop. Simulation results based on Abu Dhabi irradiance profiles and grid demand data demonstrate the technical feasibility of the proposed framework and quantify the round-trip efficiency, daily hydrogen throughput, and carbon displacement potential. The proposed model provides a replicable optimisation template for solar-surplus economies, and lays the groundwork for a full technoeconomic evaluation and UAE-wide deployment study as future research directions.

PAPER 123

Modeling Road Users' Support for Traffic Safety Initiatives in the UAE: A Structural Equation Modeling Approach

Haneen Abuzaid, Raghad Almashhour, Areej Mohammed and Ghassan Abu-Lebdeh
Presenter: Haneen Abuzaid

ABSTRACT

Transportation plays a major role in the daily lives of human beings. There is extensive research on the economic burdens associated with traffic, relative to the gap in the social dimension of traffic. The aim of this study is to evaluate road users' support traffic safety initiatives in the UAE using Structure Equation Modeling, where a set of related indicators was extracted from the literature to measure each traffic safety initiative. All the indicators were assessed via an online survey in the UAE with 458 respondents. The results showed a significant correlation among four traffic safety constructs: distracted driving, technology advances, speed detection, and dangerous behaviors. Furthermore, the analysis revealed that road users' support to traffic safety in the UAE is positively influenced by these constructs. The findings would be advantageous to governmental entities, policy and decision makers, contractors, and developers; to enhance the safety of driving experience and the social sustainability of roads and transportation.

PAPER 127

Ethical Dissonance and Operational Burnout: Factors Influencing Conflict Management Failures across High-Pressure Environments in the Philippines

Aleli Ruizan, Yoshiki Kurata, Jonathan Gregorio and Nhoela Jill Torreliza
Presenter: Aleli J. Ruizan

ABSTRACT

This study examined the impact of ethical dissonance and operational burnout on conflict management failure in the high-pressure industrial environments in the Philippines. Using the Lean Six Sigma (LSS) approach and the DMAIC framework, this study analyzed survey data from 50 professionals across sectors, including construction, government agencies, IT, and BPO. The study identified how to prioritize operational targets over personal values. This is coupled with high workloads and impairs collaborative dispute resolution. A Cronbach's alpha value of 0.913 indicated high reliability. Results show that increased burnout and ethical strain are associated with greater reliance on avoidance-based or reactive conflict strategies. A conflict management failure index is established as a key performance indicator to measure organizational defects. Through lean principles and innovative structural interventions, the paper proposes strategies to mitigate communication breakdown and improve sustainable resolution processes in stressful industrial settings.

PAPER 128

Capacity planning and operational scheduling of grid-connected green hydrogen systems under variable electricity tariff

Rawan Abdelsalam, Andrei Sleptchenko, Ahmad Mayyas and Toufic Mezher
Presenter: Rawan Abdelsalam

ABSTRACT

Green hydrogen is a promising solution for decarbonizing hard-to-abate sectors; however, its production is challenged by the mismatch between intermittent renewable generation and fixed hydrogen demand. This paper proposes an integrated optimization framework for the capacity planning and operational scheduling of a grid-connected green hydrogen system under variable electricity tariffs. The system consists of photovoltaic generation, a proton exchange membrane electrolyzer, and a hydrogen storage tank supplying a fixed hydrogen demand. A bi-level optimization approach is adopted, where Particle Swarm Optimization determines optimal system sizing, while a linear programming-based Energy Management System optimizes hourly operation. The objective is to minimize the levelized cost of hydrogen by jointly optimizing design and dispatch decisions. The framework is evaluated under three representative solar irradiance scenarios (high, average, and low) to capture resource variability. Results show that solar availability significantly impacts both system sizing and operational strategy. The lowest levelized cost of hydrogen of 6.36 USD/kg is achieved under favorable solar conditions, while limited solar availability leads to increased reliance on grid electricity and higher costs. The findings highlight the importance of integrating storage and flexible operation to shift production toward low-tariff periods.

PAPER 129

Towards a Unified Framework for Master Production Scheduling under Uncertainty: Integrating Machine Learning Forecasts with Stochastic Optimization

Mahmoud Eldakrory, Shady Salama, Mohamed Fahmy and Zakaria Yahia
Presenter: Zakaria Yahia

ABSTRACT

Master Production Scheduling (MPS) remains a cornerstone of manufacturing planning, yet its effectiveness is often undermined by uncertainty arising from demand, supply, and production-side disruptions. Existing approaches typically address these uncertainties in isolation, limiting their robustness in dynamic industrial environments. This paper proposes a Modified Separated Estimation and Optimization (MSEO) framework that extends the SEO paradigm by explicitly incorporating production-side uncertainties such as capacity limitations, crew unavailability, machine breakdowns, and product changeovers. The framework integrates machine learning–based probabilistic forecasting with stochastic optimization in a rolling-horizon setting, enabling adaptive and resilient production schedules. By uniting forecasting and scheduling into a single decision-support system, the proposed framework provides a data-driven approach for uncertainty-aware MPS. The proposed MILP model was validated through a realistic numerical case study involving three products over five planning periods under multiple disruption conditions. The model achieved an optimal objective function value of $5398.60 with a computation time of 0.0121 seconds, demonstrating its ability to effectively adapt production decisions under disruption scenarios while minimizing profit loss. The proposed framework advances MPS research by enhancing operational resilience and scheduling robustness in modern manufacturing systems.

PAPER 130

Digital Government Development, Human Capital, and Organizational Ergonomics and Workplace Safety as Drivers of Government Effectiveness in GCC Countries: Evidence from a Dynamic System GMM Approach

Hanene Chouchane

Presenter: Hanene CHOUCHANE

ABSTRACT

This study examines the determinants of Government Effectiveness in six Gulf Cooperation Council (GCC) countries over the period 2003–2024 using a panel dataset of 168 observations. An Integrated Socio-Digital Governance Framework is developed to assess the roles of Digital Government Development, Human Capital, and Organizational Ergonomics and Workplace Safety in shaping institutional performance. The analysis employs a dynamic System Generalized Method of Moments (System GMM) estimator to address persistence, endogeneity, and unobserved heterogeneity. The findings indicate that Digital Government Development, Human Capital, and Organizational Ergonomics and Workplace Safety Conditions significantly improve Government Effectiveness. Furthermore, the interaction between Digital Government Development and Human Capital is positive and significant, suggesting that digital transformation yields stronger governance outcomes when supported by adequate workforce capabilities. The results remain robust across alternative specifications and estimation methods.

PAPER 131

Demand Driven Inventory Planning For Quick-Commerce Apparel: A Case Study on Uncertain Demand

Khushi Goyal and Kaja Bantha Navas R

Presenter: Kaja Bantha Navas R

ABSTRACT

Quick-commerce apparel retail operates in an environment characterized by uncertain demand, short replenishment windows, and high service-level expectations. Traditional inventory planning methods used by many apparel brands are largely manual and reactive, often resulting in stock imbalances, stock outs, and excess inventory holding. This research develops a demand-driven inventory planning framework for quick-commerce apparel operations using historical sales analysis, PID-level product segmentation, and structured replenishment logic. The framework integrates normalization-based product prioritization with inventory control parameters such as reorder point (ROP), safety stock, and order-up-to level. Key performance indicators including Cycle Service Level (CSL), Fill Rate (FR), and Days of Stock on Hand (DS SOH) were used to evaluate the effectiveness of the proposed model. A pilot implementation demonstrated improvements in product availability and inventory alignment across high-performing products. The study highlights the importance of a data-driven inventory planning system for improving operational efficiency in fast-paced quick-commerce environments.

PAPER 132

When optimality meets efficiency: A novel simulation-optimization with adaptive model exchange

Zakka Ugih Rizqi, Ole Madsen, Casper Schou and Michael Cleemann Christensen

Presenter: Zakka Ugih Rizqi

ABSTRACT

Simulation-Optimization (SO) has become a reliable framework to optimize complex systems via stochastic simulation.

However, recent SO methods face the significant challenges in balancing optimality and efficiency due to expensive evaluation in handling output noise. This paper proposes the SO with Adaptive Model Exchange (SO-AME) where metaheuristics dynamically switches between rigorous simulation model and fast-to-evaluate Machine Learning (ML) model based on prediction performance. The intention is to perform a vast majority of its exploration and exploitation using cheap ML, reserving expensive simulation runs only for high-performing candidates. Methodologically, ML model learns the complex input-output relation of simulation adaptively within Simheuristics loop. A case study is given to design pharmaceutical production. Compared with other robust SO methods, results validate that SO-AME significantly reduces the computational burden yet improves the optimality, offering a scalable AI-driven solution for optimizing complex systems under uncertainty.

PAPER 134

Explainable Heterogeneous Graph Learning for Maritime Cyber Threat Detection

Rahul Deb Mohalder, Hamed Aboutorab, Ali Ahrari, Pankaj Sharma, Omar Khadeer Hussain and Ripon Kumar Chakrabortty

Presenter: Rahul Deb Mohalder

ABSTRACT

Ports and maritime logistics operators are increasingly using blockchain to track cargo provenance and automate payments through smart contracts. However, most security tools such as Slither and Mythril still examine network activity, blockchain transactions, and smart contract code separately. This makes it difficult to detect attacks that move across layers. In this work, we propose MarCyGraph, an explainable Maritime Cyber Graph framework for detecting maritime cyber threats. It brings together evidence from five real public datasets: CICIoT2023, X-IIoTID, Elliptic, SmartBugs Curated, and MarineCadastre AIS. The data are organised as a graph with ten node types and fourteen edge types, covering Internet of Things devices, blockchain transactions, smart contracts, and maritime context. MarCyGraph uses a Heterogeneous Graph Transformer (HGT) to learn from these connected layers and provides explanations showing which layer and feature contributed to an alert. Instead of treating alerts as separate events, the framework links related evidence across the system. In the cross-layer task, it achieved 90.16% accuracy, 0.832 macro F1, 0.956 AUROC (Area Under the Receiver Operating Characteristic), and 0.844 AUPRC (Area Under the Precision-Recall Curve). It also improved macro F1 by 9.7 points compared with a homogeneous Graph Attention Network (GAT) model. These results suggest that MarCyGraph can help analysts connect an IoT anomaly with its possible blockchain impact, reducing the need to check several isolated tools manually during investigation.

PAPER 136

An AI model for the Annotation of Acid-fast Bacilli (AFB) in images to detect Extra-pulmonary Tuberculosis

Ravi Seethamraju and Krishna Sundar Diatha

Presenter: Ravi Seethamraju

ABSTRACT

Accurate annotation of acid-fast bacilli (AFB) in images is essential for developing a reliable machine learning models for the diagnosis of extra-pulmonary tuberculosis (EP-TB). However manual annotation is time-consuming labour-intensive and prone to inter-observer variability limiting scalability and reproducibility. This study reports on the development and validation of an automated annotation tool to label AFB in whole-slide images of tissue biopsies for EP-TB detection. During inference the models generate explainable auto-annotations that support both diagnostic assistance and the creation of additional annotated datasets for further model training. The tool was evaluated using metrics such as sensitivity specificity annotation efficiency and usability. Results demonstrate improved annotation consistency and reduced annotation time. This study addresses a critical challenge in medical AI development: generating high quality annotations and curated datasets for pathology images.

PAPER 138

Strategies for mitigating large-scale global energy supply chain disruptions

Towfique Rahman, Md. Abdul Moktadir, Yong Wu and Yousaf Ayub

Presenter: Towfique Rahman

ABSTRACT

The contemporary global energy landscape has become increasingly vulnerable due to large-scale supply chain (SC) disruptions caused by geopolitical instabilities, cyberattacks, and the transition to renewable energy sources. This research applies a reliability-enhanced fuzzy cognitive map (FCM) approach to systematically analyze the interdependencies and dynamic evolution of the identified 15 key mitigation strategies for the global energy SC. By integrating structured expert elicitation with a reliability-optimized aggregation procedure, the study identifies both upstream strategic drivers and steady-state operational priorities necessary for building a resilient energy SC. Dynamic simulations reveal that while geopolitical intelligence and diplomatic cooperation hold high initial importance, they primarily serve to activate downstream

measures such as public-private emergency coordination platforms which emerge as the highest operational priority. The findings provide a framework for prioritizing and integrating strategies, such as artificial intelligence (AI) enabled analytics and strategic diversification, to enhance energy SC resilience.

PAPER 139

IDRF: A Bounded Graph-Based Framework for Investigative Dependency Reasoning

Aleena Harold Peter, Akhil Harold Peter, Madhusmita Das and Chandramani Sahoo

Presenter: Aleena Harold Peter

ABSTRACT

Existing dependency analysis approaches primarily use metric-driven assessment, vulnerability detection, visualization dashboards, or prediction models. However, they often lack interpretability in explaining why certain dependencies warrant further attention. To address this limitation, we propose Investigative Dependency Reasoning Framework (IDRF), a prototype system designed to analyze python package dependencies using structural metrics and metadata collected from the python package index (PyPI) and related repositories. IDRF evaluates twelve bounded dependency environments comprising 318 packages, constructs bounded dependency graphs with limited-depth expansion, and computes investigative priority scores using heuristic metrics. The system produces human-readable investigative insight cards highlighting dependencies requiring further analysis based on interpretable scoring rules, generating 60 insight cards across the evaluated environments. Results show that IDRF can surface dependencies that warrant additional attention within bounded dependency constraints. It demonstrates how bounded graph analysis coupled with priority scoring produces interpretable dependency reasoning.

PAPER 140

Optimization and Strategic Planning of Electric Vehicle Charging Stations in Qatar

Sara Mhd Khir Alsabbagh and Nezir Aydin

Presenter: Nezir Aydin

ABSTRACT

This paper develops a framework for optimizing the placement of Electric Vehicle Charging Stations (EVCS) in Qatar using the Set Covering Problem (SCP). The model identifies the minimum number of charging stations required to ensure full accessibility across eight municipalities, while minimizing the total installation costs. The study considers two charging technologies, Medium DC Fast (MDC) and High-Power DC (HPDC). The model is implemented in IBM ILOG CPLEX Studio and evaluated under six coverage threshold scenarios for planning horizons 2025 and 2030. Results show that the base scenario with a 15-minute MDC and a 30-minute HPDC threshold provides the best balance between accessibility and cost, requiring 71 stations in 2025 and 114 in 2030. Sensitivity analyses confirm that coverage constraints are binding and that the network configuration is driven by the accessibility threshold. Policy implications are discussed in alignment with Qatar National Vision 2030.

