CIE51 HANDBOOK

&

PROGRAM SCHEDULE

UNSW CANBERRA

Decision Support & Analytics Research Group

Welcome Message from the Conference Chairs

Welcome to the 51st International Conference on Computers and Industrial Engineering (CIE51), hosted by the Decision Support & Analytics Research Group at UNSW Canberra and the Center for Sustainable Operations and Supply Chain Resilience at the University of Adelaide. This prestigious event, taking place from December 9th to 11th, 2024, at UNSW Sydney's Kensington Campus, promises to be an engaging platform for advancing the fields of industrial engineering, supply chain management, and computer-aided decision-making.

This year, we are proud to report a record-breaking **~400** submissions from authors representing over **50** countries, demonstrating this event's global appeal. The conference has an impressive acceptance rate, highlighting the exceptional quality of the research being showcased, with topics spanning from supply chain resilience to data-driven industrial optimization. The conference will feature over 330 esteemed speakers from 50 countries representing diverse disciplines within industrial engineering. Attendees can look forward to seven keynote presentations, an industry forum, an editorial panel, and two invited speeches from renowned scientists and practitioners on cutting-edge topics. This event continues the tradition of excellence established by Computers & Industrial Engineering: An International Journal, published by Elsevier, which boasts an impressive Impact Factor of 7.9 and a Scopus Cite Score of 11.9, ranking it in the 95th percentile of general engineering journals.

CIE51 provides an unparalleled opportunity to explore the latest advancements in industrial engineering and supply chain innovation. It fosters collaboration among researchers, practitioners, and industry experts, facilitating meaningful discussions that shape the future of smart, sustainable, and resilient systems (the conference theme for CIE51 is "Towards Smart, Sustainable, and Resilient Systems"). With over 400 reviews conducted by a dedicated panel of 100 external reviewers, the scientific rigour of this event ensures its place among the most respected conferences in the field.

Industrial engineering and supply chain resilience are critical for bolstering Australia's sovereign capabilities. Global disruptions have underscored the importance of resilient, locally controlled supply chains in recent years. The Australian government's focus on Sovereign Industrial Capability Priorities highlights the need for innovation in areas such as combat survivability, cyber resilience, and advanced manufacturing. By addressing these challenges, CIE51 plays a pivotal role in supporting national security and economic independence.

From "Supply Chain 5.0" to "Enabling Supply Chain Resilience Through Data-Driven Insights," the topics covered in this conference reflect the pressing issues of our time and pave the way for transformative solutions.

We are excited to welcome all attendees to Sydney for an intellectually stimulating and professionally rewarding event. Your participation enriches this conference and contributes to its success.

Conference Chairs
Dr. Ripon K. Chakrabortty
Dr. Hasan H. Turan
Prof. Kannan Govindan
Prof. Yasser Dessouky

Conference Co-Chairs

Dr Ripon K. Chakrabortty

Senior Lecturer, Leader & Founder of the Decision Support & Analytics Research Group (DSARG), School of System & Computing, UNSW Canberra, Australia

Dr Hasan H Turan

Senior Lecturer, Research Lead at the Capability Systems Centre, School of System & Computing, UNSW Canberra, Australia.

Professor Kannan Govindan

Director of CSOSRC at the University of Adelaide, Australia, and Chair Professor at the University of Southern Denmark, Denmark.

Professor Yasser Dessouky

San Jose State University, United States of America.

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31. Dr Morteza Saberi, University of Technology Sydney, Australia.
32. Dr Reza Kiani Mavi, Edith Cowan University, Australia.
33. Dr Mostafa Khatami, University of Wollongong, Australia.
34. Dr Emiliya Suprun, UNSW Canberra, Australia.
35. Dr Damith Mohotti, UNSW Canberra, Australia
36. Dr Ram Prasad Mohanty, Founder & Director, DK Int Pty Ltd, Canberra, Australia.
37. Dr Shabnam Kasra Kermanshahi, UNSW Canberra, Australia.

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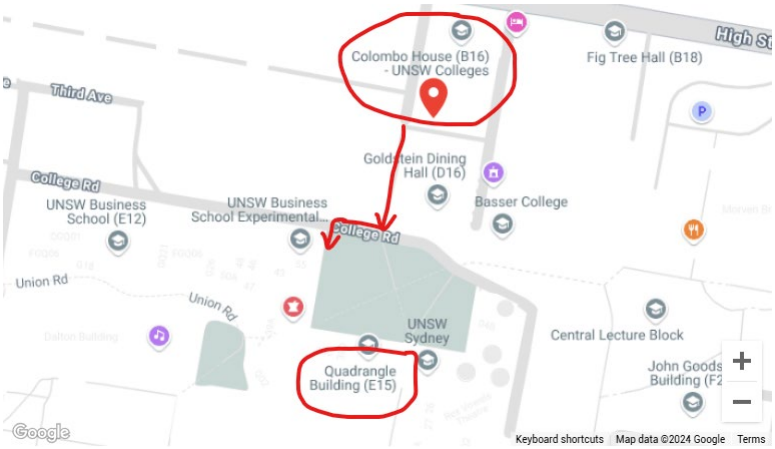
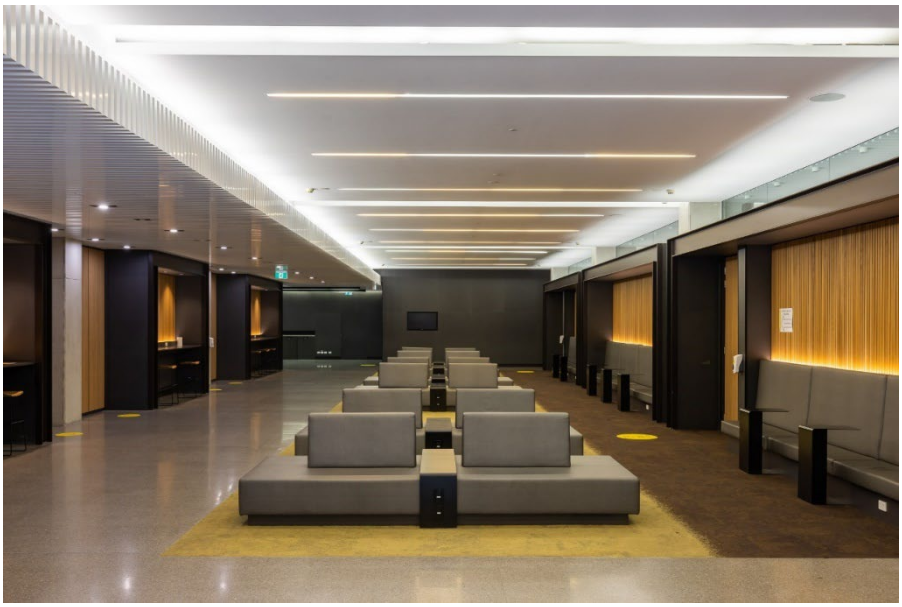
18. Md Shahin, PhD Student, UNSW Canberra, Australia.

Conference Venue





Columbo Building

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Key Information

WiFi Access
UNSW Guest Network

If you are a visitor to UNSW and wish to use the WiFi network you will need to use your device to navigate to **Settings**; then **WiFi**; and select the **UNSW Guest** network.

The registration process is as follows:

Step 1: You will land on a registration screen and be asked to provide your name and e-mail details. You will need to accept the T&Cs and Privacy Statement before proceeding.
Step 2: You will then land on a welcome screen, advising that you have temporary (approximately five minutes) access, before being redirected (and landing) on the UNSW home page. At this time, you will need to promptly navigate to your mail account.
Step 3: You will receive an e-mail, with Activation Link, that must be activated.
Step 4: You will land on a confirmation screen requesting you confirm (or reject) WiFi access.
Step 5: You will then land on a final screen, confirming (or denying) WiFi access. Visitors will be provided with one week of continuous access. After that time, you can repeat the registration process as often as you wish.

Support: UNSW IT Service Centre 02 9385 1333

Registration Desk
The registration desk will be open at the following times

- Monday, December 9, 8.30 am — 9:15 am
- Tuesday, December 10, 8.30 am — 9:15 am
- Wednesday, December 11, 8.30 am – 9.15 am

Catering

- Morning coffee/refreshment – Columbo Building Foyer
- Lunch Buffet – Columbo Building Foyer
- Afternoon coffee/refreshment - Columbo Building Foyer
- Gala Dinner, Closing Ceremony and Award Night - on Wednesday, December 11, 6:30 pm – 9:30 pm
    - **Venue:** Roundhouse, UNSW Sydney, International Rd, Kensington NSW 2052. [10 - 15 mins walking distance from the Columbo Building]

Presentation Format

- Each presentation should be a maximum of 10 minutes, followed by 5 minutes Q&As.
- There are no specific templates for the PPT file. However, presenters must ensure their texts and images are readable and understandable.
- Presenters must come and provide their PPT file to the room's volunteer at least 15 minutes before the event. The presenter's responsible for checking the PPT file and USB port, as we won't let presenters connect their laptops to the UNSW system due to internet security protocol.

Keynote Speeches

Distinguished Professor Jie Lu

IEEE Fellow, IFSA Fellow, ACS Fellow, Australian Laureate Fellow

Director of Australian Artificial Intelligence Institute

University of Technology Sydney, Australia

Distinguished Professor Jie Lu is a world-renowned scientist in the field of computational intelligence, primarily known for her work in fuzzy transfer learning, concept drift, recommender systems, and decision support systems. She is an IEEE Fellow, IFSA Fellow, Australian Computer Society Fellow, and Australian Laureate Fellow. Professor Lu is the Director of the Australian Artificial Intelligence Institute (AAII) at University of Technology Sydney (UTS), Australia. She has published six research books and over 500 papers in leading journals and conferences; won 10 Australian Research Council (ARC) Discovery Projects and over 20 industry projects as leading chief investigator; and has supervised 50 PhD students to completion. Prof Lu serves as Editor-In-Chief for Knowledge-Based Systems and International Journal of Computational Intelligence Systems. She is a recognized keynote speaker, delivering over 40 keynote speeches at international conferences. She is the recipient of two IEEE Transactions on Fuzzy Systems Outstanding Paper Awards (2019 and 2022), NeurIPS Outstanding Paper Award (2022), Australasian Artificial Intelligence Distinguished Research Contribution Award (2022), Australian NSW Premier's Prize on Excellence in Engineering or Information & Communication Technology (2023) and the Officer of the Order of Australia (AO) in the Australia Day 2023.

Title: Autonomous Machine Learning for Decision Support in Complex Environments

Abstract

The talk will present how machine learning can innovatively and effectively learn from data to support data-driven decision-making in uncertain and dynamic situations. A set of new autonomous transfer learning theories, methodologies and algorithms will be presented that can transfer knowledge learnt in more source domains to a target domain by building latent space, mapping functions and self-training to overcome tremendous uncertainties in data, learning processes and decision outputs. Another set of autonomous concept drift theories, methodologies and algorithms will be discussed about how to handle ever-changing dynamic data stream environments with unpredictable stream pattern drifts by effectively and accurately detecting concept drift in an explanatory way, indicating when, where and how concept drift occurs and reacting accordingly. These new developments enable advanced machine learning and therefore enhance data-driven prediction and decision support systems in uncertain and dynamic real-world environments.

Professor Tava Olsen

Deputy Dean, Academic, Melbourne Business School, University of Melbourne, Australia

Tava Olsen is a Professor of Operations and Supply Chain Management and the Deputy Dean, Academic at Melbourne Business School. Tava is an award-winning expert in operations and supply chain management, with a PhD from Stanford University and extensive experience publishing in and serving on the editorial board of four Financial Times Top 50 journals. Prior to joining Melbourne Business School, she was the head of two departments at the University of Auckland Business School: Information Systems and Operations Management, as well as Accounting and Finance. She also served previously as Deputy Dean from 2020 to 2021 and was also the Director of its Centre for Supply Chain Management from 2010 to 2022.

Before moving back to her native Auckland, Tava spent most of her academic career in the United States. She taught operations and manufacturing management at Washington University's Olin Business School – first as Associate Professor and later Professor – from 2000 to 2010, and was an Assistant Professor at the University of Michigan from 1994 to 2000. Tava has edited several top academic journals including Operations Research (Area Editor for Operations and Supply Chain), Production and Operations Management (Senior Editor), Management Science (Associate Editor) and Manufacturing and Service Operations Management (Associate Editor).