PAPER 141

Using novel absorbers to improve PTC performance and miniaturize CSP systems

Hirofumi Kakemoto

Presenter: Hirofumi Kakemoto

ABSTRACT

A parabolic trough collector with a novel β-FeSi2 absorber was designed as a prototype of a renewable energy generation system, i.e., a distributed small-scale concentrating solar power parabolic trough collector system. The efficiency of parabolic trough collector was calculated using transformed Hottel-Whillier-Bliss formula exposing to direct sunlight, as the functions of absorbance and time. The mixture of nitrates: NaNO3 and KNO3, and Ca(OH)2 based compounds were investigated with their thermal properties for capacity factors, solar multiple, versus storage time, and compared for the thermal storage (inner tanks) as with favorable specific heat, together with heat transfer from thermal storage. The efficiency for output-power was determined by a miniaturized steam power generator. Finally, the total efficiency of the parabolic trough collector system in this study was determined as (heating efficiency of parabolic trough collector module)□(output-power efficiency) to be 48% and above results were confirmed by using computer simulation.

PAPER 142

Deep Reinforcement Learning-Driven Order Prediction and Improved ALNS for Unrelated Parallel Machine Scheduling under Demand Uncertainty

Hao Sun and Zhili Zhou

Presenter: Hao Sun

ABSTRACT

The proliferation of industrial information technology has made digital transformation and intelligent manufacturing central to modern manufacturing, with digital twin technology enabling real-time optimization and dynamic decision-making.

Meanwhile, e-commerce growth has driven fragmented, small-scale, multi-batch uncertainly demand, forcing enterprises to balance delivery time windows, production-line flexibility, and sequence-dependent setups costs, thereby substantially complicating scheduling. To address this, we formulate a mixed-integer programming model for unrelated parallel machine scheduling aimed at maximizing total profit, under constraints including delivery time windows, sequence-dependent setup times, product heterogeneity, and machines capacity differences and so on. On the demand side, deep reinforcement learning is integrated for order forecasting, embedding demand into production planning to balance loads and optimize resources, thereby mitigating stockout and overstock risks and furnishing data-driven planning foundations for digital twin systems. On the solution side, an improved adaptive large-scale neighborhood search (ALNS) algorithm is designed based on the tabu search escape mechanism, with destroy and repair operators tailored to the model's characteristics to enhance efficient real-time solving for complex scheduling problems. Computational experiments validate the effectiveness of the proposed approach, demonstrating improved delivery reliability and capacity utilization, reduced costs and decision-making opacity, and a scientific basis for intelligent scheduling in manufacturing enterprises.

PAPER 143

Data-Driven Estimated Time of Arrival Prediction for Proactive Dock Scheduling at Logistics Terminals

Hadjer Louzim, Abdelghani Bekrar, Atika Rivenq and Yassin Elhillali
Presenter: Hadjer Louzim

ABSTRACT

Today, logistic systems face many issues. Logistics terminals increasingly suffer from congestion, long waiting times and inefficient truck scheduling. To overcome this limitations this paper proposes a closed loop framework combining Machine Learning (ML)-based Estimated Time of Arrival (ETA) prediction with dynamic dock scheduling and rescheduling at logistics terminals under truck arrival uncertainty. Three prediction models namely an Artificial Neural Network (ANN), a Random Forest (RF), and XGBoost are tested on a dataset from the U.S. Bureau of Transportation Statistics (BTS) adapted to a freight logistics. Among the three tested models, XGBoost achieves the best performance with a Mean Absolute Error (MAE) of 6.35 minutes and an R2 of0.9768,andisselectedas an inputto MixedIntegerLinearProgramming (MILP) formulations models: an initial scheduling model minimizing makespan based on predicted ETAs, and a dynamic rescheduling model that adjusts assignments based on Actual Time of Arrivals (ATAs). Validated on five days from the test set with 6 docks. These Results demonstrate that tightly coupling data-driven ETA prediction with proactive scheduling decisions significantly reduces terminal disruption.

PAPER 144

Border-Clearance Time Variability and Inventory Buffering: When Customs Digitalisation Reduces and When It Raises Safety Stock

Areej Siddiqui, Sania Ashraf, Arij Lahmar, Mahmood Abdulsattar Ahmad and Ganesh Balasubramanian
Presenter: Ganesh Balasubramanian

ABSTRACT

Customs digitalisation single-window systems, pre-arrival processing, and automated risk management is widely promoted as a means of compressing the variability of border-clearance time. Drawing on classical inventory theory, we ask how that variance compression affects a firm’s optimal safety stock. Using a discrete-event simulation of a continuous-review (Q, r) replenishment system with skewed (lognormal) clearance times, and isolating the variance channel through a mean-preserving compression, we find that the inventory benefit of digitalisation is strongly regime-dependent. Above a cycle-service-level threshold (≈0.68 in our base case), variance compression reduces required safety stock substantially by roughly two-thirds at very high service levels. Below the threshold across the 50–70% band where most firms operate the benefit vanishes and reverses: variance compression raises the required buffer. The widely assumed inventory dividend of customs digitalisation thus accrues mainly to high-service-level firms. This regime-heterogeneity also offers a mechanism reconciling the operations prediction with the null clearance-uncertainty effect reported in aggregate trade data. The result speaks directly to the conference theme of moving “from data to policy”: the operational returns to a border-digitalisation policy depend on the service-level profile of the importing firm population.

PAPER 145

Techno-Economic Assessment of Green Hydrogen Integration in UAE Refinery Operations: A Ruwais Refinery Case Study

Shayma Alshehhi, Pedro Rochedo and Rawan Abdelsalam
Presenter: Shayma Hassan AlShehhi

ABSTRACT

Green hydrogen is a potential decarbonization option for oil refineries, where hydrogen is already used in hydrotreating and hydrocracking. While previous studies have examined hydrogen production economics, limited work has integrated refinery

simulation, hydrogen supply optimization, and refinery margin analysis for a UAE refinery. This study evaluates the techno-economic impact of replacing grey hydrogen with green hydrogen in the UAE's refinery operations, using the Ruwais refinery as a case study. The methodology combines CAESAR refinery simulation, green hydrogen supply-system modeling, and refinery economic and emissions analysis. CAESAR estimates refinery operation, product output, utility use, and hydrogen demand, which is used to size an off-grid solar-based green hydrogen system. The refinery requires 270,2 kt/yr of hydrogen. Meeting this demand requires 9.4 GWp of PV, 5.5 GW of electrolysis, and 824.6 tonnes of hydrogen storage, resulting in an LCOH of 6.32 USD/kg H2. Switching to green hydrogen reduces the refinery margin from 12.1 to 7.1 USD/bbl and avoids 2.7 $MtCO_2$/year. The results suggest that refinery-scale green hydrogen can substantially reduce emissions, but remains economically challenging under current technology costs, requiring carbon pricing, policy support, or future cost reductions to become competitive.

PAPER 146

Sensor-to-Dashboard: Design Thinking Process of Robot Platform for Precision Irrigation

Naomi Unkelos-Shpigel, Kareem Zeedan, Rami Taha and Uzi Rosen

Presenter: Naomi Unkelos-Shpigel

ABSTRACT

The escalating water crisis, intensified by climate change and inefficient irrigation practices, highlights the urgent need for innovative solutions in agriculture. This paper presents a design thinking-driven approach to developing an IoT-based smart irrigation system for sustainable precision agriculture. The system integrates real-time data collection from humidity and temperature sensors deployed via a mobile robotic platform, combined with weather forecast APIs to enable data-driven irrigation scheduling tailored to plant-specific requirements. The proposed architecture consists of four interconnected layers: Sensor, Edge, Cloud, and Application. Sensor data is transmitted via MQTT protocols to a Firebase-powered cloud infrastructure, while a ReactJS dashboard provides farm managers with real-time monitoring, automated alerts, and irrigation control. The paper documents the design thinking process, multidisciplinary collaboration challenges, and lessons learned from early field testing. K

PAPER 147

Development and Validation of a Sustainable Supply Chain Performance Framework for the UAE Construction Industry

Areej Mohammed, Yara Mattar, Haneen Abuzaid and Ghassan Abu-Lebdeh

Presenter: Haneen Abuzaid

ABSTRACT

Sustainability has increasingly become a crucial aspect of evaluating the performance of supply chain management in the construction sector and an integral component of sustainable development. The UAE construction sector plays a vital role in the country's economic growth and is expected to grow rapidly in the coming years. Yet, the UAE's sustainable supply chain practices have not adequately addressed this industry. Therefore, there is a need to develop a resilient and extensive indicators' set to track progress toward sustainable supply chain management in the UAE construction sector. This study aims to present a framework that investigates sustainability in the UAE construction supply chain. After a thorough literature review, 32 sustainability indicators were derived and validated according to the triple bottom line and the requirements of different project stakeholders. The developed framework and the resulting set of key performance indicators serve as a solid foundation for assessing sustainable supply chain performance in the construction industry in the UAE, and provide policymakers, construction industry practitioners, and researchers with a validated reference for benchmarking sustainable performance and promoting sustainability.

PAPER 148

Fault Detection and Explainable Classification in Automotive HIL Validation via Denoising Autoencoders and In-Context Large Language Models

Mohammad Abboush

Presenter: Mohammad Abboush

ABSTRACT

Validating automotive software systems produces large multivariate test recordings that are still examined through effort-intensive manual review and rule-based evaluation, which detects faults beyond predefined rules poorly. Machine and deep learning have advanced fault diagnosis, yet most supervised models require large labelled datasets, generalise poorly to unseen conditions, and offer little insight into their decisions. We propose a generalisable and explainable two-phase framework for fault detection and classification during real-time validation. A denoising autoencoder trained only on healthy signals first flags abnormal behaviour through reconstruction-error analysis, removing the need for fault labels. Each abnormal window is then encoded as compact textual statistical evidence relative to a time-aligned healthy reference and

classified by a frozen large language model under zero-shot and few-shot prompting, returning the predicted class, ranked alternatives, a confidence value, the fault location, and a short evidence-based explanation. Eight open-source models are evaluated across two powertrains and three driving regimes. The detector attains average F1-scores of 0.97 across powertrains and 0.98 across regimes, with average mean error below 0.03. Zero-shot prompting proves insufficient (best 0.519 F1-score), whereas few-shot prompting reaches perfect discrimination under stable regimes, showing that prompting strategy, rather than parameter count, governs classification quality: a nine-billion-parameter model surpasses every zero-shot medium and large model. Mistral Small 24B is adopted as the main pipeline model for its balance of accuracy, class balanced reliability, calibration, and inference cost, giving engineers interpretable diagnostic reports and more efficient validation.

PAPER 149

A Digital Twin-Ready Framework for Dynamic Circularity Assessment in UAE Building Retrofit: A Systematic Review

Elbethel Muluye, Hani Alzraiee and Sameh El-Sayegh
Presenter: Elbethel Muluye

ABSTRACT

The built environment contributes substantially to global energy consumption and material waste, creating urgent need for sustainable retrofit strategies. While Digital Twin (DT) technologies and Circular Economy (CE) principles have gained considerable research attention, integrated frameworks tailored to the UAE context remain absent. This systematic literature review synthesized 85 peer-reviewed studies published between 2014 and 2026 using the PRISMA 2020 protocol, achieving strong inter-rater reliability. Six thematic clusters were identified and analyzed across four dimensions: retrofit decision support, circularity assessment, UAE contextualization, and predictive simulation. The review confirmed a persistent four-dimensional capability gap. To address this, a Digital Twin-ready framework is proposed comprising four layers: UAE exposure-context calibration, Circularity Readiness Index (CRI) computation, rule-based decision support, and predictive simulation. The framework provides a rigorous foundation for future validation and operational implementation of circular retrofit decision-support systems in the UAE.

PAPER 150

Economic-environmental design of the cumulative sum control chart for quality monitoring

Zeinab Hamad, Ridvan Aydin, Salah Haridy, Heba Elhaddad, Ahmed Maged and Mohammad Shamsuzzaman
Presenter: Zeinab Hamad

ABSTRACT

The manufacturing sector is a key driver of global economic growth, yet it substantially contributes to resource consumption, waste generation, and environmental degradation. Conventional quality control methods in manufacturing primarily focus on statistical and economic outcomes, with limited attention to environmental implications, particularly for attribute data. This research proposes an economic-environmental design of the cumulative sum (CUSUM) chart for attribute-based quality monitoring. The proposed model optimizes charting parameters while maintaining acceptable false-alarm and inspection rates and enhancing the detection of nonconforming products. The model is validated through a case study from the plastic extrusion blow molding industry. The findings reveal that the optimal CUSUM chart provides the most effective monitoring scheme, with an economic-environmental cost reduction of 35% compared to the traditional CUSUM chart and 13% compared to the optimal np chart. The optimized CUSUM chart enhances quality control and reduces costs and emissions.

PAPER 153

Evaluating AI-driven voice biomarker systems for schizophrenia: A systematic review using a systems approach and human factors principles

Raghad Alsakaji, Haya Al Jaghoub, Shayma Alshehhi, Sarah Alkindi, Faisal Nawaz and Firda Rahmadani
Presenter: Firda Rahmadani

ABSTRACT

This paper explores the use of Artificial Intelligence (AI)-driven voice biomarkers for early detection and continuous monitoring of schizophrenia. Traditional diagnostic approaches are often subjective, timeconsuming, and limited in scalability. In contrast, AI offers automated, non-invasive alternatives that can detect vocal indicators linked to core symptoms. A systematic literature review was conducted using the PRISMA framework. Thereafter, the selected studies were evaluated through a systems approach guided by eight Human Factors and Ergonomics (HF/E) principles. The review revealed promising but heterogeneous model performance across classification, prediction, and correlation-based tasks using features extracted from speech across multiple languages and contexts. However, limitations related to generalizability, explainability, workload, and ethical issues were noted. While AI-based voice biomarkers show high potential for enhancing

psychiatric diagnosis and monitoring, most solutions remain at the proof-of-concept stage. A systems approach is essential to bridge the gap between technological innovation and real-world clinical application, ensuring usability, safety, and scalability.