Tava has taught a wide variety of courses, including operations management, service operations, healthcare management, business analytics, simulation, critical thinking, and project management, to a range of audiences from bachelors to executives. Outside of teaching, she also served as President of the Manufacturing and Service Operations Management Society and has been awarded more than US$3 million of external funding throughout her career, including through the Royal Society of New Zealand's Marsden Grant and the National Science Foundation's CAREER Award in the US.

Keynote Title: Paying More to Get it Faster: Does it Hurt or Help Resilience?

Abstract:

This talk gives an overview of my and others' research in lead time-based pricing. We consider the what, when, and how of paying more to get a product or service faster, particularly in capacity-constrained settings. Canonical applications include custom furniture and DNA testing. At the time of ordering, customers may be presented with a menu of lead times and prices, just as companies like Amazon do for delivery times. However, due to the provider's capacity constraints, these lead times need to reflect what can be produced (and when). We discuss when offering such lead time-based pricing can help with firm resilience and when it does the reverse.

Professor Chen-Fu Chien

National Tsing Hua University, Taiwan R.O.C.

Dr. Chen-Fu Chien is Tsinghua Chair Professor and Executive Vice President, National Tsing Hua University (NTHU), Hsinchu, Taiwan. He is now the President of Asia Pacific Industrial Engineering & Management Systems Society (APIEMS). Since 2018, he has been the Director of Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center that is one of four national AI centers sponsored by National Science and Technology Council (NSTC), Taiwan. He is the founder and Director for Decision Analysis Laboratory (DALab), the NTHU-TSMC Center for Manufacturing Excellence, and the Zhen-Ding Tech & National Tsing Hua University Joint Research Center in Taiwan. He received B.S. with double majors in Industrial Engineering and Electrical Engineering with the Phi Tau Phi Honor from NTHU in 1990. He received M.S. in Industrial Engineering and Ph.D. of Decision Sciences and Operations Research at UW-Madison, in 1994 and 1996, respectively. He was a Fulbright Scholar in the Department of Industrial Engineering and Operations Research, UC Berkeley, from 2002 to 2003. From 2005 to 2008, he had been on-leave as the Deputy Director of Industrial Engineering Division in Taiwan Semiconductor Manufacturing Company (TSMC). He received the Executive Training of PCMPCL from Harvard Business School in 2007. He was a Visiting Professor in Institute for Manufacturing, Cambridge University (sponsored by Royal Society, UK), Visiting Professor in Beijing Tsinghua University (sponsored by Chinese Development Foundation), Visiting Professor in Waseda University (sponsored by Japan Interchange Association Young Scholar Fellowship), and Visiting Professor in Tianjin University and Zhejiang University, China.

Title: TSMC Way: Empower Smart Semiconductor Manufacturing for Sustainable Growth and Chip Peace

Abstract:

The global supply chain paradigm is shifting as leading nations reemphasise the importance of semiconductor manufacturing since semiconductors are key components for empowering AI-based economies and various products. Supply chains have thus become fragmented and complicated, in which virtual vertical integration of global manufacturing networks is crucial yet increasingly challenging to enhance resilience and capital-effectiveness. Driven by Moore's Law, semiconductor manufacturing is capital-intensive and complicated via continuous migration for advanced technology nodes to maintain the shrinkage of IC features. Indeed, Taiwan Semiconductor Manufacturing Company (TSMC), which is the world's most advanced and valuable semiconductor foundry, emphasizes a trinity of strengths, not only being the technology leader for technology migration but also striving for manufacturing excellence and maximum total benefits to serve various customers. Focusing on realistic needs to empower smart production for semiconductor manufacturing, we have conducted many empirical studies with TSMC and leading companies in the semiconductor industry. Based on case studies of longtime collaborations, this talk aims to share the importance of industrial engineering to empower smart manufacturing solutions for semiconductor manufacturing and enhance the sustainability of the semiconductor ecosystem, in which the "Blue Lakes Strategy" is employed to empower the partners for coevolution and sustainable growth of healthy business ecosystem for chip peace.

Professor Steven Carnovale

College of Business at Florida Atlantic University, USA

Dr. Carnovale is a Professor of Supply Chain Management at the College of Business at Florida Atlantic University and Co-Editor-in-Chief of the Journal of Purchasing and Supply Management. Prior to joining FAU, Dr Carnovale was Associate Professor of Supply Chain Management at the Saunders College of Business at the Rochester Institute of Technology from August 2018 to December 2022 and Nike Professor of Supply Chain Management at Portland State University from Sept. 2014 to June 2018. Dr Carnovale is a supply chain strategist specialising in interfirm networks, risk management and global sourcing/production networks with a specific focus on equity-based partnerships. He is an Associate Editor at the Journal of Supply Chain Management. His research has appeared in the Journal of Supply Chain Management, the Journal of Business Logistics, the Journal of Purchasing and Supply Management, the Journal of International Business Studies, the International Journal of Production Economics, the European Journal of Operational Research and Annals of Operations Research, among others. Dr. Carnovale earned his B.S. and PhD degrees at Rutgers University, specialising in Supply Chain Management and Marketing Sciences. Dr. Carnovale is a frequent speaker at both academic and professional supply chain meetings on topics related to supply networks & analytics, with a specific focus on how firms can use these concepts to generate enhanced visibility and financial performance within their supply chains and extended enterprises. Prior to his academic work, he co-founded a marketing strategy and consulting firm and worked in sales and operations management roles in the IT sector, as well as in market research and marketing analytics roles.

Speech Title: "Bending the Future of Supply Chain Risk Management: Supply Chain Plasticity"

Abstract:

Risk, disruptions, agility, flexibility, responsiveness, and resilience are all terms that fall under the umbrella of supply chain risk management. But have we been thinking about it all wrong? Is returning to a pre-disruption state what we want? What good is responsiveness if we are bouncing back to the status quo? How should we consider supply chain risk management in an unpredictable and uncertain world characterised by variable and high-impact low/medium probability events? Supply chain plasticity is a novel concept that advocates that bouncing back is not enough; rather, changing the supply chain network structure to match future needs proactively is the key to becoming truly responsive.

Professor Min Xie

Chair Professor, City University of Hong Kong, Hong Kong, China
Member of the European Academy of Sciences and Arts, Fellow of IEEE
Asian Region VP, Institute of Industrial and Systems Engineers

Min Xie entered USTC in 1978 and later received his undergraduate and postgraduate education in Sweden. He has been a chair professor of Chair Professor at City Univ of Hong Kong since 2011. Prior to that, he was with the National Univ of Singapore for 20 years, where he joined as one of the first recipients of LKY research fellow. He has carried out extensive research in quality, reliability and industrial engineering and published over 300 journal papers and 10 books. He has advised 60 PhD students, now working in industry or academia in different continents. He was elected IEEE fellow in 2006 and in 2022 to European Academy of Sciences and Arts. He currently serves as Chairman of the Fellow Evaluation Committee for IEEE TEMS Society and VP for the Asian Region of IISE.

Speech Title: AI systems – challenging issues to consider for industrial engineers

Abstract:
Driven by the rapid advancement of AI and data science, intelligent systems are becoming ubiquitous in industry and our daily lives. Analyzing and improving the reliability and safety of intelligent systems is a challenging task. In this talk, we will present some of our related research and discuss the problem from a systems engineering perspective. Intelligent systems rely heavily on the availability of large amounts of data, which can be affected by issues such as measurement accuracy, sensor dependability, and uncertainty due to the changing environments in which these systems operate. Some possible approaches to address these challenges will also be discussed. These may include techniques for ensuring data quality, robust sensor fusion, uncertainty quantification, and system-level verification and validation. By rigorously addressing the dependability of intelligent systems, we can unlock their full potential while ensuring the safety and reliability of the critical applications they enable.

Prof. Dr. Dr. habil. Dmitry Ivanov

Full Professor of Supply Chain and Operations Management, director of the Digital-AI Supply Chain Lab, and faculty director M.A. Global Supply Chain and Operations Management at the Berlin School of Economics and Law, Germany

Professor Ivanov's research spans supply chain resilience and digital supply chain twins. Author of the Viable Supply Chain Model and founder of the ripple effect research in supply chains. His educational background includes industrial engineering and management during five years of diploma studies along with artificial intelligence, information systems, simulation, and control theory during PhD and habilitation. He gained Dr., Dr. Sc., and Dr. habil. Degrees, won several research excellence awards, and got an extensive industry experience. His research record counts around 450 publications, with more than 160 papers in prestigious academic journals and the leading books "Global Supply Chain and Operations Management" (three editions), "Introduction to Supply Chain Resilience", "Introduction to Supply Chain Analytics", „Structural Dynamics and Resilience in Supply Chain Risk Management", "Scheduling in Industry 4.0 and Cloud Manufacturing", "Digital Supply Chain" and „Handbook of Ripple Effects in the Supply Chain". He delivered invited plenary, keynote, panel and guest talks at the conferences of INFORMS, IFPR, IFIP, IFAC, DSI and POM, and over 30 universities worldwide. Author of anyLogistix Supply Chain Simulation and Optimization Software academic area. He has been Chairman, IPC Chair, and Advisory Board member for over 60 international conferences in supply chain and operations management, industrial engineering, control and information sciences. Recipient of several prestigious academic awards. Principal investigator in several projects about digital supply chain twins and resilience funded by EU Horizon and DFG. Listed in several rankings as one of the most cited researchers in Business and Management. Chair of IFAC CC 5 "Cyber-Physical Manufacturing Systems", Editor-in-Chief of International Journal of Integrated Supply Management, Associate Editor of International Journal of Production Research, Annals of Operations Research and OMEGA, guest editor and Editorial Board member in over 20 leading international journals including IISE Transactions and IJPE, to name a few.

Speech Title: AI-driven transformation of supply chain simulation models toward digital twins

Abstract:

In this talk, we discuss how human-based and AI-based decision-making support can be combined when managing supply chain resilience. The focus of our talk is an intelligent digital twin (iDT) framework. New digital technologies and artificial intelligence are enabling novel approaches and tools, allowing us to move from isolated models to intelligent decision-support systems. Our talk presents a comprehensive decision-making framework for leveraging digital twins in stress-testing and resilience analysis of supply chains and outlines the ways digital twins can aid in theoretical advancements in supply chain resilience and viability. Examples of supply chain stress testing will include material and energy disruptions. Some future research areas for energy aspects in supply chains will be discussed.

Professor Dr Alexandre Dolgui

Dr. Alexandre Dolgui received his MSc degree from Minsk Radioengineering Institute (1983), PhD degree from the National Academy of Sciences of Belarus (1990), and Dr Habil degree from the University of Technology of Compiègne (France) in 2000. He is an IISE Fellow, a Distinguished Professor and the Head of the Automation, Production and Computer Sciences Department at the IMT Atlantique campus in Nantes, France. His research focuses on manufacturing line design, production planning, scheduling, and supply chain engineering. His main results are based on exact mathematical programming methods and their intelligent coupling with heuristics, metaheuristics and automatic control techniques. He has contributed to the theory of assembly line balancing, combinatorial design of machining lines, process planning, supply chain scheduling, lot sizing, and replenishment planning under uncertainties, as well as to the theory of resilience and risk analysis in supply networks. He is the co-author of 5 books, the co-editor of 32 books or conference proceedings, and the author of over 330 refereed papers in international journals. He is the Editor-in-Chief of the International Journal of Production Research, an Area Editor of Computers & Industrial Engineering, a former Associate Editor of IEEE Transactions on Industrial Informatics and Omega, Member of the Editorial Board of 24 other journals, including the International Journal of Production Economics. He is an Active Fellow of the European Academy for Industrial Management, Member of the Board of the International Foundation for Production Research, former Chair (Vice-Chair now) of IFAC TC 5.2 Manufacturing Modelling for Management and Control, Member of IFIP WG 5.7 Advances in Production Management Systems, IEEE System Council Analytics and Risk Technical Committee, he has been Scientific Chair of many leading scientific conferences and received several international and French awards.

Speech Title: A Review of Models for Scheduling Electric Buses Charging Tasks in an Urban Environment

Abstract:

The problem of scheduling electric vehicle (EV) charging tasks on parallel chargers over time is considered. The decision time range is an interval or a circle. Each charging task has to be performed within its fixed time window. The charging tasks can be preemptive or not. Each charging preemption may imply a setup time or cost. Each task is associated with a given amount of energy that has to be received from the chargers, which determines the charging time requirement. The chargers are characterized by their electric power. The total power supply is limited and the limit can be time dependent. The objective is to minimize the total cost of the chargers, setups and received energy. In practice, this problem is part of a more general EV routing and charging scheduling problem. It appears when a routing decision precedes a charging decision and provides charging time windows and energy requirements for the latter. Various special cases of the charging scheduling problem have been studied in the literature, in the practical and theoretical contexts. We review and analyze these special cases using traditional scheduling terminology, thereby creating a bridge between practical charging scheduling models and theoretical scheduling models.