PAPER 154

An Effective Evolutionary Algorithm for Drone-Assisted Relief Distribution Problem with Isolated Areas

Setyo Tri Windras Mara, Ruhul Sarker and Saber Elsayed
Presenter: Setyo Tri Windras Mara

ABSTRACT
When disaster occurs, the distribution of relief goods to the disaster-affected communities is necessary to minimize the loss and casualties. However, the occurrence of disaster often damages the essential logistics infrastructures, resulting in the isolation of some disaster-affected areas. This situation leads to the relevance of airborne transportation modes, such as drones, in assisting the distribution of relief goods. Therefore, this article considers a drone-assisted relief distribution system, where drones are utilized to deliver relief goods to the isolated areas. Considering the urgent nature of this problem, an evolutionary algorithm with a novel solution representation is proposed as an effective decision-support tool. The algorithm's effectiveness is tested through a series of computational experiments, resulting in 2.98-3.04% performance gaps in best solutions found and 11.37-30.08% gaps in the computational efficiency.

PAPER 155

Enterprise Solution to Reviewer Assignment and Scheduling Problem

Prasoon Jha, Pankaj Sahu, Mangesh Gharote and Manu Kumar Gupta
Presenter: Manu Kumar

ABSTRACT
Reviewer Assignment and Scheduling in large-scale innovation events requires selecting suitable reviewers (juries), forming panels, assigning entries (papers) to panels, and scheduling the event. Multiple criteria, such as reviewer expertise, experience, and availability, must be considered for a feasible reviewer assignment and event schedule. This paper defines the Reviewer Assignment and Scheduling Problem (RAPS), a combined variant of the reviewer assignment and conference scheduling problems discussed in the prior art. We propose a three-stage integer programming framework to solve RAPS: the first stage forms feasible jury panels, the second assigns entries to panels using a composite matching score, and the third schedules panel-entry pairs across available time slots. Computational experiments on representative instances show that the proposed approach generates high-coverage, high-utilization, and practically usable schedules for enterprise-scale settings. The framework serves as a decision-support system for improving the efficiency and quality of reviewer assignment and scheduling.

PAPER 158

Developing Optimal Operational Strategies for Human-Robot Interdependent Systems in Restaurants

Byeong Ju Jo, Young Kwan Ko and Young Dae Ko
Presenter: Byeong Ju Jo

ABSTRACT
Despite the widespread adoption of robots across various industries, service-oriented sectors such as hospitality continue to face significant limitations in deploying robots due to the inherently unstructured nature of service tasks. Customers still tend to prefer interactions with human employees, while exceptional situations that fall outside predefined procedures frequently arise in practice. Therefore, rather than pursuing the complete replacement of human employees, there is a growing need to establish a systematic and interdependent human–robot cooperation framework. This study proposes an optimal operational system for interdependent human–robot cooperation in restaurant environments and redefines robots not merely as substitutes for human labor but as complementary partners. This study developed a multi-objective optimization model that simultaneously minimizes total operating costs, including robot subscription fees and employee labor costs, as well as employees' physical workload, while satisfying predefined customer satisfaction targets. In the proposed framework, repetitive and physically demanding transportation tasks are assigned to robots, whereas personalized face-to-face services are performed by human employees. Furthermore, realistic operational constraints are mathematically incorporated, including employee break requirements mandated by labor regulations, robot battery charging requirements, and the negative impact of accumulated employee fatigue on service quality. To address operational problems of varying scales, this study implements a staged solution approach that combines mathematical optimization techniques for obtaining baseline optimal solutions, metaheuristic algorithms for large-scale operational problems, and reinforcement learning methods to capture uncertainty in real-time environments. This study presents a leading framework at the intersection of service operations management and ergonomics and provides practical insights for sustainable technology integration in service industries.

PAPER 159

A Rolling Horizon Approach for Demand-Responsive Transit Operations

Geonwook Ryoo and Young Dae Ko
Presenter: Geonwook Ryoo

ABSTRACT

Demand-Responsive Transit (DRT) operates without fixed routes or timetables. Vehicles are dispatched in response to passengers' real-time requests. DRT is well suited to environments where demand is temporally concentrated, spatially dispersed, and highly variable. These characteristics align with the tourism context, where attractions are spread out and travel demand fluctuates considerably. DRT can serve as an alternative. It enables tourists to flexibly visit multiple dispersed attractions, even in transit-underserved regions with limited public transportation. However, realizing the potential of DRT requires sophisticated operational decisions. Operators must decide which vehicle serves which request, in what sequence, and when. This challenge intensifies because tourist travel requests arrive sequentially throughout operating periods. Operators must periodically revise plans while ensuring service continuity for passengers already onboard. This study develops an optimization model for DRT operations under such dynamic conditions. The problem is formulated as a mixed-integer linear programming (MILP) model. It is based on the standard structure of the vehicle routing problem (VRP) and the dial-a-ride problem (DARP) and is extended to account for mid-operation re-planning. The model fixes the assigned vehicle for onboard requests to guarantee service continuity. Vehicles resume operation from their current locations rather than the depot and may depart early. This static model is applied repeatedly via a rolling-horizon procedure. The system updates vehicle states and request sets at fixed intervals. It responds to dynamically arriving demand while preserving solution quality at each stage. The model is implemented using IBM ILOG CPLEX and validated through a small-scale numerical example. The results confirm that the re-optimization procedure maintains the continuity of onboard passengers while efficiently integrating newly arriving requests, with idle vehicles dispatched only when additional capacity is required. This study thus provides a foundation for real-time DRT operational decision-making that supports access to dispersed attractions in transit-underserved tourism settings.

PAPER 160

A Study on Reinforcement Learning-Based Optimization of Collaborative Operations between Hotel Service Robots and Staff

Sang Woo Shin and Young Dae Ko
Presenter: Young Dae Ko

ABSTRACT

This study proposes a reinforcement learning-based collaborative operation model between hotel service robots and human employees to address the dynamic task allocation problem in hotel service environments. Hotel service operations involve various customer requests that occur unpredictably over time, while the availability of robots and employees continuously changes according to operational conditions. Consequently, conventional static optimization approaches have limitations in effectively reflecting the uncertainty and real-time characteristics of actual hotel operation. To represent a realistic service environment, a virtual hotel consisting of 15 floors and 117 guest rooms was constructed. The operational environment included delivery and retrieval tasks that could be performed by service robots, as well as complaint-handling tasks that were exclusively assigned to human employees. The hotel service process was formulated as a Markov Decision Process (MDP), and a Proximal Policy Optimization (PPO) algorithm was employed to learn adaptive task allocation policies for service robots. In addition, a hybrid collaboration framework was developed in which reinforcement learning-based robots operated alongside rule-based human employees. While the PPO agents dynamically selected tasks according to the current system state, human employees followed predefined rule-based dispatching policies, enabling the evaluation of collaborative decision-making between heterogeneous service agents. Numerical experiments were conducted under static, dynamic, and dynamic collaboration scenarios, and the proposed model was compared with a CPLEX-based optimization benchmark. The results demonstrate that the proposed approach effectively adapts to real-time task arrivals and changing operational conditions. Furthermore, the hybrid collaboration structure improved overall operational performance by combining the adaptability of reinforcement learning with the stability and predictability of rule-based decision-making. The findings suggest that reinforcement learning can serve as an effective decision-making framework for dynamic task allocation in hotel service operations and that collaboration between learning-based robots and rule-based human workers can further enhance operational efficiency in complex service environments.

PAPER 161

A Multi-Period Facility Location Model for Integrated Air–Ground–Underground Urban Logistics

Hyeseon Han and Byung Duk Song
Presenter: Hyeseon Han

ABSTRACT

Rapid growth in parcel delivery and increasing demand for time-sensitive freight, such as fresh food and pharmaceuticals, have intensified the need for fast and congestion-resilient urban logistics systems. However, ground-based logistics infrastructure in dense metropolitan areas is already highly saturated, and further facility expansion is often spatially and operationally constrained. This study proposes a multi-period facility location model for an integrated air–ground–underground urban logistics system that connects Urban Air Mobility, ground vehicles, and subway-based freight transportation with existing logistics infrastructure. Unlike conventional hub location or multi-echelon facility location problems, the proposed model determines whether candidate locations can serve as integrated logistics hubs capable of supporting multimodal transshipment among aerial, ground, and underground transportation modes. Candidate sites include existing large-scale ground terminals, micro-fulfillment centers, subway stations suitable for underground logistics facilities, and vacant sites where new facilities can be constructed. The model simultaneously considers facility construction and operation decisions, inter-hub freight flows, last-mile delivery allocation, unmet demand penalties, transshipment costs, and annual budget constraints over multiple planning periods. The proposed framework also reflects the shared-use nature of UAM infrastructure by considering the interaction between passenger and freight demand when estimating available cargo capacity. To examine the applicability of the model, a case study is conducted for the Seoul metropolitan area, where ground logistics facilities are highly saturated and subway infrastructure is widely distributed. The results demonstrate that the proposed model can support phased investment decisions for multimodal logistics hubs and provide strategic insights for improving the responsiveness of time-sensitive urban freight delivery.

PAPER 162

Game Theory Based Decision Model in Hotel HRM : Selection of Training and Pay-for-performance

Gyu Heon Kim and Young Dae Ko

Presenter: Gyu Heon Kim

ABSTRACT

In the hotel industry, service quality is an important factor because it influences key outcomes such as guest satisfaction, reputation, and demand. High service quality can enhance a hotel’s reputation and lead to an increase in repeat customers and additional demand. Service quality depends on how hotels invest in their employees. Employee training can enhance employees’ service-related capabilities, while pay-for-performance can motivate employees to maintain high service quality. Based on this relationship, this study develops a Stackelberg game-theoretic model to examine hotels’ strategic decisions on employee training and pay-for-performance for long-term profit maximization. The model provides a framework for explaining how hotels may determine training and pay-for-performance levels over time. In the model, the hotel acts as the leader, setting two strategic decision variables: training investment and pay-for-performance. The employee acts as the follower and chooses an effort level based on individual utility. Reputation is modeled as a dynamic state variable. Higher service quality in one period accumulates as reputation, which in turn generates demand in subsequent periods. A central contribution of this study is that it jointly examines two key investments in hotels. Employee training improves employees’ service-related capabilities, and its effects can persist over time by contributing to reputation and future demand. Pay-for-performance can motivate employees to exert greater effort; however, as employees’ abilities and performance increase, hotels need to provide compensation that reflects their higher contribution. Therefore, this study proposes a decision-making model that jointly considers the interaction between these two factors. Overall, the proposed model serves as a hotel-based human-resource investment framework that considers both long-term capability development and short-term effort incentives, offering managerial implications for designing contracts that improve service quality, reputation, demand, and hotel profitability over time.

PAPER 164

A Resilience Analysis of the Unrelated Parallel Machine Scheduling Problem with Makespan Objective

Paz Perez-Gonzalez, Jose M Framinan and Yasser Dessouky

Presenter: Paz Perez-Gonzalez

ABSTRACT

In this paper, scheduling resiliency is analyzed, defined as the deterioration of the performance measure used in the scheduling process after a disruption occurs and a reaction method has been applied to respond to this disruption. The unrelated parallel machines scheduling problem with makespan objective is considered, and a machine breakdown occurs before the schedule is executed and cannot be repaired. Two reaction methods are compared: Rescheduling all jobs on the remaining machines (named as rescheduling problem); or freezing the scheduled jobs on the operational machines, and only scheduling those assigned to the down machine (named as availability problem). Results show that, in low-variability scenarios the deterioration of the objective function by the availability problem has no statistically significant differences compared to the rescheduling problem, requiring negligible computational times. These findings imply that, in specific

scenarios, the frozen policy can be an effective approach for achieving resilience in manufacturing scheduling.

PAPER 166

Decision-Making Framework for Tender Evaluation and Subcontractor Selection in Construction Projects: Integrating Risk and Environmental Factors

Jawaher Aldhuhoori, Ali Cheaitou and Malek Masmoudi
Presenter: Jawaher Ali Zaid Aldhuhoori

ABSTRACT

This paper develops an integrated decision-making framework for tender evaluation and subcontractor selection in construction projects. The framework responds to the limitations of lowest-bid procurement by combining prequalification, Data Envelopment Analysis (DEA), fuzzy logic assessment, Fuzzy TOPSIS prioritization, and bi-objective Mixed-Integer Linear Programming (MILP). In the first stage, DEA screens subcontractors and retains only efficient candidates. In the second stage, risk and environmental exposure factors are evaluated using linguistic judgments and fuzzy logic. Fuzzy TOPSIS is used as a supporting prioritization check to compare ordering of efficient subcontractors under multiple criteria. In the final stage, a bi-objective MILP model selects the subcontractor or subcontractors and determines the quantity of work assigned to each selected subcontractor by minimizing total cost and total risk. A numerical UAE construction tendering case application demonstrates how the framework supports transparent award decisions and helps tender committees evaluate cost-risk trade-offs before contract award.

PAPER 167

Industry 4.0 Enabled Sustainability Transformation in UAE Manufacturing: An ISM MICMAC Decision Framework

Nujood Alkaabi and Malek Masmoudi
Presenter: Nujood Faisal Mohammed Alkaabi

ABSTRACT

This paper develops a framework explaining how Industry 4.0 critical success factor drivers enhance sustainability and circular economy performance in UAE manufacturing. Although digital technologies are presented as sustainability enablers, limited studies explain the causal ordering of technological, organizational, human, supply-chain and policy drivers that shape sustainability transformation in industrial settings. A literature-derived set of critical success factor drivers was validated by 10 experts from manufacturing, sustainability, digital transformation and academic backgrounds. Their pairwise judgments were analyzed using Interpretive Structural Modeling (ISM) and MICMAC analysis to identify hierarchical relationships and driving-dependence structure. The results identify digital infrastructure, leadership commitment, data governance and policy support as influential driving critical success factors. Organizational readiness, human capital, supply-chain integration and implementation maturity form the linkage layer, while sustainability and circular economy performance are dependent outcomes. The paper provides a reproducible decision framework for sequencing Industry 4.0 investments toward sustainability and circular economy transformation.

PAPER 169

Human-centered workplace layout assessment based on spatial and temporal CO2 analysis using validated computational fluid dynamics

Omar Shatarat, Alessandro Dausilio, Valentina Lazzara, Velia Malizia, Stefania La Grutta and Giuseppe Aiello
Presenter: Omar Shatarat

ABSTRACT

This study presents a proof-of-concept method for ventilation-informed workplace-layout assessment. Measured carbon dioxide decay was combined with a computational fluid dynamics model of an occupied indoor room during one natural cross-ventilation event. After validation against measurements at a central monitoring point, the simulated CO2 field was evaluated within the breathing zone and local volumes around each seated operator. Mean concentration, percentile concentration, and the fraction of local volume above a comparative threshold characterized spatial and temporal dilution. Cross-ventilation reduced average CO2 concentration, but the improvement was spatially non-uniform. At the end of the analyzed period, op7 and op4 retained the highest local fractions above the threshold. The method identifies positions where layout or ventilation interventions should be prioritized. It serves as a screening and decision-support procedure rather than a completed layout optimization; comparison of alternative configurations is reserved for future work.

PAPER 170

Optimizing Emergency Water Distribution: A Blockchain-Enabled Heuristic Framework for Equitable Humanitarian Supply Chains

Rehab Ali, Pere Latre Duran, Christopher Pike, Mayer Attie and Benjamin Wilkinson
Presenter: Rehab Ali

ABSTRACT

Post-disaster water distribution represents a critical and underexplored application of humanitarian supply chain optimization, where delays and inequities in resource allocation can have life-threatening consequences. This paper presents a heuristic optimization framework for emergency bottled water distribution across Florida counties following hurricane-induced disruptions. The proposed framework integrates geospatial facility data, census-derived demand estimates, and transportation distance matrices to model post-disaster allocation behavior under constrained supply conditions. The resulting statewide allocation network consists of 26 bottled water facilities and 67 Florida counties, creating 1,742 potential transportation allocation links between supply and demand nodes. Two allocation variants are developed and compared: a blockchain-enabled collaborative model in which suppliers share demand fulfillment information in real time, and a competitive non-blockchain model representing conventional decentralized logistics behavior. The study evaluates the operational and equity implications of information transparency in humanitarian supply chains using transportation cost, service level, and variance-based equity metrics. Computational experiments conducted under a disaster scenario Supply/Demand ratio of 0.425 demonstrate that the blockchain-enabled model achieves a 49.49% reduction in equity variance relative to the non-blockchain baseline, albeit with a 29.76% increase in transportation cost. Sensitivity analysis across multiple Supply/Demand conditions further confirms the robustness of the observed cost-equity tradeoff. The findings provide quantitative evidence that decentralized information transparency mechanisms inspired by blockchain coordination can substantially improve fairness in humanitarian resource allocation during disaster response operations. The proposed framework contributes to both humanitarian logistics and Industry 4.0 research by demonstrating how collaborative coordination mechanisms influence supply chain behavior under severe disruption conditions.

PAPER 171

A Multi-Criteria Decision Framework for Selecting Video-to-3D Reconstruction Software in Forensic Engineering

Zehra Canan Araci, Afra Ahmed Alsharif, Nour Samer Kabour, Ghala Amjad Dablan, Amna Almaazmi, Abdullah Al Ali, Mohammed Al Ali and Mohammad A. Alqassim
Presenter: Zehra Canan Araci

ABSTRACT

Motion-video footage is routine forensic evidence, yet practitioners lack a structured, reproducible basis for choosing among the many tools that convert it into three-dimensional (3D) models. This study presents an expert-validated decision framework applying the Analytic Hierarchy Process (AHP) to video-to-3D software selection under realistic forensic conditions. Four photogrammetry-based tools were evaluated across 36 trials using motion video from a mobile phone and a 360-degree camera under four conditions (indoor/outdoor, day/night). Performance combined processing and upload time with structured assessment of user experience and output quality, while four criteria (speed, accuracy, cost, user-friendliness) were weighted by ten Dubai Police forensic experts. Aggregation yielded a consistent ranking (consistency ratios within 0.10): RealityScan first, then 3DF Zephyr, Agisoft Metashape, and EyesCloud3D. Sensitivity analysis confirmed robustness except when user-friendliness dominated, favouring 3DF Zephyr. The contribution is a transferable, criteria-based evaluation method that forensic units can adapt to their priorities.

PAPER 172

A Decision Support Tool for Improving Healthcare Service Quality in Technology-Enabled Healthcare Settings

Karam Al-Assaf, Zied Bahroun and Vian Ahmed
Presenter: Karam Alassaf

ABSTRACT

Healthcare systems face persistent challenges in delivering consistent service quality despite rapid technological transformation. Traditional Healthcare Service Quality (HCSQ) models treat quality dimensions descriptively and assume equal importance, limiting structured prioritization in technology-enabled settings. This study proposes a Relational Framework for HCSQ (RF-HCSQ) and Decision Support Tool (DST) integrating validated quality domains and Key Performance Indicators (KPIs) with hybrid multi-criteria weighting. A mixed-method approach combined expert interviews, a three-round Delphi validation, a practitioner survey (N=127), and a patient survey (N=206). Ten domains and 47 KPIs were validated and weighted via hybrid techniques integrating the Analytic Hierarchy Process (AHP), Arithmetic Mean aggregation, and Shannon entropy, while patient priorities were modeled using the Plackett-Luce method. Bootstrap resampling confirmed robustness.

Findings identify Patient Safety as the most influential domain and Clinical Quality as the second, with Technology Impact functioning as an enabling rather than outcome-driving domain. A preliminary end-user evaluation (n=7) indicated that the DST supports structured prioritization and actionable performance review.

PAPER 173

Event driven dynamic ambulance dispatch with transformer reinforcement learning and explainability

Yimo Yan, Bo Zou, Theja Tulabandhula and Yong-Hong Kuo
Presenter: Yimo Yan

ABSTRACT

Efficient ambulance dispatch is essential for timely emergency medical care under limited fleet capacity and uncertain patient demand. This paper presents an event driven semi Markov decision model in which dispatch decisions are triggered by patient call arrivals or newly idle ambulances. The model allows strategic ambulance withholding and ambulance redirection. To solve the problem, we develop a transformer reinforcement learning framework that learns contextual ambulance and patient location assignments through attention based communication. We further distill the learned policy into a surrogate decision tree to support explainable dispatch recommendations. Experiments on synthetic cases and Toronto paramedic data show that the proposed approach reduces patient waiting and improves ambulance operating efficiency.

PAPER 176

An Integrated DEMATEL-ANP-C-IMOHBA-VIKOR Framework for Multi Objective Renewable Energy and Circular Economy System Design

Muhammad Falah Alfath and Abduh Sayid Albana
Presenter: MUHAMMAD FALAH ALFATH

ABSTRACT

The concurrent pursuit of renewable energy (RE) transition and circular economy (CE) objectives, introduces complex multi objective trade-offs among economic cost, environmental impact, social benefit, and energy security. Existing frameworks seldom integrate causal decision-making with multi-objective optimization under a unified structure. This paper proposes a novel integrated framework combining Decision-Making Trial and Evaluation Laboratory (DEMATEL), Analytic Network Process (ANP), a Chaotic Multi-Objective Honey Badger Algorithm (C-IMOHBA), and the VIKOR ranking method. The principal algorithmic contribution is the replacement of pseudo-random number generation in IMOHBA with a Tent-Logistic hybrid chaotic map. This deterministic integration effectively avoids premature convergence and eliminates degenerate zero security solutions that comprise 7% of the vanilla IMOHBA archive. Criteria weights derived from a five-expert DEMATEL-ANP elicitation prioritize environmental impact (32.13%) and economic cost (28.07%). These weights are applied in VIKOR to rank 300 Pareto-optimal solutions generated under IRENA-validated constraints. Numerical experiments confirm that C-IMOHBA achieves superior diversity and convergence metrics in 89.6 seconds, outperforming the 94.4 seconds vanilla baseline. The top-ranked compromise solution demonstrates a balanced operational profile: an LCOE of $19.08/MWh, emissions of 15.27 kg CO_2eq/MWh, employment of 1.827 jobs/MW, and a robust energy security index of 34.53. Ultimately, the framework provides a structured, reproducible decision-support methodology for policymakers addressing sustainable RE-CE system design.

PAPER 177

A Stochastic One Warehouse Multiple Retailer System with Lead Time Uncertainty

Gracy Sharma and Om Prakash
Presenter: Dr. Om Prakash

ABSTRACT

This paper comprises a one warehouse multiple retailer (OWMR) inventory model operating under a continuous-review (R, Q) policy. Customer demand at each retailer is modeled as a compound Poisson process with stochastic lead times while the warehouse has a fixed lead time. Solution Procedure together with convexity analysis of the total cost function has been carried out. An algorithm is given to obtain optimal decision variables. Sensitivity analysis is performed to investigate the effects of key system parameters on the inventory policy and total system cost. The results demonstrate that the proposed policy is robust to variations in warehouse ordering, holding, and shortage costs, whereas the demand size distribution and retailer lead time have the greatest influence on the optimal inventory decisions and total system cost.

PAPER 178

Regulatory Airspace Governance and Platform Coopetition: A Game-Theoretic Analysis for Dubai's Drone Delivery Market

Ganesh Balasubramanian, Areej Siddiqui, Mahmood Abdulsattar Ahmad and Sania Ashraf
Presenter: Ganesh Balasubramanian

ABSTRACT

We formulate the strategic interaction between the regulatory airspace governance and the platform competition in the emerging drone food delivery market of Dubai as a two-stage Stackelberg-Nash game. The regulator (Dubai Civil Aviation Authority), as a Stackelberg leader, sets the quota of airspace slots, the licensing fee per delivery, and the safety threshold to maximize social welfare. After observing the regulatory decisions, two competing food delivery platforms, (Keeta Drone and Talabat), simultaneously choose delivery prices and drone fleet investments as Nash competitors, subject to a shared airspace capacity constraint that links their costs through a congestion externality. We obtain a closed-form Subgame Perfect Nash Equilibrium, and reveal five key propositions characterising the (i) airspace Tragedy of the Commons, (ii) optimal licensing fee, (iii) self-reinforcement of Keeta's cost advantage through coopetition, (iv) strategic complementarity of fleet investments, and (v) safety-investment Pareto complementarity. Finally, using a numerical analysis considering Dubai market data, we quantify welfare losses from market asymmetry, and suggest optimal regulatory policies to DCAA.

PAPER 180

Toward National Supply Chain Resilience Metrics: A Literature Mapping and Roadmap

Ilias Tafjouti, Majed Hadid and Adel Elomri

Presenter: Ilias Tafjouti

ABSTRACT

Quantitative supply chain resilience (SCR) measurement has accumulated a substantial methodological base, but that base is unevenly distributed across the units of analysis at which resilience is measured. This paper maps the as-is literature landscape of selected SCR measurement studies by unit of analysis and by measurement stream, and diagnoses what that distribution reveals. The mapping shows that methodological depth concentrates at the firm, network, and system levels, with sector-level composite benchmarking as the largest aggregate unit, while country-level SCR measurement emerges as weakly represented and conceptually underdeveloped. Read across the classification, this country-level gap appears as a structural feature of the literature rather than a temporary data shortage. On the basis of this diagnosis, the paper proposes a roadmap framework for the future development of country-level SCR metrics and illustrates its application through a case on Qatar, leaving empirical validation to subsequent research.

PAPER 181

Managing telemedicine disruptions in hybrid outpatient appointment systems

Aparna Venkataraman, Varun Ramamohan and Sisira Edirippulige

Presenter: Aparna Venkataraman

ABSTRACT

Hybrid outpatient clinics must expand access while maintaining reliable operational performance. This is difficult when telemedicine visits share clinical capacity with in-person care and are affected by infrastructure disruptions. Unlike service time variability, telemedicine disruptions can add consultation time or prevent visits from being completed. This paper studies how disruption conditions and appointment slot length affect such systems. An analytical model is developed to separate added workload from incomplete telemedicine visits and to derive a reference slot length for a given disruption setting. The mechanism is tested using a discrete-event simulation of a hybrid outpatient clinic with scheduled patients, walk-ins, emergencies, no-shows, and carryovers. Results show that short disruptions increase overtime and utilization, while longer disruptions reduce congestion because some telemedicine visits are not completed. Longer slots reduce waiting, but increase carryover by reducing daily appointment capacity. Resilient hybrid outpatient scheduling, therefore, requires balancing congestion, capacity, and telemedicine appointment completion.

PAPER 182

Behavioral Mean-Variance Portfolio Selection for Other Financial Institution Stocks in the Philippine Stock Exchange (PSE) Using Security-Potential/Aspiration (SP/A) Probability Weighting

Michael Urmanita, Benedict Banaag, Jose Rafael Isaac Reyes, Ma. Althea Kassandra Domingo, Michael Young, Klint Allen Mariñas and Michael Calamba

Presenter: Michael Young

ABSTRACT

This study integrates Security-Potential/Aspiration (SP/A) theory into the Markowitz Mean-Variance (MV) framework to examine how a cautiously hopeful probability assignment shapes portfolio construction in the Other Financial Institutions (OFI) subsector of the Philippine Stock Exchange (PSE). Using daily returns from 1993 to 2022 for thirteen non-bank firms, the study weighted fear and hope equally at four intensities and optimized each across a Risk-Return Factor (RRF) under a fixed daily budget. Before screening, cumulative return peaked at a risk-averse RRF and rose with intensity. After screening, no configuration exceeded the Market Return and no intensity dominated. Portfolio weights followed the RRF rather than the intensity, so the framework serves best as a disciplined way to allocate within the subsector.