Invited Speeches

Professor Subhash C. Sarin

Subhash C. Sarin currently holds the Paul T. Norton Endowed Professorship in the Grado Department of Industrial and Systems Engineering at Virginia Tech. He has made research contributions in production scheduling, sequencing, applied mathematical programming, and analyzing and designing algorithms for the operational control of manufacturing and logistics systems. He has published in prestigious Industrial Engineering and Operations Research journals. He has co-authored three books in the production scheduling area. He has been recognized with several prestigious awards at the university, state, and national levels for his research work, teaching, service and advising. Among others, these include: Institute of Industrial and Systems Engineers (IISE) David F. Baker Distinguished Research Award for significant contributions to the advancement of the industrial engineering profession through outstanding research activity (the highest research award given by the Institute); IISE Albert Holzman Distinguished Educator Award for outstanding contributions to the industrial engineering profession through teaching, research and publication; Alumni Award for Excellence in Graduate Advising (the highest graduate advising award given by Virginia Tech.); Pletta Award, as the Virginia's Engineering Educator of the Year; Sporn Award for Excellence in Teaching of Engineering Subjects, Virginia Tech; Graduate School's Outstanding Mentor Award for the College of Engineering, Virginia Tech; Dean's Award for Excellence in Research , and Dean's Award for Excellence in Teaching. He is also a recipient of several best paper awards and has been elected as a Fellow of IISE. He has served on the editorial boards of several journals. He has graduated 82 students (29 Ph.D. and 53 M.S. (with thesis).) His students are now well-placed in academia and industry (including Deans, Department Heads, Directors of Research Laboratories, Professors, and CEOs.)

Speech Title: Nuclear Power Plant Outage Scheduling Problem and Large-scale Resilient Scheduling Solution

Abstract

Nuclear power plant outage scheduling, which falls within the category of the Resource-Constrained Project Scheduling Problem (RCPSP), is a frequent occurrence that poses a monumental challenge of scope with over 10,000 activities. These interlinked activities need to be precisely scheduled for processing on limited resources (high-tech machinery and expert personnel.) In this paper, we address the multiple facets of the Nuclear Power Plant Outage Scheduling Problem in four stages: (i) decomposition of the massive network of activities into multiple smaller ones that can be solved in parallel, (ii) construction of a time-zero schedule for the set of outage-related activities in each of the smaller networks and composition of the overall schedule, (iii) provision of swift and reliable solutions for time-sensitive emergencies, and (iv) extension of the methodology to quantify the scheduling risk using the conditional-value-at-risk (CVaR) measure. The CVaR is determined based on an expectation-variance analysis, and it quantifies the schedule risk, accounts for uncertainties, and enables the determination of a resilient schedule. Finally, an application of the developed methodology to a real-life instance with data representative of the operations in a nuclear power plant is presented.

Prof. Sami Kara,

FSEAUNSW, FRSN, FAET, FCIRP, FACATECH

Sami Kara is a professor of sustainable manufacturing and life cycle engineering at the University of New South Wales (UNSW), Sydney Australia (www.lceresearch.unsw.edu.au) and the Director of Vertically Integrated Projects Program @ UNSW (https://www.unsw.edu.au/challeng/vertically-integrated-projects). He has a professional background of more than 30 years in industry, research, and tertiary education, including several engineering and management positions in manufacturing companies in Australia and around the world. His research interest is in developing technology solutions with a life cycle view by using circular economy strategies to decarbonize and reduce environmental impact of manufacturing industry while helping them create value. Prof Kara is also the Vice-President elect for the International Academy for Production Engineering (CIRP). He has authored more than 300 peer reviewed scientific publications.

He is regularly invited as a Subject Matter Expert to review Australian and international government proposals in decarbonization of the manufacturing industry and environmental sustainability. He also works as an advisor for various international organizations in providing strategic directions to decarbonize their organizations towards achieving their net-zero targets. Professor Kara is an elected fellow of the International Academy of Production Engineering (CIRP), Royal Society of New South Wales (FRSN), UNSW Scientia Education Academy, International Academy of Engineering and Technology (AET), and German National Academy of Science and Engineering (ACATECH).

Speech Title: Circular Economy and its Potential for Achieving Environmental Sustainability

Abstract:

Two of our society's greatest challenges are to meet the current and future material needs of its populations while staying within the carrying bio-capacity of our planet. Circular Economy (CE) has been put forward as a solution to address this complex challenge and has often been used synonymously with environmental sustainability. However, sustainability and CE are different concepts, and the assumption that circularity is inherently environmentally sustainable has yet to be successfully demonstrated. In this talk, the presenter will provide a historical evolution of material circularity concepts and strategies and their potential for increasing material efficiency and reducing environmental impacts. The talk will provide concluding remarks and future perspectives on implementing CE to meet societies' growing material needs in an environmentally sustainable manner.

Meet the Editors' Panel

Prof Alexandre DOLGUI, Editor-in-Chief of the International Journal of Production Research, an Area Editor of Computers & Industrial Engineering Journal.

Prof Yasser Dessouky, Editor-in-Chief of the International Journal of Computers & Industrial Engineering.

Prof Kannan Govindan, Executive Editor of the Journal of Cleaner Production, Associate Editor of Transportation Research Part E: Logistics and Transportation Review, Senior Editor of Industrial Management and Data Systems, Editor of Annals of Operations Research, an area Editor of INFOR: Information Systems and Operational Research.

Prof Tava Olsen, Area Editor, Operations Research (2018 – 2023). Associate Editor (2003 – 2005, 2008 – 2018), Associate Editor, Management Science (1999 – 2005, 2009 – 2018), Associate Editor, M&SOM (2006 – 2018), Senior Editor, Production and Operations Management (2004 – 2023)

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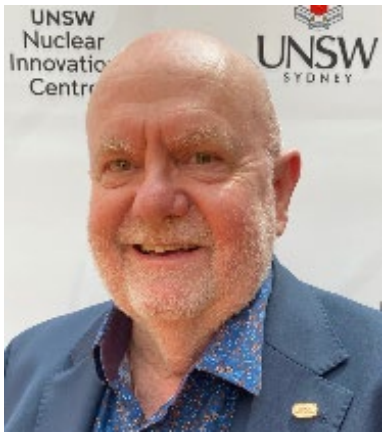
Prof Dayna Simpson, Department Editor at the Journal of Operations Management and an Associate Editor at the Journal of Supply Chain Management

Prof Steven Carnovale, Co-Editor-in-Chief of the Journal of Purchasing and Supply Management.

Industry Forum on "Towards Smart, Sustainable, and Resilient Systems"

On the 2nd day of the conference, **the 10th of December (Tuesday), between 10:30 and 12:30**, the CIE51 will organise an industry forum, which will be facilitated by panel members coming from the project management accreditation body (AIPM), transportation and logistics companies, government bodies, and others. The panel members are:

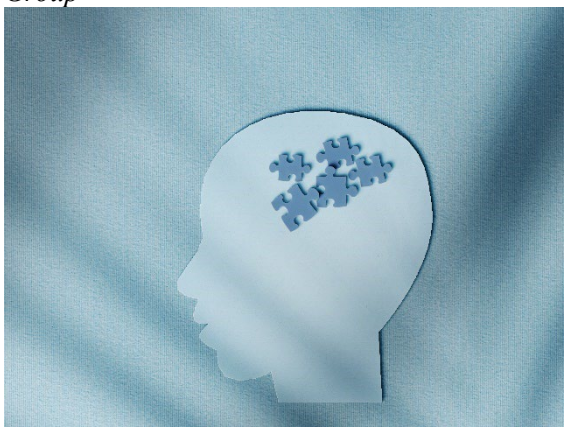
***Dr Darius Danesh**, Chief Executive Officer, Australian Institute of Project Management (AIPM)*



***Michael W McLean**, Managing Director, McLean Management Consultants Pty Ltd*

***Martin Heinzlmair**, General Manager, CRISIS Group*

***Karandeep Chada**, Chartered Institute of Logistics and Transport Australia (CILTA)*



***Michael Read**, Director (ITSA & Deputy CISO), Cyber Security Resilience, Cyber Security & Resilience Branch, National Disability Insurance Agency*

***Archival Garcia**, Chief Executive Office, Fluent Cargo*

Program Summary

Day 1: Monday, 9th of December, 2024	
8:30 – 10:00	**Registration** (Columbo Building Foyer, UNSW Sydney)
9:15 - 9:45	**Opening Ceremony**
9:45- 10:30	**Keynote Speech**
10:30 - 11:00	**Morning Tea (Columbo Building Foyer, UNSW Sydney)**
11:00 - 11:30	**Keynote Speech**
11:30 - 13:00	**Parallel Sessions**
13:00 - 14:00	**Lunch & Networking (Columbo Building Foyer, UNSW Sydney)**
14:00 - 15:30	**Parallel Sessions**
15:30 - 16:00	**Afternoon Tea (Columbo Building Foyer, UNSW Sydney)**
16:00 - 17:30	**Parallel Sessions**
17:30 - 18:15	**Meet The Editors' Panel**
18:15- 20:15	**Welcome Reception & Networking (Columbo Building Foyer, UNSW Sydney)** **Networking Drinks & Canapé**

Day 2: Tuesday, 10th of December, 2024	
8:30 - 9:30	**Registration** (Columbo Building Foyer, UNSW Sydney)
9:15 - 10:00	**Keynote Speech**
9:15 - 10: 00	**Invited Speech**
10:00 - 10:30	**Morning Tea (Columbo Building Foyer, UNSW Sydney)**
10:30 - 12:00	**Industry Forum on "Towards Smart, Sustainable, and Resilient Systems"**
12:00 - 12:40	**Keynote Speech**
12:30 - 13:10	**Keynote Speech**
13:00 - 14:00	**Lunch & Networking (Columbo Building Foyer, UNSW Sydney)**
14:00 - 15:30	**Parallel Sessions**
15:30 - 16:00	**Afternoon Tea (Columbo Building Foyer, UNSW Sydney)**
16:00 - 17:30	**Parallel Sessions**
17:30 - 18:15	**Keynote Speech**

Day 3: Wednesday, 11th of December, 2024	
8:30 - 9:30	**Registration** (Columbo Building Foyer, UNSW Sydney)
9:15 -10:00	**Keynote Speech**
10:00 - 10:30	**Morning Tea (Columbo Building Foyer, UNSW Sydney)**
10:30 - 13:00	**Workshop on "Demonstration of Simulation Modeling with AnyLogic"**
10:30 - 12:00	**Parallel Sessions**
12:00 - 12:45	**Invited Speech**
12:45 - 13:45	**Lunch & Networking (Columbo Building Foyer, UNSW Sydney)**
13:45 - 15:15	**Parallel Sessions**
14:00 - 17:00	**Workshop on "System Dynamics Modelling and Decarbonisation of Transport Sector"**
15:15 - 15:45	**Afternoon Tea (Columbo Building Foyer, UNSW Sydney)**
15:45- 17:15	**Parallel Sessions**
18:30 - 21:30	**Gala Dinner, Closing Ceremony and Award Night!** **Venue: Roundhouse, UNSW Sydney, International Rd, Kensington NSW 2052.**

Sessions Summary

Session ID	Sessions Theme
SS1	AI-empowered Industrial Systems: case studies, challenges, and future prospects
SS2	Optimization of Electric-based Logistics System
SS3	Enabling Supply Chain Resilience Through Data-Driven Digital Technologies
SS4	Data-driven decision-making for planning and controlling manufacturing and service supply chains toward Net-Zero carbon emissions
SS5	Supply Chain 5.0 - Towards Human-Centric, Sustainable, and Resilient Systems
SS6	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling
SS7	Human-Centric Production Systems in the Era of Industry 5.0
SS8	Supply Chain Sustainability
SS9	Vehicle Routing Problem with Synchronization
SS10	Leveraging quality management, sustainability management and digital manufacturing to support the industrial net zero transition
SS11	Computer-based Sustainable Logistic and Supply Chain Management
SS12	Operations Research with Industrial Applications
SS13	Sustainable Transport Systems
SS14	The Future of Education and Work in the new Digitized Society
SS15	Advancements of Machine Learning and AI in Civil Infrastructure and Defence Applications
CT1	Industrial Engineering for Business Intelligence
CT2	Operations Planning & Management
CT3	Healthcare Management Systems
CT4	Future of Supply Chain