PAPER 185

Impact of Quantity Restricted Delivery and Stochastic Lead Time on One Warehouse Multiple Retailers System

Shubham Priyadarshi and Om Prakash
Presenter: Dr. Om Prakash

ABSTRACT

This paper investigates a centralized one-warehouse multiple-retailer (OWMR) distribution system with quantity-restricted deliveries from the warehouse to downstream retailers. Demand at each retailer follows a compound Poisson process, and inventory is managed through continuous-review (R,Q) policies. Shortages are completely backordered, with customer orders fulfilled according to a first-come-first-served (FCFS) rule. The model explicitly incorporates stochastic retailer lead times. To analyze the proposed system, several theoretical results are established regarding the convexity of the total cost function. An algorithm-based optimization procedure is developed to jointly determine base quantity, retailer, and warehouse reorder points that minimize the total cost. The numerical study reveals that the combined effect of stochastic retailer lead times and restricted deliveries substantially influences inventory decisions, which results in higher reorder points to maintain service levels. The results further reveal that retailer backordering costs are a key driver of the optimal policy, higher shortage penalties lead to increased reorder points across the supply chain as a precaution against stockouts under stochastic lead times and restricted delivery operations

PAPER 186

A risk-based failure mode and effects analysis framework for transformer fire prevention

Sarah Alkindi, Hasan Al-Ali, Maitha Almarzooqi, Khalifa Almansoori and Saed Amer
Presenter: Sarah Ahmed Mohamed Saif Alkindi

ABSTRACT

Transformer fires are high-risk events affecting safety, equipment reliability, and power continuity. This paper presents a risk based framework for transformer fire prevention, developed by integrating four analytical tools: Descriptive Analysis, Pareto Analysis, Root Cause Analysis (RCA) using a fishbone diagram, and Failure Mode and Effects Analysis (FMEA). Data from six research papers covering eight failure causes were analysed. Pareto Analysis identified electrical faults, overheating, and insulation degradation as the top three risk drivers. FMEA quantified each root cause using Severity, Occurrence, and Detection ratings, producing Risk Priority Numbers (RPN) before and after proposed controls. Mitigation measures including condition-based maintenance, online dissolved gas analysis, thermal imaging, and operator training significantly reduced RPN values. The integrated framework supports earlier fault detection and decision-making aligned with National Fire Protection Association (NFPA) 70B-2023, offering a practical tool for safer transformer operation.

PAPER 187

A mixed-methods framework for assessing psychosocial risks and work-related stress in the United Arab Emirates

Sarah Alkindi, Khalifa Almansoori, Hajar Mutlaq, Mahra Almazrouei, Batool Jahanzeb and Saed Amer
Presenter: Sarah Ahmed Mohamed Saif Alkindi

ABSTRACT

Work-related stress is a growing occupational health concern that affects employee wellbeing and organisational performance. It occurs when job demands exceed workers' capacity and is closely associated with psychosocial risks, including excessive workload, job insecurity, limited decision-making authority, poor support, and unclear roles. This paper proposes a mixed-methods framework for assessing psychosocial risks and work-related stress in the United Arab Emirates (UAE). Published studies were reviewed to identify methodological gaps and inform a two-phase design combining quantitative survey assessment with qualitative interviews. The framework supports risk identification, contextual interpretation, and evidence-based mitigation planning. Given the productivity burden of mental health problems in the UAE, the proposed approach offers a practical basis for proactive psychosocial risk management and workplace wellbeing improvement.

PAPER 190

Designing an Integrated Smart Port Gate Information System: The GateOS.ai Case at the Port of Sines

Raquel Gil-Pereira, Rui Borges Lopes and Leonor Teixeira
Presenter: Raquel Gil Pereira

ABSTRACT
Maritime container gates involve a sequence of tasks, including vehicle and cargo identification, document verification, routing decisions, and access authorization. However, the information required to support these activities is often fragmented across multiple independent platforms. This paper introduces GateOS.ai, a Smart Gate information system designed for the Port of Sines. The study followed an echeloned Design Science Research methodology informed by stakeholder co-creation and human-centered design principles. The resulting artifact comprises validated checkpoint-based requirements, an operator-facing interface prototype, and a layered architecture grounded in Digital Twin concepts. The architecture connects gate infrastructure and captured events with data management, external systems, analytical models, and user decision support. Qualitative stakeholder reviews helped refine the proposed workflows and confirm their alignment with the intended gate process. The study provides a structured path from operational needs to system design and supports the gradual evolution of the gate environment toward a data-driven ecosystem.

PAPER 191

Interplay of circular sourcing and operational control parameters in driving supply chain resilience

Rachele Fussone, Rebecca Fussone, Salvatore Cannella and Jose Manuel Framinan
Presenter: Rachele Fussone

ABSTRACT
Nowadays, disruptive events increasingly affect supply chain resilience and performance, while limited raw material availability drives global adoption of the Circular Economy paradigm. This study assesses how Circular Economy practices influence supply chain resilience by investigating the joint effect of structural design and operational control parameters through simulation-based analysis integrated with Design of Experiments. We examine five sourcing configurations, namely single-sourcing, double-sourcing, symbiotic-sourcing, closed-loop and circular-sourcing. Results show that structural design emerges as the primary determinant of resilience, shaping how supply chains respond to disruptions. At the same time, supply chain resilience is a dynamic outcome that depends on the alignment of sourcing strategies with operational policies. Overall, the adoption of Circular Economy-based sourcing strengthens absorptive capacity, to the extent that service continuity can be maintained without relying on high safety factors.

PAPER 192

Human-Centric Sustainable Logistics 5.0 Adoption Among Last Mile Workers: A Neurophysiological Experimental Research in Progress Study

Pramit Khatua and Himanshu Gupta
Presenter: Pramit Khatua

ABSTRACT
Logistics 5.0 extends digital logistics by integrating cyber physical systems, intelligent platforms, wearable technologies, human centered interfaces, and real time decision support. Yet its successful implementation depends not only on technological maturity but also on the adoption behavior of frontline last mile logistics workers. This research in progress study examines how last mile workers cognitively and behaviorally respond to Logistics 5.0 platform features using simultaneous EEG and Tobii eye tracking. The proposed experiment compares traditional logistics platforms, and Logistics 5.0 platforms with worker task choice. Neurophysiological measures, behavioral task outcomes, and self-reports will be used to examine trust, autonomy, cognitive workload, and adoption intention. The study contributes to industrial engineering, operations management, supply chain, and logistics by explaining worker level adoption mechanisms in intelligent logistics systems.

PAPER 193

The Impact of Using Digital Technologies within Course Content on the Study Duration in Engineering Programs

Fatma Ismail Ghanim and Zehra Canan Araci
Presenter: Fatima Ismail Ibrahim Ghanim

ABSTRACT
Digital technologies are now embedded in engineering education, but little is known about the extent to which they save students time. This paper attempts to address this question. Using data from surveys of 112 engineering students at the University of Sharjah, the author attempts to understand the relationship between the integration of digital technologies into coursework, students' perceptions of digital integration, and their engagement and satisfaction with digital learning, and the perceived amount of time required to complete academic tasks. A 5-point Likert-scale questionnaire was developed for engineering students at different academic levels and analysed with descriptive statistics, Pearson correlation, and three-stage multiple regression analysis. All variables predicted time reduction and engagement and satisfaction were the single largest predictors. The regression model explained 42% of the variance in time reduction and regardless of the

variables, study duration decreased. The paper recommends the use of digital tools, along with engaged and satisfied learners, to effectively reduce study time. The paper concludes with recommendations for course design and teacher digital literacy, and institutional digital strategy in engineering education.

PAPER 194

Portfolio Optimization of Philippine Stock Exchange Industrial Sector Companies Using Mean-Variance Analysis and SP/A Probability Assignment Under Varying Fear and Hope Parameters

Mark Anthony Santiago, Althea Ainsly Limin, Claire Blethe Herrera, Jan Marini Dagli, Michael Young, Klint Allen Mariñas and Michael Calamba

Presenter: Mark Anthony Santiago

ABSTRACT

This study examines portfolio optimization in the Philippine Stock Exchange (PSE) Industrial Sector by integrating Mean-Variance Theory (MVT) with the Security-Potential/Aspiration (SP/A) framework. Using data from 73 industrial firms from 1993 to 2022, expected returns were estimated through a rolling-window approach. Portfolio optimization was performed under varying Risk-Return Factor (RRF) levels, reflecting bearish and bullish investment preferences, while investor decision-making was modeled under a cautiously hopeful condition in which fear and hope were equally weighted. Behavioral probability assignments were generated using different SP/A parameter levels and incorporated into the optimization process. The resulting portfolios were evaluated against a benchmark portfolio and the PSE. Results show that portfolios incorporating behavioral probability assignments achieved superior risk-adjusted performance, with balanced risk-return preferences producing the most favorable outcomes, while highly return-focused portfolios exhibited greater volatility. These findings demonstrate the value of incorporating behavioral factors into portfolio optimization and investment decision-making in emerging markets.

PAPER 195

Integrating additive manufacturing as a resilience capability in spare parts supply chains: a dual sourcing optimization model with bound metal deposition

Muhammad Fahad Sheikh, Majed Hadid, Ayoub Khouyi, Fatima G. Alabtah, Marwan Khraisheh and Laoucine Kerbache

Presenter: Muhammad Fahad Sheikh

ABSTRACT

Spare parts supply chains in asset-intensive industries are highly exposed to disruption because demand is intermittent, suppliers are distant, and lead times are long. Integrating on-site additive manufacturing alongside conventional suppliers is increasingly viewed as a proactive resilience capability, yet existing sourcing models rarely capture the process-specific economics of metal additive manufacturing. This paper develops a mixed-integer linear programming model for a hedged spare parts supply chain in which conventional suppliers and an on-site bound metal deposition facility are jointly optimized. The model embeds the full bound metal deposition cost structure, covering design, feedstock procurement and inventory, printing, debinding, sintering, post-processing, and part qualification, together with supplier capacities, minimum order quantities, and multimodal transportation. A twelve-month numerical study of three industrial spare parts shows the hedged design meets all demand at minimum cost, qualifies every part for additive production, deploys additive capacity exactly where conventional sourcing binds, and retains substantial reserve capacity for disruption response. A demand sensitivity analysis reveals the demand thresholds at which the additive share expands, clarifying the conditions under which the capability is most valuable. The study is thus positioned as a decision-support demonstration for spare parts sourcing, offering managerial guidance on when embedding on-site AM capacity constitutes a cost-effective resilience investment.

PAPER 196

GFLFGOA-GWO: A Novel hybrid Swarm-optimization Algorithm

Madhusmita Das, Chandramani Sahoo, Priyanka Suresh, Hari Kumar Reddy B and Aleena Harold Peter

Presenter: MADHUSMITA DAS

ABSTRACT

The design of optimization algorithms is essential for addressing numerous real-world engineering challenges in the current era. This study focuses on swarm-optimization algorithms (SOAs) that simulate the behavior of swarms in order to address the aforementioned remark due to their exploration-exploitation trade-off, versatility, adaptability and so on. In this paper, we introduce a novel hybrid SOA named as gravitational force Lévy flight grasshopper optimization algorithm-grey wolf optimization (GFLFGOA-GWO) algorithm. The proposed GFLFGOA-GWO algorithm's exploration capability is enhanced through social interaction and Lévy perturbations, while leader-based guidance guarantees exploitation. The performance of the GFLFGOA-GWO is verified by performing two different types of experiments on thirteen benchmark functions (BFs) comparing with the other baseline algorithms (GWO, RWGWO, LFGOA, GFGOA, GFLFGOA, GOA). The first set of experiment is the

descriptive statistics metric (mean, standard deviation, median, minimum error, and maximum error). Following this, a non-parametric test (Wilcoxon, Friedman test, and performance index (PI) analysis) has also been performed to observe the optimization of the GFLFGOA-GWO algorithm on BF functions. Through descriptive statistics, GFLFGOA-GWO achieved superiority on 9 out of 13 BFs. Our findings illuminate an overall win rate of 86.2% with no statistically significant loss on any BF based on the non-parametric test.

PAPER 197

Drivers and Barriers to Residential Rooftop PV Adoption in the UAE: A Qualitative Interview Study

Haya Al Jaghoub, Shatha Elatrash and Ahmad Mayyas
Presenter: Haya AlJaghoub

ABSTRACT
Residential rooftop photovoltaic (PV) systems can support the UAE's transition toward sustainable energy, but their adoption depends strongly on residents' perceptions and readiness. This exploratory qualitative study examines the factors shaping UAE residents' willingness to adopt rooftop PV through semi-structured interviews with four purposively selected participants representing diverse ages, genders, and income levels. Transcripts were analyzed using word-frequency, Classical Content, thematic, and sentiment analysis. Four themes emerged: economic considerations, technical performance and reliability, structural and residential constraints, and adoption enablers. Upfront costs, financing, maintenance, and provider trust were key concerns, while long-term savings, environmental benefits, social influence, and government support encouraged adoption, with priorities varying by income group. Despite these concerns, sentiment analysis revealed consistently positive attitudes toward rooftop PV across all participants. Although the small sample limits generalizability, these preliminary findings can help UAE policymakers and PV providers design targeted financial incentives, reliability assurances, and awareness campaigns to support residential PV adoption.

PAPER 198

Digital and AI-Based Supply Chain Integration in the Solar Energy Sector: A PRISMA-Based Systematic Literature Review with Implications for the UAE

Mohammad Matar and Ali Cheaitou
Presenter: Mohammad Abdullah Matar

ABSTRACT
Given the rapid expansion of solar energy projects, it is essential to have supply chains that are data-driven and efficient. However, the solar energy supply chain is fragmented. A systematic literature review based on the PRISMA model was conducted to investigate the current state of digital and artificial intelligence-based supply chain integration in the solar energy industry in the United Arab Emirates. Studies that meet the criteria will be published between 2014 and 2026 from various databases and analyzed for relevance to the research questions proposed here. The review will investigate various technologies, the successful factors for implementing them in supply chains, the challenges of using these technologies in supply chains, the functions of supply chains in the solar energy industry, and the performance of those supply chains utilizing these technologies. The outcomes of this study will contribute to the discussion of how AI and digital technologies could be applied to enhance the integration of supply chains in the solar energy industry.