Program Details

Day 1: Monday, 9th of December, 2024			
8:30 – 10:00	**Registration** (Columbo Building Foyer, UNSW Sydney)		
9:15 - 9:45	**Opening Ceremony** (K-B16-LG03-Columbo Theatre A & K-B16-LG04-Columbo Theatre B- live streaming)		
9:45- 10:30	**Keynote Speech (Professor Tava Olsen)** Title: Paying More to Get it Faster: Does it Hurt or Help Resilience? Room: (K-B16-LG03-Columbo Theatre A & K-B16-LG04-Columbo Theatre B- live streaming)		
10:30 - 11:00	**Morning Tea (Columbo Building Foyer, UNSW Sydney)**		
11:00 - 11:30	**Keynote Speech (Professor Jie Lu)** Title: Autonomous Machine Learning for Decision Support in Complex Environments Room: (K-B16-LG03-Columbo Theatre A & K-B16-LG04-Columbo Theatre B- live streaming)		
11:30 - 13:00	**Parallel Sessions**		
	Session SS1 (K-B16-LG03-Columbo Theatre A)	**Session SS8 (K-B16-LG04-Columbo Theatre B)**	**Session SS11 (K-B16-LG05-Columbo Theatre C)**
	AI-empowered Industrial Systems: case studies, challenges, and future prospects **I**	Supply Chain Sustainability **II**	Computer-based Sustainable Logistic and Supply Chain Management **III**
	Session SS3 (K-B16-LG01 - Colombo LG01)	**Session SS4 (K-B16-LG02 - Colombo LG02)**	**Session SS13 (K-E15-G031 - Quad G031- Quadrangle Building)**
	Enabling Supply Chain Resilience Through Data-Driven Digital Technologies **I**	Data-driven decision-making for planning and controlling manufacturing and service supply chains toward Net-Zero carbon emissions **I**	Sustainable Transport Systems **I**
13:00 - 14:00	**Lunch & Networking (Columbo Building Foyer, UNSW Sydney)**		
14:00 - 15:30	**Parallel Sessions**		
	Session SS12 (K-B16-LG03-Columbo Theatre A)	**Session CT1 (K-B16-LG04-Columbo Theatre B)**	**Session SS2 (K-B16-LG01 - Colombo LG01)**
	Operations Research with Industrial Applications **I**	Industrial Engineering for Business Intelligence	Optimization of Electric-based Logistics System

	Session SS6 (K-B16-LG05-Columbo Theatre C)	**Session SS7 (K-B16-LG02 - Colombo LG02)**	**Session SS13 (K-E15-G031 - Quad G031- Quadrangle Building)**
	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling **I**	Human-Centric Production Systems in the Era of Industry 5.0 - **I**	Sustainable Transport Systems **II**
15:30 - 16:00	**Afternoon Tea (Columbo Building Foyer, UNSW Sydney)**		
16:00 - 17:30	**Parallel Sessions**		
	Session SS1 (K-B16-LG03-Columbo Theatre A)	**Session SS4 (K-B16-LG04-Columbo Theatre B)**	**Session SS8 (K-B16-LG05-Columbo Theatre C)**
	AI-empowered Industrial Systems: case studies, challenges, and future prospects **II**	Data-driven decision-making for planning and controlling manufacturing and service supply chains toward Net-Zero carbon emissions **II**	Supply Chain Sustainability **III**
	Session SS10 (K-B16-LG01 - Colombo LG01)	**Session SS12 (K-B16-LG02 - Colombo LG02)**	**Session SS12 (K-E15-G031 - Quad G031- Quadrangle Building)**
	Leveraging quality management, sustainability management and digital manufacturing to support the industrial net zero transition **I**	Operations Research with Industrial Applications **II**	Operations Research with Industrial Applications **III**
17:30 - 18:15	**Meet The Editors' Panel** (Panel: Prof Alexandre DOLGUI, Prof Yasser Dessouky, Prof Dayna Simpson, Prof Tava Olsen, Prof Steven Carnovale, and Prof Kannan Govindan as a Facilitator) **Room:** (K-B16-LG03-Columbo Theatre A & K-B16-LG04-Columbo Theatre B- live streaming)		
18:15- 20:15	**Welcome Reception & Networking (Columbo Building Foyer, UNSW Sydney)** **Networking Drinks & Canapé**		

Day 2: Tuesday, 10th of December, 2024			
8:30 – 9:30	**Registration** (Columbo Building Foyer, UNSW Sydney)		
9:15 - 10:00	**Keynote Speech (Professor Steven Carnovale)** **Title: Bending the Future of Supply Chain Risk Management: Supply Chain Plasticity** Room: K-B16-LG03-Columbo Theatre A		
9:15 - 10: 00	**Invited Speech (Professor Subhash C. Sarin)** **Title: Nuclear Power Plant Outage Scheduling Problem and Large-scale Resilient Scheduling Solution** Room: K-B16-LG03-Columbo Theatre C		
10:00 - 10:30	**Morning Tea (Columbo Building Foyer, UNSW Sydney)**		
10:30 - 12:00	**Industry Forum on "Towards Smart, Sustainable, and Resilient Systems"** Room: (K-B16-LG03-Columbo Theatre A & K-B16-LG04-Columbo Theatre B- live streaming) **Panel:** Dr Darius Danesh, Mr Michael W McLean, Mr Martin Heinzlmair, Mr Karandeep Chada, and Mr Michael Read **Facilitators:** Dr Peter SHI and A/Prof Ferry Jie		
12:00 - 12:40	**Keynote Speech (Professor Alexandre DOLGUI)** **Title: A Review of Models for Scheduling Electric Buses Charging Tasks in an Urban Environment** Room: K-B16-LG03-Columbo Theatre A		
12:30 - 13:10	**Keynote Speech (Professor Min Xie)** **Title: AI systems – challenging issues to consider for industrial engineers** Room: K-B16-LG03-Columbo Theatre C		
12:00 - 13:00	**Reserved for contingency** **Room: K-B16-LG03-Columbo Theatre B**		
13:00 - 14:00	**Lunch & Networking (Columbo Building Foyer, UNSW Sydney)**		
14:00 - 15:30	**Parallel Sessions**		
	Session SS5 (K-E15-G044 - Quad G044-Quadrangle Building)	**Session SS10 (K-B16-LG04-Columbo Theatre B)**	**Session SS11 (K-B16-LG01 - Colombo LG01)**
	Supply Chain 5.0 - Towards Human-Centric, Sustainable, and Resilient Systems	Leveraging quality management, sustainability management and digital manufacturing to support the industrial net zero transition **II**	Computer-based Sustainable Logistics and Supply Chain Management **II**

	Session SS6 (K-B16-LG05-Columbo Theatre C)	**Session SS7 (K-B16-LG02 - Colombo LG02)**	**Session SS9 (K-E15-G031 - Quad G031-Quadrangle Building)**
	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling **II**	Human-Centric Production Systems in the Era of Industry 5.0 - **II**	Vehicle Routing Problem with Synchronization
15:30 - 16:00	**Afternoon Tea (Columbo Building Foyer, UNSW Sydney)**		
16:00 - 17:30	**Parallel Sessions**		
	Session SS1 (K-E15-G044 - Quad G044-Quadrangle Building)	**Session SS6 (K-B16-LG04-Columbo Theatre B)**	**Session SS8 (K-B16-LG05-Columbo Theatre C)**
	AI-empowered Industrial Systems: case studies, challenges, and future prospects **III**	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling **III**	Supply Chain Sustainability **III**
	Session CT2 (K-B16-LG01 - Colombo LG01)	**Session SS12 (K-B16-LG02 - Colombo LG02)**	**Session SS13 (K-E15-G031 - Quad G031-Quadrangle Building)**
	Operations Planning & Management **I**	Operations Research with Industrial Applications **IV**	Operations Research with Industrial Applications **V**
17:30 - 18:15	**Keynote Speech (Professor Dmitry Ivanov)** **Title: AI-driven transformation of supply chain simulation models toward digital twins** Room: K-B16-LG03-Columbo Theatre A		

Day 3: Wednesday, 11th of December, 2024			
8:30 – 9:30	**Registration** (Columbo Building Foyer, UNSW Sydney)		
9:15 -10:00	**Keynote Speech (Professor Chen-Fu Chien)** **Title: "TSMC Way: Empower Smart Semiconductor Manufacturing for Sustainable Growth and Chip Peace"** Room: K-B16-LG03-Columbo Theatre A		
10:00 - 10:30	**Morning Tea (Columbo Building Foyer, UNSW Sydney)**		
10:30 - 13:00	**Workshop on "Demonstration of Simulation Modeling with AnyLogic"- Ticketed Event** **Convenor & Lecturer: Dr Hasan H Turan** Room: K-E15-G040 - Quad G040 (Quadrangle Building)		
10:30 - 12:00	**Parallel Sessions**		
	Session SS1 (K-E15-G044 - Quad G044- Quadrangle Building)	**Session SS6 (K-B16-LG04-Columbo Theatre B)**	**Session SS11 (K-B16-LG05-Columbo Theatre C)**
	AI-empowered Industrial Systems: case studies, challenges, and future prospects **IV**	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling **IV**	Computer-based Sustainable Logistic and Supply Chain Management **IV**
	Session SS12 (K-B16-LG01 - Colombo LG01)	**Session SS12 (K-B16-LG02 - Colombo LG02)**	**Session SS14 (K-E15-G031 - Quad G031- Quadrangle Building)**
	Operations Research with Industrial Applications **VI**	Operations Research with Industrial Applications **VIII**	The Future of Education and Work in the new Digitized Society
12:00 - 12:45	**Invited Speech (Professor Sami Kara)** **Title: Circular Economy and its Potential for Achieving Environmental Sustainability** Room: K-B16-LG03-Columbo Theatre A		
12:00 - 12:45	**Reserved for contingency** **Room: K-B16-LG03-Columbo Theatre B**		
12:45 - 13:45	**Lunch & Networking (Columbo Building Foyer, UNSW Sydney)**		
13:45 - 15:15	**Parallel Sessions**		
	Session SS1 (K-E15-G044 - Quad G044- Quadrangle Building)	**Session SS6 (K-B16-LG04-Columbo Theatre B)**	**Session SS11 (K-B16-LG01 - Colombo LG01)**

	AI-empowered Industrial Systems: case studies, challenges, and future prospects **V**	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling **V**	Computer-based Sustainable Logistic and Supply Chain Management **III**
	Session SS12 (K-B16-LG01 - Colombo LG01)	**Session SS12 (K-B16-LG02 - Colombo LG02)**	**Session CT32 (K-E15-G031 - Quad G031- Quadrangle Building)**
	Operations Research with Industrial Applications **VII**	Operations Research with Industrial Applications **X**	Operations Planning & Management **II**
14:00 - 17:00	**Workshop on "System Dynamics Modelling and Decarbonisation of Transport Sector"- Ticketed Event** **Convenors & Lecturers: Dr Hossein Hosseini and Dr Elnaz Irannezhad** Room: K-E15-G040 - Quad G040 (Quadrangle Building)		
15:15 - 15:45	**Afternoon Tea (Columbo Building Foyer, UNSW Sydney)**		
15:45- 17:15	**Parallel Sessions**		
	Session SS1 (K-E15-G044 - Quad G044- Quadrangle Building)	**Session SS6 (K-B16-LG04-Columbo Theatre B)**	**Session SS12 (K-B16-LG05-Columbo Theatre C)**
	AI-empowered Industrial Systems: case studies, challenges, and future prospects **VI**	From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling **VI**	Operations Research with Industrial Applications **IX**
	Session SS15 (K-B16-LG01 - Colombo LG01)	**Session CT4 (K-B16-LG02 - Colombo LG02)**	**Session CT3 (K-E15-G031 - Quad G031- Quadrangle Building)**
	Advancements of Machine Learning and AI in Civil Infrastructure and Defence Applications	Future of Supply Chain	Healthcare Management Systems
17:15 - 18:30	**Break**		
18:30 - 21:30	**Gala Dinner, Closing Ceremony and Award Night!** **Venue: Roundhouse, UNSW Sydney, International Rd, Kensington NSW 2052.** [10 - 15 mins walking distance from the Columbo Building]		

Paper Assignment by Session and Day

DAY 1- 9th December (Monday)

Day 1: 11:30 - 13:00
Room: K-B16-LG03-Columbo Theatre A
Chair (s): Professor Xun Xu

Session SS1: AI-empowered Industrial Systems: case studies, challenges, and future prospects I		
Paper ID	**Authors**	**Paper Title**
155	Ziyue Geng and Xun Xu	AN OVERVIEW OF GENERATIVE AI FOR MANUFACTURING
40	Tianyu Zhou, Ying Liu and Maneesh Kumar	AI-POWERED CHATBOTS FOR IMPROVING INTERACTIVE USER EXPERIENCE: STATE-OF-THE-ART
45	Reina Komoda and Haruka Yamashita	Estimating the Optimal Advertisement Serving Media with Hierarchical Bayesian Model Using Customer Attribute Data
55	Zhongyuan Liao and Yi Cai	Computer Vision-based Decision-making Framework for Reconfigurable Soft Robot Manipulation
58	Nilesh Kumar and Changfeng Wang	HOW DIGITAL TRUST AMONG EMPLOYEES NURTURES COLLABORATIVE INNOVATION: THE MEDIATING ROLE OF PARTNERSHIP CAPACITY AND MODERATING EFFECT OF RED TAPES
61 (Recorded)	Venkata Krishna Rao Pabolu, Shivam Dhiman and Divya Shrivastava	ARTIFICIAL INTELLIGENCE TO RECOGNIZE ACTIVE WORK ENGAGEMENT OF AN ASSEMBLY-LINE WORKER

Day 1: 11:30 -13:00
Room: K-B16-LG04-Columbo Theatre B
Chair (s): Associate Professor Daniel D Prior

Session SS8: Supply Chain Sustainability I		
Paper ID	**Authors**	**Paper Title**
150	Pratyush Kumar Patro, Adolf Acquaye, Raja Jayaraman and Khaled Salah	Circular Economy Indexing with Generative AI and PCA
213	Assal Aminian, Reza Tavakkoli-Moghaddam, Behdin Vahedi-Nouri, Keivan Tafakkori and Mohammad Rahmani	An Optimization Model of a Bread Supply Chain with the Circular Economy

218	Rishav Deval and Jayendran Venkateswaran	Emission-constrained Production and Inventory Control System (EC-PICS): A cost-based analysis under dynamic emission regulations
247	Shailesh Chandra	TRANSITIONING FROM A CONVENTIONAL TO AN AUTOMATED TERMINAL: PORT VEHICLE EFFICIENCY-BASED ANALYSIS
255	Chethana Chandrasiri, Asela Kulatunga and Subodha Dharmapriya	SIMULATION BASED SUPPLY CHAIN RECONFIGURATION TOWARDS SUSTAINABILITY
263	Vinit Ghosh, Rohan Mukherjee and Andrea Appolloni	Digital-Powered Transformation of Circular Supply Chains for Sustainable Future -A Structural Topic Modelling Approach

Day 1: 11:30 -13:00
Room: K-B16-LG05-Columbo
Theatre C
Chair (s): Associate Professor Devika Kannan

Session SS11: Computer-based Sustainable Logistic and Supply Chain Management I		
Paper ID	**Authors**	**Paper Title**
222	Marjia Haque, Sanjoy Kumar Paul, Ruhul Sarker and Daryl Essam	A Simulation-Optimization Approach for Supply Chain under Uncertainties
229	Santosh Palaskar, Nandyala Hemachandra and Narayan Rangaraj	Hierarchical Aggregation-wise Multivariate Time Series Forecasting for Supply Chain
348	Qingyu Liu, Kannan Govindan and Devika Kannan	PACKAGING 4.0: THE IMPACT OF POLICY MECHANISMS ON IOT-ENABLED PACKAGING ADOPTION IN CIRCULAR SUPPLY CHAIN
320	Song Xu, Xiangyue Ou and Kannan Govindan	An adaptive genetic hyper-heuristic algorithm for a two-echelon vehicle routing problem with dual-customer satisfaction in community group-buying
340	Shuqin Xu, Devika Kannan, Kannan Govindan and Qi Xu	THE IMPACT OF BLOCKCHAIN ON NEGATIVE PRICES IN THE ELECTRICITY SUPPLY CHAIN
335	Kannan Govindan, Devika Kannan and Laura Gregersen	Sustainable Plastic Waste Management in Developing Countries- A systematic literature review

Day 1: 11:30 -13:00
Room: K-B16-LG01 - Colombo LG01
Chair (s): Prof Daniel Prajogo and Dr Agus Wicaksana

Session SS3: Enabling Supply Chain Resilience Through Data-Driven Digital Technologies I		
Paper ID	**Authors**	**Paper Title**
94	Agus Wicaksana and William Ho	ENABLING SUPPLY CHAIN RESILIENCE THROUGH DATA-DRIVEN DIGITAL TECHNOLOGIES
127	Xinyan Zhang and Pimtong Tavitiyaman	The effects of big data analytics on hotel supply chain resilience and employee-centered social performance
148	Towfique Rahman, Sanjoy Kumar Paul, Nagesh Shukla, Tapan Sarker and Harsha Sarvaiya	ANALYSING THE INTEGRATION OF MARKETING STRATEGIES AND SUPPLY CHAIN READINESS
151	Maryam Shahsavari, Omar Khadeer Hussain, Pankaj Sharma and Morteza Saberi	Using Large Language Models to Build a Bayesian Network of Causal Contributing Events Leading to Risk Events in Supply Chains
262	Farhad Habibi, Alireza Abbasi, William Ho and Ripon K. Chakrabortty	Navigating the Disruption Maze: Strategies to Enhance Supply Chain Resilience
325	Divanshu Sharma, Nagesh Shukla, Sanjoy K. Paul and Biswajeet Pradhan	SUPPLY NETWORK MAPPING FOR SUPPLY CHAIN VISIBILITY AND RESILIENCY

Day 1: 11:30 - 13:00
Room: K-B16-LG02 - Colombo LG02
Chair (s): Associate Professor Omar K Hussain

Session SS4: Data-driven decision-making for planning and controlling manufacturing and service supply chains toward Net-Zero carbon emissions I		
Paper ID	**Authors**	**Paper Title**
85	Md. Abdul Moktadir, Yousaf Ayub and Jingzheng Ren	RESILIENCE CHALLENGES MITIGATION STRATEGIES FOR WASTE MANAGEMENT 5.0 DRIVEN CIRCULAR WASTE UPCYCLING PROCESS: AN INTELLIGENT DECISION SUPPORT MODEL
186	Masha Dilmi Jayasuriya, Madushan Fernando, Amila Thibbotuwawa and Peter Nielsen	OPTIMIZING UAV DELIVERY ROUTING FOR ISLAND DEMAND SURGES: A DATA-DRIVEN APPROACH TO MINIMIZE CARBON EMISSIONS
207	Abdelrahman Sultan, Khloud M. Mansour, Fatema Khedr, Mohamed F. Aly, Ahmed Mohib and Ahmed H. Salem	Leveraging A Decision Support System in the Airlines Service Industry

241	Kriti Karmakar and Prof. Pradip Kumar Ray	MANAGEMENT OF BLOOD BANK OPERATIONS THROUGH DATA-DRIVEN STATISTICAL ANALYSIS
289	Utriweni Mukhaiyar, Panji Adhipura, Sri Winarni, Muhammad Luthfi Wijaya, Kurnia Novita Sari, Udjianna Sekteria Pasaribu, Sapto Wahyu Indratno and Lucky Cahya Wanditra	FORECASTING OF THE HEAVY EQUIPMENT MARKET DEMAND THROUGH TRANSFER FUNCTION MODEL WITH MULTI INPUT VARIABLES OF COMMODITY PRICES
296	Vikram Gupta	MULTI OBJECTIVE OPTIMIZATION OF L-PBF GEAR ADDITIVE MANUFACTURING PROCESS PARAMETERS BASED ON PLACKETT-BURMAN DESIGN AND NSGA-II

Day 1: 11:30 -13:00
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): Dr Elnaz Irannezhad and Dr Michel Fathi

Session SS13: Sustainable Transport Systems I		
Paper ID	**Authors**	**Paper Title**
96	Yiming Chen, Wenbing Chang, Linchao Yang and Shenghan Zhou	DISTRIBUTIONALLY ROBUST OPTIMIZATION MODEL FOR AIRCRAFT ROUTING PROBLEM CONSIDERING PROLONGED DELAYS
119	Josephine German, Anak Agung Ngurah Perwira Redi, Ardvin Kester Ong, Michael Young, Kristien Paola Robas, Maria Angelica Bare, Deceree Anne Haboy and Matthew Solivio	CONSUMER PREFERENCE ANALYSIS OF HEAVY-DUTY TRUCKS (HDT) FOR FREIGHT TRANSPORT IN THE PHILIPPINES: AN APPLICATION OF CONJOINT ANALYSIS
195	Xueping Li, Haowen Xu, Jose Tupayachi, Olufemi Omitaomu and Xudong Wang	Emerging AI and Cognitive Digital Twin Technologies Towards Low-Carbon Multimodal Freight Transportation System
252	Sahil Sahil and Sarada Prasad Sarmah	DRIVING CHANGE: EVALUATING THE IMPACT OF ODD-EVEN POLICIES ON ELECTRIC VEHICLE ADOPTION AND END-OF-LIFE VEHICLE SCRAPPAGE
271	Akshay Bhosale and Sayak Roychowdhury	Bayesian-BWM Integrated CoCoSo method with Single Valued Neutrosophic Fuzzy Sets to Prioritize Threat-agent Types in Connected and Autonomous Vehicles
297	Lin Lin, Orlando Rivera Letelier, Xinyu Wang, Robin Sandell and Andrés Fielbaum	Timetabling an electric ferry public transport system through an ILP

Day 1: 14:00 - 15:30
Room: K-B16-LG03-Columbo Theatre A
Chair (s): Associate Professor Honglei Xu

Session SS12: Operations Research with Industrial Applications I		
Paper ID	**Authors**	**Paper Title**
1	John P.T. Mo and Boyd A. Nicholds	ASSESSING EFFECTIVENESS OF PLANNED SYSTEM CHANGES
20	Amin Zakhirehkar Sahih, Milad Ghasri and Alireza Abbasi	A TECHNICAL AND ECONOMIC EVALUATION OF UTILIZING COMMUNITY-WIDE TRADING DECISIONS OPTIMIZERS IN P2P RENEWABLE ENERGY MARKETS.
32	Ya-Xuan Xiao and Ren-Qian Zhang	Multi-sourcing for Product Service Considering Cost Heterogeneity and Demand Uncertainty
52	Vincent F. Yu, Sy Hoang Do, Ngoc Minh Nguyen and Hsiu-I Ting	INTEGRATED OPERATION PLANNING FOR MULTIPLE HYDROPOWER DAMS CONSIDERING IRRIGATION, FLOOD CONTROL AND DELTA SALINIZATION: A CASE STUDY IN VIETNAM
18	Taho Yang, Yu-Chun Kao and Yiyo Kuo	A STUDY ON OPTIMIZING PROCESS PARAMETERS TO MINIMIZE WEAVING PROCESS INVENTORY
63	Bingqing Tan, Yishu Yang, Svetlana Besklubova and Ray Y. Zhong	MULTI-ATTRIBUTE EVALUATION MODEL FOR THE FEASIBILITY OF A PREFABRICATION HUB IN HONG KONG

Day 1: 14:00 -15:30
Room: K-B16-LG04-Columbo Theatre B
Chair (s): Professor Runliang Dou and Dr Michel Fathi

Session CT1: Industrial Engineering for Business Intelligence		
Paper ID	**Authors**	**Paper Title**
14	Ashish Raj and Debabrata Das	OPTIMAL COORDINATION BETWEEN Q-COMMERCE COMPANIES AND DELIVERY RIDERS BY INTEGRATING LIMITED TRUST EQUILIBRIUM
16	Xuze Wang, Fei Xiao, Bingwen Li, Maitri Paramitha, Zhenhang Chu and Min Zhou	Overview of Intelligent Fault Diagnosis Technologies for Solid Fuel Rockets
38	Kenshiro Tsubota and Haruka Yamashita	Proposal of a Personalized Answer Display System Considering User Preferences on Q&A Sites
110	Tomáš Tichý, Ales Kresta and Frantisek Zapletal	Evaluation of selected market risk models with MCDM techniques
244	Tamer Yared, Abdullah Qasem, Rashed Mansour and Soud Alsaleh	USING THE SYSTEM USABILITY SCALE (SUS) TO EVALUATE VARIOUS SMARTPHONE MEASUREMENT APPLICATIONS FOR ASSESSING WORKPLACE ENVIRONMENTAL FACTORS
258	Harrison Pastega and Ripon Chakrabortty	Bolstering Australian Defence Force Recruitment and Retention