PAPER 200

Pre-budget screening for timing certification of carbon capture, utilization, and storage retrofit investment in China

Yanjun Luo, Yu Zhang, Nan Sun, Lawrence Loh and Qiang Mai
Presenter: Yanjun Luo

ABSTRACT
A carbon capture, utilization, and storage (CCUS) retrofit is an irreversible investment whose value depends on when the firm commits, because allowance prices and capture costs move over the investment window. Choosing that date is an optimal stopping problem, for which least-squares Monte Carlo yields an executable timing rule. Capital approval requires more than an executable rule: evidence of how much value that rule gives up against the optimum. A dual certificate supplies that evidence, at the price of a simulation budget of its own. The certificate admits several implementations, and which of them is tightest on a given instance is not known until that budget has been spent; nothing available beforehand orders them. We split the certificate’s inner conditional expectation into two terms: a regression-linear term that is available in closed form under regime-switching lognormal dynamics, and a nonlinear residual that must be simulated. The residual’s share of the two terms’ combined mean absolute magnitude—the residual share—indicates whether the plain hybrid—the certificate with unstratified residual sampling—is competitive with the standard nested estimator. A probe run costing under 2% of a full certification pass is enough to compute that share. On a calibrated 600 MW Chinese coal-fired retrofit, that share, read against a threshold, rules out the plain hybrid before any full-budget run; of the three implementations compared—nested,

plain hybrid and stratified hybrid—the stratified hybrid then produces the smallest estimated gap. Even so, the resulting certificate settles less than a capital committee needs. One-sided lower confidence limits lie well above zero, so the trained rule has demonstrable value; the gap between the estimated bounds, however, remains too wide to rank the retrofit against a close alternative. The share therefore governs what certification costs; the width the certificate returns bounds what it can be asked to decide.

PAPER 202

Enhancing Supply Chain Efficiency in Oman's Logistics and Transportation Sector: The Role of Digital Transformation and Organizational Agility

Eyad Al Kharusi and Meilinda Maghfiroh
Presenter: Meilinda Fitriani Nur Maghfiroh

ABSTRACT
Digital transformation plays a significant role in enhancing the efficiency of Oman's supply chain, particularly in the logistics and transportation sectors, by adopting advanced technologies. This mixed-methods study investigates how digital technologies improve supply chain efficiency in Oman by identifying key technologies, analyzing implementation barriers, assessing current systems, and evaluating the benefits of digital transformation. Data were collected through a questionnaire administered to 50 respondents and semi-structured interviews conducted with six participants. The quantitative findings indicate strong relationships between digital transformation, organizational agility, and competitive performance, with organizational agility serving as a mediating factor and environmental uncertainty acting as a moderating factor. The qualitative findings highlight the adoption of technologies such as the Internet of Things (IoT), cloud computing, and artificial intelligence (AI), which contribute to cost savings of 10–20% and lead-time reductions of up to 30%. Despite these benefits, the study identifies several challenges, including financial constraints and shortages of skilled labor, which may hinder the effective implementation of digital technologies. Overall, the study concludes that digital transformation is essential for improving Oman's supply chain efficiency and strengthening global competitiveness. It recommends increased investment in digital technologies, workforce training, and supportive policy interventions to overcome implementation barriers and support the goals of Oman Vision 2040.

PAPER 204

Conceptual Framework for Understanding Consumer Attitudes Toward Drone-Based Delivery Services

Areej Mohammed, Malick Ndiaye, Adolf Acquaye and Batool Madani
Presenter: Dr Areej Mohammed

ABSTRACT
Drone-based delivery services have emerged as a promising innovation for enhancing last-mile logistics through faster deliveries, improved accessibility, and reduced environmental impacts. However, the successful implementation of this technology depends largely on consumer acceptance. Existing studies examining drone delivery adoption remain fragmented, often focusing on a limited set of determinants or relying on a single theoretical perspective. Accordingly, this study reviews and synthesizes the existing literature to identify the key factors influencing consumers' attitudes toward drone-based delivery services. Drawing on insights from the Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology, Diffusion of Innovation Theory, Task–Technology Fit Theory, and Privacy Calculus Theory, an integrated conceptual framework is developed. The review identifies perceived usefulness, perceived ease of use, task–technology fit, relative advantage, speed expectancy, hedonic motivation, environmental friendliness expectancy, social influence, privacy risk, and safety risk as the principal determinants of consumer attitudes toward drone delivery services.

PAPER 205

A Multi-Objective Optimization Model for Food Import Supplier Selection: a comparison of evolutionary algorithms

Sara Al-Mansoori, Zekra Mohamed, Adriana Gabor and Siddhartha Shakya
Presenter: Zekra Mohamed

ABSTRACT
Food import diversification is an important strategy for improving the resilience of import-dependent food systems. This paper studies the allocation of food imports across multiple suppliers while considering three conflicting objectives: reducing supplier risk, reducing import cost, and limiting dependence on dominant suppliers. The problem is formulated as a constrained multi-objective optimization model and solved using two evolutionary approaches: NSGA II and MOEA/D. A projection step is used to ensure that all generated allocations satisfy demand and supplier capacity constraints. Computational experiments compare the two algorithms using hypervolume, inverted generational distance, runtime, and non-dominated solution quality. The results provide insight into the behavior of dominance-based and decomposition-based evolutionary methods for constrained food import allocation.

PAPER 208

Risk-Aware Sustainable Aviation Fuel Procurement under Regulatory Uncertainty: A Two-Stage Stochastic CVaR Model for Airline Networks

Mohamed Abdelmagid, Abdullah Quran and Maher Maalouf
Presenter: Mohamed Abdelmagid

ABSTRACT

Sustainable aviation fuel is scarce, costs several times as much as fossil jet fuel, and is increasingly mandated by regulation. We study how an airline should commit to forward purchase contracts before observing fuel prices, carbon prices, and supply availability, and how it should allocate physical SAF and voluntary book-and-claim certificates across its network afterwards. We formulate a two-stage stochastic mixed-integer program whose objective combines the expected net compliance cost with its Conditional Value-at-Risk and calibrate one hundred correlated price and availability scenarios entirely from public data. A case study of a Gulf-carrier network with thirteen long-haul routes serving EU, UK, and other international destinations over twenty-four quarters shows that SAF compliance adds about four and a half percent to the fuel-and-carbon bill, and that voluntary certificate flexibility reduces tail cost by about three percent while cutting required forward commitments by more than one third

PAPER 209

Factors Affecting Construction Productivity in UAE Building Construction Industry: A Relative Importance Index Analysis

Gifty Elizabath Syam, Vikas Swarnakar, Albert Wijeweera and Malik Khalfan
Presenter: GIFTY ELIZABATH SYAM

ABSTRACT

Construction productivity is a key performance indicator in building construction projects because it directly affects project time, cost, quality, and resource efficiency. This study aims to identify and rank the main factors affecting construction productivity in the UAE building construction industry. Based on a review of Scopus-indexed literature, 38 productivity sub-factors were classified into six categories: labor/workforce, project-related, materials and equipment, construction site, management, and external factors. A structured questionnaire survey was distributed to professionals working in UAE building construction projects, and 30 valid responses were analyzed using the Relative Importance Index method. The results show that material and equipment maintenance/equipment breakdown, labor skill and experience/labor shortage, proper supervision, poor work site condition, and delay in payment are the most prominent productivity-related factors. The findings provide practical guidance for contractors, consultants, and project managers to improve productivity through better resource planning, workforce management, supervision, site conditions, payment practices, safety, and rework control.

PAPER 210

Predicting Power Grid Transformer Burn Rates using Hyperdimensional Computing: A Case Study in Cauca, Colombia

Toheeb Salahudeen, Maher Maalouf and Ibrahim Elfadel
Presenter: Toheeb Salahudeen

ABSTRACT

The reliability of power grid transformers is a cornerstone of socio-economic stability in the Cauca Department, Colombia, where diverse geographical conditions and intense ceraunic activity pose significant risks to critical infrastructure. Traditional predictive maintenance models, while accurate, often suffer from high computational overhead and latency, limiting their deployment in edge-computing environments. This paper introduces a Hyperdimensional Regression (HDR) framework as a computationally agile, energy-efficient alternative to conventional ensemble learners for power systems regression. Leveraging a comprehensive dataset of 15,873 transformers, we employ 2019 operational data for model training and 2020 data for rigorous temporal validation, ensuring practical applicability in predicting future infrastructure states. Experimental results demonstrate that while ensemble methods such as XGBoost yield high peak accuracy, the proposed HDR framework achieves robust predictive performance with R^2 scores reaching 65.5% at a fraction of the computational cost. Notably, the HDR models maintain sub-second, deterministic inference latencies, proving to be approximately $17\times$ faster than high-performing baselines like XGBoost. This study establishes HDR as a superior high-fidelity, low-latency alternative for real-time fault detection in power distribution networks, providing utility providers with a scalable tool for optimizing maintenance schedules in both rural and urban grids.

PAPER 211

Single-vendor multiple-buyer supply chain model under quality of products, service level constraints, and optimal production rate

Asif Iqbal Malik
Presenter: ASIF IQBAL MALIK

ABSTRACT

In modern supply chain networks, multiple buyers often generate high and uncertain demand, making fixed production policies insufficient for achieving cost efficiency and maintaining product quality. This paper develops a single-vendor multi-buyer supply chain model that incorporates variable production rates, imperfect product quality, service-level constraints, and distribution-free lead-time demand. The unit production cost is assumed to depend on the production rate, and three alternative quality functions are proposed to characterize the relationship between production rate and process quality. The objective is to determine the optimal production and inventory policy that minimizes the total supply chain cost under a single-setup multiple-delivery framework. Closed-form analytical results and an efficient solution algorithm are developed to obtain the optimal decisions. Numerical examples and sensitivity analyses are presented to validate the model and investigate the effects of key parameters. The findings reveal that production-rate flexibility plays a critical role in reducing total supply chain cost while mitigating quality deterioration, providing valuable managerial insights for coordinated supply chain operations.

PAPER 215

Digital twin as testing grounds for Agentic AI

Sara Bahlooq, Andrei Sleptchenko and Mohammed Omar
Presenter: Sara Bahlooq

ABSTRACT

Recent advances in AI have enabled agentic systems to act in operational environments with limited human oversight, raising the risk that they may violate or ignore human instructions and cause damage. The use of a digital twin as an intermediate environment can mitigate this risk by having actions examined before they reach the real system. While digital twin has been examined as environments for AI simulation more broadly, this study focuses on agentic AI and the use of DT as an intermediate environment for examining actions before real world execution. This paper develops a review informed conceptual framework that characterizes digital twin as testing grounds for agentic AI. By examining studies that integrate digital twin with agentic systems, it organizes the role of the digital twin into several stages, connected by pathways. Human role remains vital and takes different shapes around directing, checking, authorizing, and maintaining agentic systems.

PAPER 216

A New Mathematical Model for the Asymmetric Traveling Salesman Problem

Hour Almadhaani and Ping Ji
Presenter: Hour Almadhaani

ABSTRACT

Last-mile delivery is one of the most costly and complex stages of logistics, especially in urban areas where travel distances are affected by road direction, traffic conditions, and access restrictions. This paper studies the Asymmetric Traveling Salesman Problem (ATSP) as a routing framework for last-mile delivery optimization. A binary integer programming model is proposed to determine the visiting order of customers and the directed movements between consecutive positions in the tour. The model assigns each customer to exactly one position, ensures that all customers are visited once, and returns the route to the depot while minimizing the total directed travel cost. The proposed formulation is implemented in Python and solved using Gurobi Optimizer. Computational experiments are conducted on ATSP benchmark instances, including four different instances. The results show that the model generates valid ATSP routes and performs efficiently for small instances, achieving a solution time of 0.01 seconds for 4.atsp. However, the solution time increases for larger instances due to the growth of transition variables. The proposed model is compared with classical ATSP formulations, including MTZ, GP, MCF, PQ, and SST. The findings show that the model provides a clear and interpretable route structure, while future work will focus on improving its computational performance for larger-scale instances.

PAPER 217

Multi-Objective Optimization of Green Hydrogen Supply Chain Network Design

Rodayna Ibrahim, Noha Galal and Khaled El-Kilany
Presenter: Rodayna Ibrahim Hassan Mohamed Ibrahim

ABSTRACT

The transition from fossil fuels requires the deployment of highly efficient green hydrogen supply chains. This paper presents a five-echelon network design capturing the flow of green hydrogen from renewable feedstocks to large-scale power

generation and heavy industrial end-users. A bi-objective mixed-integer linear programming model, solved by a goal programming approach, is proposed to balance economic costs and environmental emissions. The model determines the optimal production and storage locations, transport modes, and distribution flows. A case study conducted in Egypt illustrates the model's effectiveness and highlights significant structural trade-offs between cost and emissions objectives. Eventually, this research offers decision-makers an actionable framework for balancing economic feasibility and sustainability goals.

PAPER 220

The Mergeable Storage Location Assignment Problem: A Flow-Based Decomposition with Energy and Carbon Accounting

Ermal Belul, Marwane Bouznif, Dritan Nace and Antoine Jouglet
Presenter: Ermal Belul

ABSTRACT

The Storage Location Assignment Problem (SLAP) determines warehouse handling costs and energy consumption. We introduce the Mergeable Storage Location Assignment Problem (MSLAP), which allows adjacent locations to be merged, increasing capacity for high-demand products and reducing replenishment frequency. A direct cost-minimizing integer program formulates MSLAP exactly but its dense overlap constraints stall at industrial scale. We recast the problem on an extended flow network with proportional side constraints and solve it in three phases: greedy initialization, flow-based topology exploration, and exact bipartite matching. On a real instance (1,543 products, 3,285 locations), the flow model reaches in one minute a cost the direct model cannot match in two hours, validating four times as many merges. Optimal assignment cuts material-handling energy by about 12%, meeting a 10% target; among compliant layouts the recommended one reduces operating cost by roughly a third, most of it from merging. Station workload balance improves by 21%, an observed side effect of spreading merges across the grid.

PAPER 221

Resilience Assessment of California Logging Truck Networks Using a Topology-Aware KNN–Weibull Framework

Shailesh Chandra
Presenter: Shailesh Chandra

ABSTRACT

This paper presents the Probabilistic Topology-Aware Multi-Modal K-Nearest Neighbor (P-TAM-KNN) framework for assessing the resilience of California's Logging Truck Network (LTN). Two integrated contributions are made. First, Weibull reliability theory is embedded inside the KNN mechanism: the k structurally nearest bridge analogues identified by the Heterogeneous Network-Topology Distance (HNTD) are used as a distance-weighted sample for Weibull MLE, transforming every KNN query into a time-varying failure probability — the first use of KNN structural analogues as a Weibull parameter estimator. Second, the Supply Chain Resilience Index (SCRI) integrates the time-varying Weibull failure probability with corridor-level disruption severity and recovery capacity into a single risk metric, identifying US-101 as the most resilience-critical LTN corridor. Two-stream validation (KNN-Weibull parameters and Caltrans operational maintenance records) independently converges on US-101 as the highest-priority corridor for intervention.

PAPER 222

Document-Grounded Enterprise FAQ Bot: A RAG Architecture for HR Self-Service

Joud Herzallah and Ibrahim Elfadel
Presenter: Joud Jawad Mousa Herzallah

ABSTRACT

This paper presents an enterprise HR FAQ chatbot built using Retrieval-Augmented Generation (RAG) to provide grounded and verifiable responses to employee queries. To address domain mismatch in the Doc2Dial dataset, a custom enterprise HR knowledge base was constructed. The system uses FAISS for dense vector retrieval and IBM Granite-3.1-2B-Instruct for response generation, deployed via a Databricks pipeline and a Hugging Face Spaces interface. The system was evaluated through multi-model benchmarking against Phi-3.5-Mini, Qwen-2.5-1.5B, and SmolLM-1.7B under CPU constraints. Granite achieved the best balance between grounding accuracy and citation compliance, with a latency of 8.5 seconds and a perplexity of 5.09. In contrast, Phi-3.5-Mini achieved lower perplexity (3.35) but higher latency (12.2 seconds), while smaller models showed reduced grounding quality and inconsistent citation behavior. A strict L2 distance threshold (> 1.5) was implemented to prevent hallucinations, ensuring deterministic fallback responses for out-of-scope queries. Results demonstrate that a lightweight, constraint-aware RAG architecture can deliver reliable, citation-grounded answers in enterprise environments.

PAPER 223

MedQuAD Healthcare Assistant: A Retrieval-Augmented Medical Question Answering Chatbot

Omnia Ahmed and Ibrahim Elfadel
Presenter: Omnia Osama Ahmed

ABSTRACT
Medical question answering systems must provide responses that are not only understandable, but also grounded in reliable sources. This paper presents the MedQuAD Healthcare Assistant, a retrieval-augmented chatbot for patient-facing educational medical question answering. The system uses the MedQuAD dataset as a medical knowledge source, retrieves relevant question-answer records using dense vector search, and generates cited responses with Qwen2.5-7B-Instruct. The evaluation compares a No-RAG baseline with MiniLM and BGE-small retrieval configurations across multiple top-k settings, using retrieval metrics, RAGAS answer-quality metrics, latency, and human evaluation. BGE-small with k = 10 achieved the strongest overall balance, reaching 1.000 Exact QA Hit@10 and 0.911 Exact QA MRR, while also providing the highest context recall among RAG configurations. These results show that dense-retrieval RAG can improve reliable information access, while still requiring expert validation before clinical use.

PAPER 224

On Population Monotonic Allocation Schemes and the Core of Economic Lot-Sizing Games with Concave Ordering and Holding Costs

Basak Altan, Ali Ekici, Ulas Ozen and Okan Orsan Ozener
Presenter: Ulas Ozen

ABSTRACT
In this paper, we study cooperation among multiple organizations (e.g., retailers) that jointly place orders from an external supplier and manage their inventories. We use the well-known Economic Lot-Sizing (ELS) model with general concave ordering and holding costs to model the retailers' decision problem and analyze the resulting cooperation games (i.e., ELS games). The existence of population monotonic allocation schemes for ELS games has been an open question in the literature. Recently, a positive answer was obtained for two-period ELS games with linear holding and backorder costs; however, a general result has remained unknown. In this paper, we show by means of a counterexample that ELS games do not admit a population monotonic cost allocation scheme in general. We then discuss a class of candidate core allocations for ELS games with general concave ordering and holding costs.

PAPER 227

LoRA Fine-Tuning and Retrieval-Augmented Baseline Analysis for a Topical-Chat Conversational LLM

Mohammed Musthafa and Ibrahim Elfadel
Presenter: Mohammed Musthafa

ABSTRACT
This paper investigates lightweight adaptation of a conversational large language model for topical open-domain dialogue. Using the Topical-Chat dataset, conversations were converted into supervised next-response prediction examples, where the model learns to generate the next assistant reply from preceding dialogue history. A Qwen2.5-1.5B-Instruct model was adapted using Low-Rank Adaptation (LoRA) under Kaggle GPU constraints. In addition, a local retrieval-augmented generation (RAG) baseline was implemented using wiki-backed Topical-Chat factual sections and BM25 retrieval. Fine-tuning experiments across progressively larger training subsets show that validation loss decreased from 3.1550 in a 300-sample pilot run to 2.6430 in the strongest reported run, with perplexity decreasing to 14.0557. The RAG baseline provided explicit evidence retrieval for factual prompts, while LoRA fine-tuning improved dialogue modeling. At this stage ,the system is suitable for supervised prototyping rather than direct public deployment.

PAPER 230

Adaptive Safety Certificates for Data-Driven Safe Online Learning in Battery Management Systems

Lakshmi Manoj and Pingfeng Wang
Presenter: Lakshmi Manoj

ABSTRACT
Battery management systems must select charging protocols in real time while keeping operation within safe limits, yet current systems enforce fixed, non-adaptive constraints that sacrifice performance over the battery lifetime. We propose an Adaptive Safety Certificate (ASC) framework that defines state-dependent safety constraints derived from public aging data and a gradient-boosting risk classifier, tightening automatically as battery health degrades. Integrated into a safe online

learning policy, the framework progressively eliminates empirically unsafe protocols as state of health decreases, concentrating selections on protocols that balance charging speed with long-term sustainability. In simulation over 2,000 charging batches, the ASC achieves 41% longer expected battery life than a random baseline, corresponding to $3,528 in deferred replacement cost per vehicle and 2,578 tonnes of avoided CO2 per 1,000-vehicle fleet. Ablation studies con- firm that state-of-health-dependent adaptation is the single most important property of the framework, with direct implications for sustainable fleet management policy.

PAPER 231

Clinical Pre-Consultation Chatbot for Telehealth Intake Conversations

Ayah Miqdady and Ibrahim Elfadel
Presenter: Ayah Miqdady

ABSTRACT

Collecting patient history before a medical consultation is repetitive, time-consuming, and leaves clinicians starting from scratch with every patient. This paper presents a clinical pre-consultation chatbot for telehealth platforms that automates the intake step using Qwen2.5-7B-Instruct, a 7.6-billion-parameter opensource language model fine-tuned on the MedDialog dataset with QLoRA. During a session the chatbot collects symptoms, duration, medications, allergies, and relevant history, then produces a structured clinician note. A FAISS-based retrieval layer grounds responses in curated clinical knowledge, and keyword-based safety guardrails block diagnosis requests and escalate emergencies. Evaluation on 36 held-out MedDialog dialogues yields ROUGE-1 = 0.1842 and BLEU = 0.0243; perplexity falls 92.5% from 44.81 to 3.37 after fine-tuning, confirming successful domain adaptation. The system is a functional prototype demonstrating that parameter-efficient fine-tuning on a single consumer GPU can produce a safe, deployable clinical intake assistant.

PAPER 233

Exploring Patient Satisfaction Drivers in UK General Practitioner Practices Using Machine Learning

Hala Al Nuaimi, Sara Bahlooq, Gifty Syam, Ann Sabu, Meera Al Wheibi, Mohamed Allam and Maher Maalouf
Presenter: Mohamed Allam

ABSTRACT

Background: Patient satisfaction is a crucial indicator of healthcare quality, which encompasses multiple dimensions of patient care. This research analyzes survey data from 720,000 patients across 42 Integrated Care Systems in the UK on patients' experiences with their GP practices by applying six machine learning regression algorithms to assess key drivers of patient satisfaction. Methods: We used Random Forest, XGBoost, CatBoost, Lasso, Ridge, and Elastic Net regression models. Cross-validation and hyperparameter tuning were conducted to optimize model performance and prevent overfitting. Results: Receptionist help emerged as the most significant factor influencing patient satisfaction, followed by listening skills of healthcare professionals and efficient appointment scheduling. Ridge and Elastic Net regression models demonstrated better performance, with R-squared values of 0.964, 0.956, respectively. Conclusions: Focusing on receptionist training, improving communication skills of healthcare professionals, and optimizing appointment scheduling systems can significantly increase patient satisfaction. Machine learning provides valuable information to improve healthcare quality.

PAPER 235

Efficient Scenario Reduction for Joint Inventory and Fulfillment Problems in Omnichannel Retail

Shahana Kappil, Adriana Gabor and Giorgio Consigli
Presenter: Shahana Kappil

ABSTRACT

This paper studies a joint inventory and fulfillment problem for an omnichannel retailer under stochastic demand. The retailer first allocates inventory across fulfillment locations and then decides how to fulfill customer orders after demand is realized. We formulate the problem as a two-stage stochastic optimization model that minimizes expected holding, fulfillment, and penalty costs. To reduce the computational effort, we use a scenario reduction method based on a modified Wasserstein distance that accounts for the cost structure of the problem. Numerical results show that this method achieves lower costs than the benchmark algorithm.

PAPER 236

The role of artificial intelligence in managing surgical site infections- an enhanced systems thinking framework

Sara Bahlooq, Sara Zaidan, Hind Abdulla, Dalal Almansoori, Ahmad Mohamad and Firda Rahmadani
Presenter: Sara Bahlooq

ABSTRACT
Surgical site infections (SSIs) remain a major healthcare challenge, affecting patient outcomes and increasing operational costs. Although artificial intelligence (AI) shows potential for improving the prediction, detection, and prevention of SSIs, the literature lacks a comprehensive systems design framework to support its implementation. This study addresses this gap by developing an enhanced systems-thinking, AI-driven decision support framework that integrates design-thinking principles. The framework comprises four components: people, systems, design, and risks. Through a review of existing literature and current practices, the study identifies key factors influencing AI implementation in SSI management, including user-centered design, system interoperability, iterative prototyping, and risk assessment. The resulting framework provides a structured approach for integrating AI into SSI management and offers guidance for researchers, clinicians, and healthcare administrators. The study concludes with recommendations for applying the framework in healthcare settings, emphasizing interdisciplinary collaboration, stakeholder engagement, and proactive risk management to improve patient safety and reduce healthcare-associated infections.

PAPER 237

A Multi-Supplier Multi-Item Probabilistic Inventory Policy with Partial Backorder and Capacity Constraint for an SME Retailer

Salsabila Zafira Faradisi, Leo Rama Kristiana and Aulia Dihas Zahira
Presenter: Salsabila Zafira Faradisi

ABSTRACT
This study develops a multi-item multi-supplier probabilistic inventory policy for an SME household-goods retailer by considering partial backorders and storage capacity constraints. The case covers 60 fast-moving SKUs supplied by eight fixed suppliers. Two policies are evaluated: a Supplier-Based Policy (SBP) with different ordering intervals across suppliers and an All-Supplier Policy (ASP) with one common interval per month. For historically stockout SKUs, the observed unmet-demand gap of 966 units is reduced to a modeled cumulative expected shortage of six units over seven months. Across all SKUs, both policies maintain monthly demand fulfillment above 95%. Replenishment quantities are adjusted to SKU-level demand and remaining inventory position, reducing unnecessary orders and excess-inventory risk. SBP yields the lowest calculated cost, while ASP offers a simpler schedule. Sensitivity analysis identifies storage capacity as the most influential parameter on the selected interval and total inventory cost.

PAPER 238

Evaluation of Used Car Showroom Network Using D-CFLP-NR Considering Customer Preference through Huff Model

Riza Nabil Harjito, Femi Yulianti and Gisti Ayu Pratiwi
Presenter: Riza Nabil Harjito

ABSTRACT
This study evaluates a network of five used-car showrooms operated by CV ABC using the Dynamic Capacitated Facility Location Problem without Relocation together with the Huff Model. Demand for 2026 was forecast from 36 months of historical sales and distributed across 13 demand zones according to showroom attractiveness and distance. The model minimizes annual fixed and transportation costs while satisfying demand and branch-capacity constraints. The optimal configuration retains the Mangga Dua, Bintaro, and Bekasi branches and closes the Kemayoran and Pantai Indah Kapuk 2 branches. This configuration reduces total annual cost from IDR 6.906 billion to IDR 3.143 billion, representing a 54.49% saving, while maintaining full demand fulfilment. Sensitivity analysis of demand and the Huff parameters a and b indicates that the selected configuration remains stable under the tested parameter variations, although a 30% demand increase exceeds the available capacity.

PAPER 239

Application of Support Vector Regression for Disaster Logistics Aid Allocation to Reduce the Fulfilment Gap at a Government Humanitarian Agency in West Java Province

Abstract:
West Java Province recorded the highest number of disaster occurrences in Indonesia in 2024, with 457 hydrometeorological cases. A gap exists between logistics demand and allocated quantities, with fulfilment shortfalls of 24 to 27% across five aid categories exceeding the 10% threshold, due to a static weighted scoring system without capturing regional demand. This study proposes a

three-stage framework: vulnerability variables are forecasted using Simple Linear Regression or Moving Average based on MAPE; Support Vector Regression predicts demand for 27 districts; allocation is proportionally determined subject to stock constraints. Validation NSE ranges from 0.6481 to 0.8038 and the fulfilment shortfall reduces to at most 10% for the 2025 validation period, outperforming the existing weighting approach. SVR outperforms Random Forest in four of the five categories, consistently achieving lower MAPE across all categories. The originality lies in a region-specific, pre-disaster demand prediction framework replacing static provincial weighting.

Syakila Putri Nansya, Femi Yulianti and Putu Giri Artha Kusuma
Presenter: Syakila Putri Nansya

ABSTRACT
West Java Province recorded the highest number of disaster occurrences in Indonesia in 2024, with 457 hydrometeorological cases. A gap exists between logistics demand and allocated quantities, with fulfilment shortfalls of 28 to 32% across five aid categories exceeding the 10% threshold, due to a static weighted scoring system without capturing regional demand. This study proposes a three-stage framework: vulnerability variables are forecasted using Simple Linear Regression or Moving Average based on MAPE; Support Vector Regression predicts demand for 27 districts; allocation is proportionally determined subject to stock constraints. Validation NSE ranges from 0.6255 to 0.8084 and the fulfilment shortfall reduces to at most 10% for both 2024 and 2025, indicating accurate regional demand prediction than the existing weighting approach. SVR outperforms Random Forest as a benchmark across all categories and periods. The originality lies in a pre-disaster region-specific demand prediction framework that replaces static weighting at the provincial level.