Day 1: 14:00 -15:30
Room: K-B16-LG01 - Colombo LG01
Chair (s): Dr Saber Elsayed and Mr Setyo Tri Windras Mara

Session SS2: Optimization of Electric-based Logistics System		
Paper ID	**Authors**	**Paper Title**
37	Dandan Su, Lucy Dowdell and Marcella Papini	Green Routing Strategies: A Comparative Analysis of Electric and Bi-Objective Location Routing Problems
53	Setyo Tri Windras Mara, Ruhul Sarker, Daryl Essam and Saber Elsayed	Evolutionary Approach for a Green Logistics System with Drone-as-a-Service Providers
181	Asmaa Elsayed, Mona Mohamed, Karam Sallam, Ibrahim Radwan and Mohamed Abdel-Basset	A COMPREHENSIVE FRAMEWORK FOR EVALUATING AUTONOMOUS VEHICLES IN SMART AND SUSTAINABLE URBAN TRANSPORTATION
331	Yongfeng Jing, Jian Jiao, Jiayun Chu and Shujie Pang	An optimization method for task resource rescheduling in avionics systems considering partitions failures
264 (Recorded)	Mohammed Yaqot	Unveiling Bullwhip Effect Main Topics: An Integrated Latent Dirichlet Allocation and Generative AI Approach
363	Adji Candra Kurniawan, Delinda Amarajaya, Theodora Rinda Hernawati, I Dewa Gde Yogindra Adipramana, Agus Wicaksana, Anak Agung Ngurah Perwira Redi and Josephine German	ENHANCING RESILIENCE IN RETAIL FRANCHISE SUPPLY CHAINS: A HYBRID APPROACH OF OPTIMIZATION AND SIMULATION TO MITIGATE DISTRIBUTION CENTER DISRUPTIONS

Day 1: 14:00 -15:30
Room: K-B16-LG05-Columbo Theatre C
Chair (s): Professor Daniel Prajogo and Dr Firouzeh Rosa Taghikhah

Session SS6: From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling I		
Paper ID	**Authors**	**Paper Title**
44	Kazuma Obara and Haruka Yamashita	Recommendation Model for Motivating Best Answer Responses to Unresolved Questions on Q&A Sites
86	Negin Ashrafi, Armin Abdollahi, Greg Placencia and Maryam Pishgar	Process Mining/ Deep Learning Model to Predict Mortality in Coronary Artery Disease Patients
97	Min Liu and Ling Jian	Deep reinforcement learning for robot real-time operations with battery constraints in robotic mobile fulfillment systems
98	Laura Tomidei, Nathalie Sick and Luke Mathieson	DATA-DRIVEN VALUE STREAM ANALYSIS USING PROCESS MINING AND MACHINE LEARNING

369	Firouzeh Rosa Taghikhah and Junbin Gao	One-Class TabNet: A Deep Learning Architecture for Imbalanced Data in Energy Investment
102	Mathieu Payette, Georges Abdul-Nour, Toualith Jean-Marc Meango, Miguel Diago and Alain Côté	Leveraging Natural Language Processing for Enhanced Maintenance Data in Power System Management

Day 1: 14:00 - 15:30
Room: K-B16-LG02 - Colombo LG02
Chair (s): Professor Dyah Santhi Dewi and Prof Sami Kara

Session SS7: Human-Centric Production Systems in the Era of Industry 5.0 - I		
Paper ID	**Authors**	**Paper Title**
105	Congdong Li, Qian Liu, Yelin Fu and Ting Qu	A FUZZY OVERLAPPING MODULE PARTITION APPROACH OF COMPLEX PRODUCTS CONSIDERING CHANGE PROPAGATION INFLUENCE
111	Yugi Watanabe, Noi Kashimoto and Sumika Arima	PRODUCTION AND JOB ROTATION PLANNING CONSIDERING DISABILITIES AND HEALTH CONDITIONS
173	Ilango Kandasamy and Yuqian Lu	Instructing collaborative robots using large language models for human-robot collaboration
176	Yee Yeng Liau and Kwangyeol Ryu	INTRODUCING SMART HUMAN-ROBOT COLLABORATION WITH HETEROGENEOUS COBOTS FOR ASSEMBLY OPERATIONS
191	Siku Kim and Kwangyeol Ryu	A FRAMEWORK FOR INTEGRATING MIXED REALITY AND ARTIFITIAL INTELLIGENCE TECHNOLOGIES TO ENHANCE HUMAN-ROBOT INTERACTION
230	Maria Anityasari, **Dyah Santhi Dewi**, Rhamandita Dyadna Prabaswara and Reza Aulia Akbar	WORKLOAD ANALYSIS OF SURABAYA CITY PUBLIC STREET LIGHTING MAINTENANCE FIELD OFFICERS

Day 1: 14:00 -15:30
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): Dr Elnaz Irannezhad and Dr Hamed Aboutorab

Session SS13: Sustainable Transport Systems II		
Paper ID	**Authors**	**Paper Title**
316	Elnaz Emami and Mohsen Ramezani	Virtual parking locations for micromobility sharing systems
328	Lynette Cheah	INVESTIGATING THE POTENTIAL FOR INTEGRATED FREIGHT AND PASSENGER TRANSPORT IN CITIES

345	Brian Lee, Lee Roberts, Sunhyung Yoo and Maryam Bostanara	BARRIERS AND ENABLERS: EXPLORING SAFETY, STORAGE, AND SOCIAL INFLUENCES ON SCHOOL COMMUTE AND RECREATIONAL CYCLING AMONG ADOLESCENTS IN SYDNEY
358	Akram Badreddine Laissaoui, Taha Arbaoui and Khaled Hadj-Hamou	A two-stage stochastic approach for the green heterogeneous fleet sizing problem
380	Md Shahin, Milad Ghasrikhouzani and Ripon K. Chakrabortty	Post-Relocation Sustainable Transport Consumption Behaviour: A Machine Learning Method
389	Juan Huang and Zhe Gao	Digital Intelligence Based Classical Ballet Education, A Future Possibility

Day 1: 16:00 -17:30
Room: K-B16-LG03-Columbo Theatre A
Chair (s): Dr Yunlong Tang and Dr Jan Polzer

Session SS1: AI-empowered Industrial Systems: case studies, challenges, and future prospects II		
Paper ID	**Authors**	**Paper Title**
72	Noriko Ogasawara, Ayako Yamagiwa, Hiroshi Ikeda and Masayuki Goto	An Analysis Model of Inquiry and Complaint Data Considering Customers' Emotion for Improving Business Process
73	Jiahong Zhang, Hexin Li, Negin Ashrafi, Zhijiang Yu, Greg Placencia and Maryam Pishgar	Prediction of In-Hospital Mortality for ICU Patients with Heart Failure
79	Wenyou Guo, Ting Qu and Kai Zhang	A Blockchain Enabled Cyber-Physical Space for Enhancing Security and Decentralization in Smart Factory
95	Yue Yin, Chengxi Li and Pai Zheng	A Mixed Reality and Digital Twin-Enabled Multimodal Human Demonstration System for Efficient Robot Learning
101	Mingming Zhang, Jan Polzer, Shi Cheng, Qunfeng Liu and Xun Xu	Efficient Welding Quality Inspection Using Lightweight 1D CNN and Signal Data from Images
109	Wei Chen, Yelin Fu, Ray Y. Zhong, Ming Li and George Q. Huang	A Federated Semi-Supervised Learning-enabled Analytics Scheme for Data Authenticity in ESG Disclosure

Day 1: 16:00 - 17:30
Room:K-B16-LG04-Columbo Theatre B
Chair (s): A/Prof Omar K Hussain and A/Prof Ferry Jie

Session SS4: Data-driven decision-making for planning and controlling manufacturing and service supply chains toward Net-Zero carbon emissions II		
Paper ID	**Authors**	**Paper Title**
310	Yifan Xin, Ismail Ali, Peter Shi, Daryl Essam and Ripon Chakrabortty	Repetitive Carbon Gaming Under Dynamic Carbon Pricing and Products' Demand
356	Rajesh Katiyar and Virendra Balon	An Evidence-Based DEMATEL Method for Identifying Critical Barriers in Megaprojects Initiative
160	Amir Hossein Ordibazar, Omar Hussain, Ripon Chakrabortty, Elnaz Irannezhad and Morteza Saberi	Predicting the impact of the weather conditions on transportation agility: A case study of an Australian Maritime Port
350	Sweikcha Nahar and Swayam Sampurna Panigrahi	The curious case of Women in Operations and Supply Chain Management domain
378	Amr Eldahshan	TRANSFORMING SUPPLY CHAIN MANAGEMENT WITH ARITIFICAL INTELLGIENCE, MACHINE LEARNING, DEEP LEARNING, QUANTUM COMPUTING, AND CLOUD COMPUTING: INNOVATION FOR BOOSTING EFFICIENCY AND REINFORCING RESILIECNE IN AUSTRALIAN INDSUTRY 5.0
315	Jian Zhou and Xiaoting Nie	RESILIENCE-ORIENTED EXPANSION PLANNING OF INTERCONNECTED MULTI-ENERGY MICROGRIDS BASED ON DEEP REINFORCEMENT LEARNING

Day 1: 16:00 -17:30
Room: K-B16-LG05-Columbo Theatre C
Chair (s): Associate Professor Daniel Prior and Prof Lusheng Shao

Session SS8: Supply Chain Sustainability II		
Paper ID	**Authors**	**Paper Title**
317	Mohit Sharma and Mohit Tyagi	ARTIFICIAL INTELLIGENCE DRIVEN DIGITAL TRANSFORMATION MET CHALLENGES ANALYSIS FOR SUPPLY CHAIN IMPROVEMENT IN CONTEXT OF CIRCULAR ECONOMY
318	Shagun Smith, Ravinderjit Singh Walia and Anju Singla	SUSTAINABLE BIO-MEDICAL WASTE MANAGEMENT ALLIEND OBSTACLES ANALYSIS USING ISM FUZZY-MICMAC APPROACH
330	Sean Arisian and Thi Thuy Trinh Cao	GLOBAL AGRICULTURAL SUPPLY CHAIN RESILIENCE UNDER UNCERTAINTY

342	Sayem Ahmed, Ripon Kumar Chakrabortty and Alireza Abbasi	BI-OBJECTIVE SUSTAINABLE FLEXIBLE JOB SHOP SCHEDULING PROBLEM WITH BATCH CONSIDERATION
388	Lusheng Shao and Jayashankar Swaminathan	USING FEED SUPPLEMENTS TO CURB LIVESTOCK METHANE EMISSIONS?
351	Mohiuddin Sarker, Nazmush Sakib, Sayem Ahmed and Ripon Kumar Chakrabortty	SUSTAINABLE SUPPLIER SELECTION AND ORDER ALLOCATION OF RAW MATERIALS CONSIDERING DEMAND FLUCTUATIONS

Day 1: 16:00 - 17:30
Room: K-B16-LG01 - Colombo LG01
Chair (s): Associate Professor Andrea Trianni

Session SS10: Leveraging quality management, sustainability management and digital manufacturing to support the industrial net zero transition I		
Paper ID	**Authors**	**Paper Title**
81	Shogo Miyazaki and Akimasa Otsuka	GENERATION OF SKIN MODEL SHAPES CONSIDERING PARALLELISM AND PERPENDICULARITY
82	Yuma Hino and Akimasa Otsuka	TOPOLOGY OPTIMIZATION CONSIDERING FORM DEVIATIONS
87	Munwon Lim and Suk Joo Bae	Degradation Modeling and Condition-Based Maintenance for Manufacturing Process via Change-Point Gaussian Process
104	A S M Monjurul Hasan, Filipe Mattos Batista de Moraes and Andrea Trianni	LOOKING AT QUALITY MANAGEMENT AND SUSTAINABLE PERFORMANCE THROUGH THE LENS OF INDUSTRY 4.0 TECHNOLOGIES
180	Alaa Salem, Mona Mohamed, Karam Sallam, Ibrahim Radwan and Mohamed Abdel-Basset	OPTIMIZING VIRTUAL SMART IRRIGATION SYSTEMS THROUGH DIGITAL TWIN APPLICATIONS: A NEUTROSOPHIC MCDM APPROACH
206	Khloud M. Mansour, Fatema Khedr, Yara Elkassaby, Ahmed Mohib, Mohamed F. Aly and Ahmed H. Salem	An Integrated Roadmap for Implementing Circular Economy in Industrial Systems

Day 1: 16:00 - 17:30
Room: K-B16-LG02 - Colombo LG02
Chair (s): Associate Professor Honglei Xu

Session SS12: Operations Research with Industrial Applications II		
Paper ID	**Authors**	**Paper Title**
64	Andy Chen and Hasan Turan	ARTIFICIAL INTELLIGENCE FOR WORKFORCE PLANNING AND MANAGEMENT
75	Wanshi Zhang, Yifei Lin, Peiji Liu and Xu Wang	Flexible job shop scheduling problem considering energy storage system operation strategies

77	Leena Ghrayeb, Shanthi Muthuswamy and Purushothaman Damodaran	GRASP FOR MAKESPAN MINIMIZATION OF A BATCH PROCESSING MACHINE WITH UNEQUAL READY TIMES
78	Purushothaman Damodaran and Shanthi Muthuswamy	A COLUMN GENERATION HEURISTIC TO SCHEDULE BATCH PROCESSING MACHINES IN A TWO-STAGE FLOWSHOP
152	Daoheng Zhang, Hasan Hüseyin Turan, Ruhul Sarker and Daryl Essam	Data-driven Distributionally Robust Capital-Constrained Lot-Sizing with Inventory-based Financing
138	Youjie Yao, Qihao Liu, Chunjiang Zhang and Xinyu Li	ENERGY-EFFICIENT JOB SHOP SCHEDULING PROBLEM WITH FINITE TRANSPORTATION RESOURCES AND SETUP TIME

Day 1: 16:00 - 17:30
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): Dr Simon Dunstall

Session SS12: Operations Research with Industrial Applications III		
Paper ID	**Authors**	**Paper Title**
143	Zhean Shao, Wen Li and Ying Tan	SENSITIVITY ANALYSIS OF MODEL COMPLEXITY LEVEL AND TIME RESOLUTION IN ENERGY-AWARE SCHEDULING – A CASE STUDY
137	Jiahang Li, Xinyu Li, Qihao Liu, Yiping Gao and Liang Gao	A fitness-distance selection method for workforce-constrained job shop scheduling problem considering loading/unloading time
157	Doan Hoang Tuan, Pham Duc Tai, Jirachai Buddhakulsomsiri and Doan Thi Truc Linh	A MATHEMATICAL MODEL FOR STRATEGIC PLANNING OF CIRCULAR SUPPLY CHAINS
158	Haicao Song, Heshan Cheng, Xuxu Liu and Tianhua Jiang	Research on multi-objective production rescheduling optimization of precast components considering equipment failure
201	Menglei Kong, Zhong Yao and Yunfei Dong	Pricing Strategies of Online Music Platforms in Two-sided market
165	Danial Rizvi, Gavin Paul, Dinh Tung Le, Sheila Sutjipto and Munia Ahamed	Multi-modal Feedback for Enhanced Hydraulic Maintenance Operations

DAY 2- 10th December (Tuesday)

Day 2: 14:00 - 15:30
Room: K-E15-G044 - Quad G044- Quadrangle Building
Chair (s): Dr Peter SHI

Session SS5: Supply Chain 5.0 - Towards Human-Centric, Sustainable, and Resilient Systems		
Paper ID	**Authors**	**Paper Title**
57	Paulina Kus Ariningsih, Chandra Ade Irawan, Antony Pauraj and Jing Dai	An Optimization for Efficient Multi-Tiers Pharmaceutical Distribution Network with Uncertain Demand
114	Natalie Haskell, Muge Belek Fialho Teixeira, Marianella Chamarro-Koc, Wei Win Loy, Komal Chhikara, Sinduja Suresh, Marie-Luise Wille, Brigitte Hughes, Paige Little and Amanda Beatson	ENHANCED SUPPLY CHAIN 5.0 ADVANCED MANUFACTURING WORKFLOWS FOR REGIONAL HEALTHCARE RESILIENCE
203	Ken Chen, Zhen He and Xiaodan Wu	Supplier Quality Improvement for Dual-Sourcing Procurement based on supplier process control
341	Yehan Dou, Peter Shi and Monica Ren	Leveraging Artificial Intelligence for Optimising Supply Chain Finance: A Conceptual Model for Decision-Making Under Risks
365	Hadwyn Chen and Peter Shi	Exploring the Innovative Side of Supply Chain 5.0 - A Human-centric, Sustainable, Resilient, Value-oriented, Global Implementable Supply Chain Finance Model
367	Jin Yantong, Juanli Du, Yanan Ma, Gang Wu, Yangyan Shi and Chaozhe Jiang	Multimodal Transport Route Optimization for Bulk Commodities in supply chain 5.0

Day 2: 14:00 - 15:30
Room: K-B16-LG04-Columbo Theatre B
Chair (s): Associate Professor Andrea Trianni

Session SS10: Leveraging quality management, sustainability management and digital manufacturing to support the industrial net zero transition II		
Paper ID	**Authors**	**Paper Title**
210	Munia Ahamed, Nathalie Sick and Matthias Guertler	BRIDGING THE GAP: BARRIERS TO AND REQUIREMENTS FOR HUMAN-ROBOT KNOWLEDGE TRANSFER
254	Petri Helo and Bening Mayanti	Dynamics of energy costs and emissions in operations: analysing energy operational adjustments
281	Kurnia Novita Sari, Udjianna Sekteria Pasaribu, Utriweni Mukhaiyar, Adilan Widyawan Mahdiyasa, Devi Nandita Choesin and Fauzi Al'Muzakki	PREDICTION OF GROUNDWATER LEVELS TO MITIGATE THE RISK OF INCREASED CARBON EMISSIONS DUE TO PEATLAND FIRES THROUGH ANISOTROPIC SEMIVARIOGRAM MODELING WITH OUTLIER MODIFICATION

293	Seraj Y. Abed and Maher M. Othman	SERVICE SECTOR PRODUCTIVITY CHALLENGES AND MEASUREMENTS
384	Jiaqi Zhang, Liangxing Shi, Zhen He and Dennis Lin	A multivariate EWMA scheme using an improved continuous ranked probability score under data-rich environment
385	Liangxing Shi, Jiaqi Zhang, Yingdong He and Zhen He	Sampling recommendation for product-quality-level prediction

Day 2: 14:00 - 15:30
Room: K-B16-LG01 - Colombo LG01
Chair (s): Associate Professor Devika Kannan and Dr Song Xu

Session SS11: Computer-based Sustainable Logistic and Supply Chain Management II

Paper ID	Authors	Paper Title
65	Xinbo Zhang, Yanzhi Li, Huiqiang Mao, Liming Li, Xiaoqing Wang and Yuming Deng	OPTIMAL DISPATCHING FOR ORDER FULFILLMENT
68	Juhong Gao and Xiaowen Qiu	DYNAMIC PRICING GAME ANALYSIS OF CLOSED-LOOP SUPPLY CHAIN UNDER SUB-CHANNEL SALES
231	Jianming Lei and Kwangyeol Ryu	FRAMEWORK OF IMPLEMENTING SENSOR FUSION FOR ENABLING HUMAN COGNITIVE ABILITIES IN COLLABORATIVE ROBOT
99	Zhiyuan Ouyang, Zhaolin Yuan, Ming Li and George Q. Huang	A PROTOCOL-BASED DECISION FRAMEWORK FOR TRANSPORTING PREFABRICATED CONSTRUCTION MODULES THROUGH CYBER-PHYSICAL INTERNET
129 (Amila Thibbotuwawa)	Vidura De Silva, Buddhi A. Weerasinghe and H. Niles Perera	OPTIMIZING QUAYSIDE TRUCK ALLOCATION: AN EXPERT SYSTEM APPROACH TO ENHANCE DISCHARGING OPERATIONS PLANNING IN CONTAINER TERMINALS
349	Rafat Rahman, Farzana Sultana, Mahmudur Rahman Farhan, Sayem Ahmed and Ripon Kumar Chakrabortty	DESIGNING AN INTEGRATED MULTI-ECHELON, MULTI-PERIOD HEALTHCARE SUPPLY CHAIN NETWORK

Day 2: 14:00 - 15:30
Room: K-B16-LG05-Columbo Theatre C
Chair (s): Prof Daniel Prajogo and A/Prof Omar K. Hussain

Session SS6: From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling II		
Paper ID	**Authors**	**Paper Title**
108	Yingjie Zhao and Abolghasemi Mahdi	Local vs. Global Models for Hierarchical Forecasting
113	Ryosuke Saraya, Tokimasa Isomura, Ryotaro Shimizu and Masayuki Goto	GAUSSIAN-SAINT: A Probabilistic Predictive Deep Learning Model for Uncertainties with Interpretation from Two Perspectives
116	Takahiro Uemukai, Ryotaro Shimizu and Masayuki Goto	Zero-Shot Explainable Time Series Forecasting based on Large Language Model
118	Kosuke Sakurai, Ryotaro Shimizu and Masayuki Goto	PRIORITY DATA AUGMENTATION BASED ON REGIONAL EMBEDDING WITH VISION-LANGUAGE MODEL
123	Siqing Shan, Yinong Li, Yangzi Yang and Jingyu Su	COMPARATIVE STUDY ON THE INTENSITY OF GLOBAL ENERGY TRANSITION POLICIES BASED ON MULTI-DIMENSIONAL EVALUATION FRAMEWORK
131	Zhao He, Shenghan Zhou, Xu Chen, Jingxiao Wen and Wenbing Chang	The UAV risk prediction method based on CWGAN-GP and CNN

Day 2: 14:00 - 15:30
Room: K-B16-LG02 - Colombo LG02
Chair (s): Prof. Reza Tavakkoli-Moghaddam and Dr Ismail Ali

Session SS7: Human-Centric Production Systems in the Era of Industry 5.0 - II		
Paper ID	**Authors**	**Paper Title**
234	Risa Usuki and Jun Usuki	A KUSHO WORDS RECOGNITION METHOD FOR CONTACTLESS INFORMATION MANAGEMENT IN RESTAURANT KITCHENS
240	Putu Karningsih, Princesia Rahmatindar, Moses Singgih and Samsul Arifin	ASSESSING THE READINESS TO TOYOTA PRODUCTION SYSTEM 4.0
243	Kanchan Awasthi, Krunal Padwekar, Khalid Shamim and Subhas Chandra Misra	A HYBRID SPHERICAL FUZZY WINGS APPROACH FOR IDENTIFYING DRIVERS TO INDUSTRY 5.0 IMPLEMENTATION IN TEXTILE SECTOR
298 (Recorded)	Zhongyuan Li and Hamid Parsaei	TPT-LAKE: A Business-Driven Data Infrastructure for Digital Transformation In Industry 4.0
372	Yang He and Weihua Liu	The impact of logistics-manufacturing integration announcement on the stock market value: an Evidence from China

383	Himanshu Gupta and Rishabh Sharma	SYNERGIZING HUMAN AND MACHINE CAPABILITIES: ENHANCING HUMAN-CYBER-PHYSICAL INTERACTIONS FOR GRID COMPLIANCE IN SMART MANUFACTURING

Day 2: 14:00 - 15:30
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): and Dr Michel Fathi and Dr Hamed Aboutorab

Session SS9: Vehicle Routing Problem with Synchronization		
Paper ID	**Authors**	**Paper Title**
120	Rahmad Inca Liperda, Deffanda Vista Putri, Anak Agung Ngurah Perwira Redi, Meilinda Maghfiroh, Josephine German and Filscha Nurprihatin	GIS-INTEGRATED OPTIMIZATION OF ELECTRIC AMBULANCE ROUTES FOR EMERGENCY EVACUATION
156	Nguyen Thuy Trang, Pham Duc Tai, Jirachai Buddhakulsomsiri and Parthana Parthanadee	A HEURISTIC ALGORITHM FOR SOLVING LOAD-DEPENDENT VEHICLE ROUTING PROBLEM
224	Wei Wang, Chunjiao He, Chao Fang and Zonglei Han	Deployment and Trajectory Optimization of UAVs for Emergency Communication in Post-Disaster Areas
233	Shoma Kubono and Jun Usuki	DECISION MAKING IRREGULAR ORDER ACCEPTANCE THROUGH THE COOPERATION OF AUTONOMOUS INDIVIDUALS USING BLOCK OCCUPANCY AND LOGISTIC-DM
248	Amy Lee and He-Yau Kang	A PRELIMINARY STUDY OF THE SUSTAINABLE VEHICLE ROUTING PROBLEM
319	Tanzila Azad, Humyun Fuad Rahman, Daryl Essam and Ripon K. Chakrabortty	OPTIMIZATION OF ENERGY-AWARE BI-OBJECTIVE PRODUCTION SCHEDULING AND VEHICLE ROUTING PROBLEM CONSIDERING TIME OF USE PRICING