PAPER 240

A CMCLP-PSO Approach with Split Allocation for Temporary Relief Warehouse Location: A Case Study of the Cianjur Earthquake

Abstract:
The Cianjur earthquake damaged 47,000 buildings and displaced 114,683 residents, creating urgent demand for rapid relief distribution. Existing temporary warehouses are concentrated within a single subdistrict, two existing temporary warehouses have 60% of service areas exceeding the 60-minute response threshold. This indicates that the existing temporary warehouse configuration requires optimization to ensure full coverage within the 60-minute response-time threshold. In response to this problem, this study proposes a CMCLP-PSO model with a two-loop structure to determine optimal temporary warehouse locations and allocate relief supplies to affected demand points. The outer loop selects candidate warehouse locations, while the inner loop assigns demand through split allocation. The results show that the selected temporary warehouses can cover 100% of the affected area points within the 60-minute response-time threshold, reducing the proportion of service areas exceeding the threshold from 60% to 0%.

Margaretha Yesy Angelina, Putu Giri Artha Kusuma and Femi Yulianti
Presenter: Margaretha Yesy Angelina

ABSTRACT
The Cianjur earthquake damaged 47,000 buildings and displaced 114,683 residents, creating urgent demand for rapid relief distribution. Existing temporary warehouses are concentrated within a single subdistrict, two of the three existing temporary warehouses have 60% of service areas exceeding the 60-minute response threshold. This indicates that the existing temporary warehouse configuration requires optimization to ensure full coverage within the 60-minute response-time threshold. In response to this problem, this study proposes a CMCLP-PSO model with a two-loop structure to determine optimal temporary warehouse locations and allocate relief supplies to affected demand points. The outer loop selects candidate warehouse locations, while the inner loop assigns demand through split allocation. The results show that the selected temporary warehouses can cover 100% of the affected area points within the 60-minute response-time threshold, reducing the proportion of service areas exceeding the threshold from 60% to 0%.

PAPER 241

A Simheuristic Approach for Locating Temporary Emergency Warehouses under Road-Disruption Uncertainty: The Post-Earthquake Cianjur Case

Abstract:
The placement of temporary emergency warehouses is critical for improving post-disaster relief responsiveness. However, earthquake induced road disruptions create uncertainty in travel times between warehouses and affected areas. This study investigates an uncapacitated stochastic facility location problem (SFLP) that minimizes the expected maximum travel time under stochastic road-delay conditions with a limited number of warehouses. A simheuristic approach combining a biased-randomized drop heuristic with a min-max penalty and Monte Carlo simulation is adapted to the 2022 Cianjur earthquake case in West Java, Indonesia. Unlike previous studies using synthetic disruption factors, this research calibrates lognormal travel-delay distributions through three-point PERT expert elicitation with the regional disaster management agency (BPBD). Results show that deterministic solutions fail to convert additional warehouses into stochastic performance, whereas the simheuristic configuration at the existing three-warehouse budget reduces the expected worst-case response time by 68.1%, underscoring the importance of warehouse planning for reliable humanitarian logistics.

Roberto Sunjaya, Putu Giri Artha Kusuma and Femi Yulianti
Presenter: Roberto Sunjaya

ABSTRACT
The placement of temporary emergency warehouses is critical for improving post-disaster relief responsiveness. However, earthquake induced road disruptions create significant uncertainty in travel times between warehouses and affected areas. This study investigates an uncapacitated stochastic facility location problem (SFLP) that minimizes the expected maximum travel time under stochastic road-delay conditions with a limited number of warehouses. A simheuristic approach combining a biased-randomized savings heuristic and Monte Carlo simulation is adapted to the 2022 Cianjur earthquake case in West Java, Indonesia. Unlike previous studies using synthetic disruption factors, this research calibrates lognormal travel-delay distributions through three-point PERT expert elicitation with the regional disaster management agency (BPBD). Results show that deterministic solutions become less effective under uncertainty, while the proposed approach reduces expected worst-case response time approximately 66%. The findings highlight the importance of uncertainty-aware warehouse planning for reliable humanitarian logistics.

PAPER 242

Comparative Evaluation of AI Models for CAD Script Generation in 3D Printing Workflows

Belal Gharaibeh, Amro Nour, Reem Kassem, Lara Abou Baker, Meshari Al-Eebrahim and Fridon Shubitidze
Presenter: Belal Gharaibeh

ABSTRACT
Recent advances in large language models (LLMs) have created new opportunities for automating computeraided design (CAD) workflows through natural language interactions. However, generating reliable CAD scripts remains challenging due to execution errors, geometric inconsistencies, and increasing design complexity. This paper presents an iterative AI-assisted CAD generation workflow that combines prompt engineering, CAD validation, and corrective feedback to improve the reliability of AI-generated CAD scripts. The proposed workflow evaluates ChatGPT-5, Claude, and Copilot across three CAD geometries of increasing complexity using both CQ-Editor and FreeCAD environments. Generated scripts are executed and validated for geometric correctness, watertightness, STL compatibility, and manufacturability. When execution or geometry errors are detected, visual and textual feedback is used to iteratively refine the generated scripts through a structured correction process. Experimental results show that iterative feedback significantly improves CAD generation success rates across all evaluated models. Claude was the most consistent across CAD environments and shapes; ChatGPT generally needed fewer corrections for complex shapes; and Copilot showed greater difficulty, especially when it came to more complex shapes. These results highlight the strengths and weaknesses of AI-assisted CAD generations and demonstrate how iterative feedback improves CAD script reliability.

PAPER 248

Software as a Service (SaaS) for Customer-Driven Multimodal Freight Routing: Real Case Studies

Tarun K. Biswas, Sonia Farhana Nimmy, Ripon K. Chakrabortty, Omar K. Hussain, Ferry Jie and Daniel Prajogo

Presenter: Tarun Kumer Biswas

ABSTRACT

With growing sustainability and environmental concerns, the maritime shipping route selection process has become more complex, involving simultaneous optimisations across multiple criteria. This paper proposes a user-driven Software-as-a-Service (SaaS) application platform as a decision-support tool for freight forwarders, shippers, and customers, assisting them in optimising route and carrier selection within multimodal transport networks. While traditional approaches, such as multi-criteria decision-making (MCDM) methods have addressed similar decision-making problems in which users can adjust decisions based on their preferences to identify trade-offs, they have largely relied on explicit weight schemes for a fixed set of predefined criteria. In practice, these weights are often challenging to determine, especially in maritime logistics, where each criterion is governed by multiple different stakeholders with conflicting interests. Furthermore, even though customers may prefer different preference elicitation methods, existing application systems in the maritime sector often cannot incorporate diverse user inputs (e.g., weights or aspiration levels). To address these limitations, we propose a Customer-Driven Unified Goal Programming (CD-UGP)-based SaaS application framework that allows decision-makers to express preferences either through aspiration levels or using a weight scheme. The proposed framework is evaluated and validated with multiple real-life scenarios using two case studies focused on optimal container shipping route selection: (i) from Canberra to Colombo, and (ii) from Tokyo to Los Angeles. Results demonstrate that the proposed CD-UGP-based SaaS framework effectively produces more customised and practically relevant routing solutions compared to existing methods.

PAPER 250

Identifying Technical Infrastructure Failure Risks in Sharjah Nurseries

Fatima A.S. Binofai and Ali Cheaitou

Presenter: Fatima Abdullah Bin Ofai

ABSTRACT

Early childhood learning environments form the foundation for children’s physical, cognitive, and social-emotional development. While there is a body of research on educational quality and pedagogy in nursery settings, little is known about the impact of technical infrastructure failures that may negatively affect developmental outcomes. Most previous research has focused on environmental quality factors such as indoor air quality, lighting, acoustics, and thermal comfort, without using a systematic engineering approach to identify and assess infrastructure-related risks. The purpose of this study is to determine the risk factors for technical infrastructure failure affecting early childhood development outcomes in nurseries in Sharjah. A structured literature review was performed to extract and classify infrastructure-related failure modes reported in the literature related to nurseries, educational facilities, building performance, and facility management. The identified risks were subsequently categorized by infrastructure systems and categorized into three categories related to physical, cognitive, and socio-emotional developmental outcomes. The results provide a preliminary risk inventory that may support future risk assessment studies and inform evidence-based infrastructure management policies for nursery facilities.

PAPER 251

Risk-Aware Obstacle Prioritization Framework for Indoor Robots Using Deep Learning

Farhana Ahmed, Rosli Besar and Nor Hidayati Abdul Aziz

Presenter: Farhana Ahmed

ABSTRACT

The current object detection algorithm can detect objects accurately but fails to determine the riskiest object among all obstacles. The lack of prioritizing obstacles according to risk leads to less efficient decisions made in the indoor setting. This paper proposes RAOP (Risk-Aware Obstacle Prioritization); an enhancement of the state-of-the-art detection framework, YOLOv11, by adding a post-detection Risk Assessment engine based on distance between obstacles, object size, semantics of the obstacles, and object detection confidence. To enhance the performance of the system under challenging indoor lighting conditions, CLAHE is added as a preprocessing step. The proposed framework categorizes risk levels to four actions: STOP, SLOW DOWN, AVOID, and SAFE. Performance results show that the proposed method outperforms its counterparts, providing improvements of 6.49%, 0.81%, and 16.25% in precision, mAP@50, and low-light object detection accuracy, respectively. Finally, a GUI-based standalone software implementation verifies its effectiveness for indoor robotic navigation tasks.

PAPER 252

AutoChi: Automated Statistical Testing of Proportions with Chi-Square Tests

Ahmed Alsakhawi and Gurdal Ertek
Presenter: Ahmed Alsakhawi

ABSTRACT

This paper introduces AutoChi, a novel statistical software for automated hypothesis testing and statistical analysis using non-parametric chi-square and pairwise post-hoc z-tests. The first novelty of AutoChi is exhaustive and automated hypothesis testing and reporting, comparing all groups and pairwise comparisons. Although several software packages and libraries are available for statistical analysis, including R packages, Python libraries, and ready-to-use software packages with graphical user interfaces (GUI), only a small percentage of these software library tools implement end-to-end automated statistical analysis through a user-friendly graphical user interface. Furthermore, no software tool was found to carry out end-to-end automated statistical analysis for testing differences in proportions, followed by post-hoc statistical tests and visual analysis. AutoChi addresses both gaps for chi-square testing, namely the gap with respect to a fully integrated automated workflow and the gap with respect to post-hoc statistical and visual analysis. The novelty of AutoChi is the application of graph analytics through dominance graphs and arc diagrams to visualize the results of all the conducted tests. Overall, AutoChi can accelerate data analysis and hypothesis testing through automation and enable rapid generation of insights through post-hoc visual analysis that are currently not conveniently possible in existing statistical software.

PAPER 253

Social Media Presence Across GCC Countries: A Comprehensive Statistical Analysis

Ahmed Alsakhawi, Gurdal Ertek and Ananth Chiravuri
Presenter: Gurdal Ertek

ABSTRACT

The rapid emergence and growth of social media platforms across the globe and the GCC (Gulf Cooperation Council) countries had a significant impact on commerce and business. While extensive research was carried out on social media usage in the GCC, the varying presence across platforms has so far not been investigated. The presented research, based on data from a commercial data provider, focuses on seven major social media platforms, namely Instagram, TikTok, Facebook, Twitter, LinkedIn, YouTube, and Pinterest and the presence of e-commerce companies in the GCC countries under these platforms. The Chi-Square test of independence was employed for proportional statistics, whereas Bonferroni correction was employed for post-hoc testing of social media platform presence. The analysis results identified Instagram, Facebook and Twitter as the most common social media platforms overall across the GCC region, supported with statistical significance. However, there was strong heterogeneity across countries with respect to the presence of social media platforms. The projected outcomes can be employed in digital marketing planning, resource allocation, consumer engagement, business development, and service quality assessment in e-commerce in the GCC while the methodology can be adopted to any select benchmark group of countries.

PAPER 256

Modelling Misinformation Sentiment Dynamics and Attention Displacement on Social Media: Constructing Markov Chain Based Misinformation Indices within a Modified Information Disorder Spectrum

K M Najib Hayder and Mehdi Toloo
Presenter: K M Najib Hayder

ABSTRACT

For intervention in information disorder on social media, detection alone is insufficient because the volume and speed of circulation make full investigation of all disorder infeasible. This paper develops a conceptual prioritisation framework for information disorder on X (formerly Twitter), using Community Notes as an intervention-focused frontier sampling mechanism to narrative level instead of individual post level. A linguistic risk score measuring volatility of language to proxy for veracity, and a belief proxy score to proxy for vulnerability of users towards believing disordered information were used to define a 9-state risk-belief space, with state transition modelling using a Markov chain under partial observability. The results were used to construct two indices - Credibility Influence Index (CII) for directional drift in belief and the Attention Displacement Index (ADI) for magnitude of linguistic volatily. Monte Carlo bootstrap resampling provides uncertainty estimates. Empirical analysis on six narrative clusters supports a three-way prioritise/observe/deprioritise decision logic, offering a reproducible, uncertainty-aware conceptual triage framework, establishing the feasibility of a robust intervention prioritisation framework.

PAPER 259

Reliability Constrained Sizing of a Photovoltaic Battery System for a Data Centre with Diesel Backup

Rahul Rajeevkumar Urs and Abdelrahman E E El Toukhy

Presenter: Rahul Rajeevkumar Urs

ABSTRACT

Data centres need low carbon electricity, but they cannot compromise backup power. This paper presents a sizing method for photovoltaic generation, battery storage, grid supply, and an existing diesel generator. The diesel generator remains in the system and supplies only the outage energy that the photovoltaic and battery system cannot cover. The method tests 49 designs with the same Monte Carlo outage events. For a five megawatt data centre in Abu Dhabi, the lowest cost design that meets the illustrative outage autonomy target uses twenty megawatts of photovoltaic capacity and forty megawatt hours of battery capacity. It covers 45.8 percent of sampled outages without diesel and reduces diesel served outage energy by 68.2 percent. Sensitivity checks show that the results depend on weather, outage mix, battery power, tariffs, and battery life.