Day 2: 16:00 - 17:30
Room: K-E15-G044 - Quad G044- Quadrangle Building

Chair (s): A/Prof Omar K. Hussain and Prof Xueping Li

Session SS1: AI-empowered Industrial Systems: case studies, challenges, and future prospects III		
Paper ID	**Authors**	**Paper Title**
35	Dingcheng Zhang, Chenyang Jiao and Yang Yu	A DEEP GENERATIVE MODEL FOR REMAINING USEFUL LIFE PREDICTION OF AERO-ENGINES

163	Himanshu Gupta and Pramit Khatua	Incorporating Algorithmic Fairness, Accountability, Transparency and Ethics (FATE) in AI adoption for Micro, Small and Medium Enterprises in Sustainable Logistics Sector: An Evaluation of Key Hurdles
164	Yunlong Tang, Keenan Granland and Zijue Chen	Enhancing 3D Printing Farms with a Digital Twin Framework for Intelligent Manufacturing
169	Kazuchika Suzuki, Miho Mizutani, Koki Yamada, Ayako Yamagiwa and Masayuki Goto	Motion Identification from Millimeter-Wave Radar Point Cloud Data Based on One Dimensional CNN and Data Augmentation
193	Xueping Li, Tom Berg, Ashley Stowe, Luke Birt, Gerald Jones, Christopher Mason, John Williams and Scott Lawson	A Digital Twin Framework for Predictive Maintenance Using Large Language Models and Machine Learning Methods
194	Xueping Li, Tom Berg, Ashley Stowe, Luke Birt, Gerald Jones, Aran Arab and Scott Lawson	Generative Large Language Models for Predictive Maintenance Planning

Day 2: 16:00 - 17:30
Room: K-B16-LG05-Columbo Theatre C

Chair (s): Professor Daniel Prajogo and Prof Chen-Fu Chien

Session SS8: Supply Chain Sustainability III		
Paper ID	**Authors**	**Paper Title**
30	Mingqing Ma, Congdong Li, Yelin Fu and Xingyu Chen	Brand Spillover in Emerging Technology Development
60	Amirhossein Mostofi	NAVIGATING THE BIOFUEL TRANSITION: A 360-DEGREE LENS ON SUSTAINABILITY DIMENSIONS
90	Yanxi Liu, Mohammad Mojtahedi and Jinwoo Brian Lee	Off-site Construction Logistics Planning: A Simulation-Optimisation Conceptualisation Framework for Economic and Environmental Sustainability
130	Refentse Selepe, Thomas Munyai and Olasumbo Ayodeji	AN AHP-BASED RESOURCE ALLOCATION FRAMEWORK TO PRIORITISE FACTORS INFLUENCING POOR SUPPLY CHAIN QUALITY IN A MANUFACTURING COMPANY
132	Abu Hashan Md Mashud, Ripon K. Chakrabortty and Omar K. Hussain	MITIGATING PRODUCTION DISRUPTIONS AND ENVIRONMENTAL IMPACT: STRATEGIES FOR SUSTAINABLE OPERATIONS
145	Amit Kumar Singh and Mamata Jenamani	Analysing barriers to sustainable practices in food cold supply chain in context to emerging economy.

Day 2: 16:00 -17:30
Room: K-B16-LG04-Columbo Theatre B

Chair (s): A/Prof Ferry Jie and Dr Hang Tanh Bui

Session SS6: From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling III		
Paper ID	**Authors**	**Paper Title**
134	Mohammad Sarwar Morshed, Md. Asif Mustafa, Mongsathowai Marma, Md. Mahfujul Haq and Abu Hamja	IMPLEMENTATION OF MACHINE LEARNING IN PRODUCT DEVELOPMENT IN LEATHER MANUFACTURING INDUSTRY TO IMPROVE PRODUCTIVITY AND EFFICIENCY
140	Jingxiao Wen, Shenghan Zhou, Jiaqi You, Wenbing Chang and Linchao Yang	The UAV Risk Prediction Method Based on time Window Extraction and Flight Data Generation
199	Mohammed Malaibari, Mustafa Siddiqui, Bahador Bahramimianrood, Sijia Xie and Shiva Abdoli	THE ROLE OF KNOWLEDGE GRAPHS IN IMPROVED DATA MANAGEMENT FOR DIGITAL TWIN APPLICATIONS IN THE MANUFACTURING INDUSTRY
161	Rin Miyazaki, Tianxiang Yang and Masayuki Goto	A deep embedding clustering method for tabular data considering the meaning of qualitative variables
167	Shogo Chomei, Ryuta Matsuoka, Naru Simizu, Tianxiang Yang and Masayuki Goto	Twin-G NeuMF: An Enhanced Neural Matrix Factorization Model Robust to Noise
168	Daiki Fujiwara, Takuya Morikawa, Ayako Yamagiwa and Masayuki Goto	A Method for Analyzing Customer Preferences Taking Account of Diversity of Purchasing Behavior using Knowledge Graph Attention Network

Day 2: 16:00 - 17:30
Room: K-B16-LG01 - Colombo LG01
Chair (s): Dr Jabir Mumtaz and Dr Hamed Aboutorab

Session CT2: Operations Planning & Management I		
Paper ID	**Authors**	**Paper Title**
5	Charvi Hasmukh Shukla	IS THE FUTURE WHERE HUMANS AND COMPUTERS MEET? STATE OF THE ART IN THE HUMAN-COMPUTER INTERACTION FIELD IN THE 21ST CENTURY.
7	Ahmad Shah Hizam Md Yasir, Nik Mohd Zuki Nik Mohamed, Nor Aiman Sukindar, Azizul Qayyum Basri and Khairilmizal Samsudin	Simulation-based Optimization Framework for Assembly-Line Efficiency: Case Study of Special Purpose Vehicle
19	Mudassar Rauf and Jabir Mumtaz	Self-Learning Multi-Criteria Inventory Management Technique Based on Deep Reinforcement Learning

22	Huangyi Qu, Yi Cai and Yi Wang	A Hybrid Structure-based Semantic Segmentation Method for Industrial Measurement of Form and Position Tolerance on Chip Sockets
23	Akhilnandh Ramesh and Yuqian Lu	DIGITAL TWIN-ENABLED DYNAMIC FLEXIBLE JOB SHOP SCHEDULING/RESCHEDULING
39	Jabir Mumtaz, Mudassar Rauf and Kaynat Afzal Minhas	A TWO-PHASE IMPROVED SPIDER MONKEY OPTIMIZATION ALGORITHM FOR MULTI-OBJECTIVE SCHEDULING AND LOT STREAMING PROBLEMS OF PCB ASSEMBLY

Day 2: 16:00 - 17:30
Room: K-B16-LG02 - Colombo LG02
Chair (s): Dr Simon Dunstall and Dr Hasan Turan

Session SS12: Operations Research with Industrial Applications IV		
Paper ID	**Authors**	**Paper Title**
172	Xiaoyue Wang, Xingyue Zhao, Jingxuan Wang and Xi Chen	RISK ASSESSMENT FOR A SUPPLY CHAIN SYSTEM AFFECTED BY MULTI-SOURCE SHOCKS
175	Ashish Omar and Priyanka Verma	Risk-averse robust optimization of supply chain network under disruption risk with ripple effect
178	Mohammed Yaqot and Ibrahim Al-Kulayb	Optimizing Global Cereal Production: A Multi-Criteria Decision Analysis for Sustainable Agri4F Supply Chains
187	Oliviu Matei, Rudolf Erdei, Daniela Delinschi, Jose Barata, Sanaz Nikghadam-Hojjati and Iulia Bărăian	Collaborative networks in orchestration-based software architectures
376	Hasan Turan and Rym M'Halla	Artificial Intelligence Enabled Portfolio Design under Uncertainty
283	Simon Dunstall, Canchen Jiang, Hao Wang, David Smith and Edward Lam	A scalable approach for delivering grid stability services by way of coordinated electric vehicle charging and discharging

Day 2: 16:00 - 17:30
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): Professor Norbert Trautmann and Professor Reza Tavakkoli-Moghaddam

Session SS12: Operations Research with Industrial Applications V		
Paper ID	**Authors**	**Paper Title**
159	Saina Akbari Kouchaksaraei, Ruhul Sarker and Daryl Essam	DYNAMIC PRICING AND REPLENISHMENT STRATEGIES IN A PERISHABLE FOOD SUPPLY CHAIN

149 (tentative)	Li Peize, Qu Ting, Wu Naiqi and Zu Yipei	MULTI-SUPPLIER MULTI-PRODUCT STOCHASTIC INVENTORY OPTIMIZATION UNDER TRANSPORTATION SERVICE-SHARING MODEL
56	Nina Ackermann, Tamara Bigler and Norbert Trautmann	Integer programming modeling approaches for workload-balanced resource-constrained project scheduling
209	Ziyu Zhang, Xinyu Li, Liang Gao and Qihao Liu	A hybrid biogeography-based optimization algorithm for solving dual resource flexible job shop scheduling problem with transfer time
211	Shohei Kanda, Keisuke Nagasawa, Katsumi Morikawa and Katsuhiko Takahashi	Controlling the frequency of dynamic switching between make-to-stock and make-to-order production
212	Iwan Vanany, Muhammad Cholili, Niken Anggraini Savitri and Dody Hartanto	REDUCING DETENTIONS COST IN CONTAINER YARD USING DISCRETE EVENT SIMULATION: INDONESIAN PORT CASE
214	Mehrnaz Najafi, Ali Ghodratnama, Zdeněk Hanzálek, Reza Tavakkoli-Moghaddam and Mohammad Rohaninejad	An Economic Production Quantity Model with Quantity Discounts, Rework, and Process Interruptions for Several Items on a Single-Machine Environment

DAY 3- 11th December (Wednesday)

Day 3: 10:30 - 12:00
Room: K-E15-G044 - Quad G044- Quadrangle Building
Chair (s): Professor Xun Xu and Dr Yunlong Tang

Session SS1: AI-empowered Industrial Systems: case studies, challenges, and future prospects IV		
Paper ID	**Authors**	**Paper Title**
197	Vikram Dhotre, Xun Xu, Yuqian Lu and Holger Heinzel	A CONCEPTUAL DATA CONNECTIVITY MODEL FOR CONSTRUCTION 4.0
215	Zhongxue Yang, Tianren Zhang, Yulong Wu, Qiang Zhang and Yuanbin Wang	DIGITAL TWIN-DRIVEN ADAPTIVE FIXTURING FOR MACHINING OF COMPLEX THIN-WALLED PARTS
223 (Recorded)	Chen Li, Xiyan Zhao, Qing Zhang, Lin Lin, Wenqiang Zhang and Mitsuo Gen	An Evolutionary Knowledge Training-Based Proximal Policy Optimization Algorithm for Job Shop Scheduling in Flexible Intelligent Manufacturing

225	Nikolai West, Andrea Trianni and Jochen Deuse	Detection of surface-based anomalies for self-tapping screws in plastic housings using supervised machine learning
69	Mosaab Hamed, Hasan Huseyin Turan, Sondoss El Sawah, Oguz Sahin and Daniel D Prior	The Current Rare Earth Elements Market: A System Archetype Perspective
245	Haruki Ichimura and Jun Usuki	AERIAL CHARACTER STRINGS SEPARATION FOR RESTAURANT ORDERS USING DNN

Day 3: 10:30 -12:00
Room: K-B16-LG04-Columbo Theatre B
Chair (s): Prof Daniel Prajogo and Dr Michel Fathi

Session SS6: From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling IV		
Paper ID	**Authors**	**Paper Title**
170	Kengo Miyajima, Yuto Nunome, Yuta Sakai and Masayuki Goto	A Hierarchical Multi-label Classification Model Adapted to Training Data with Missing Labels in Some Layers
171	Caitlin Arnold and Ripon Chakrabortty	Predicting the Effects of Pesticides Use on Environmental Sustainability
179	Christoforus Yoga Haryanto	LLAssist: Simple Tools for Automating Literature Review Using Large Language Models
185	Sho Oiwa, Taichi Abe, Keigo Kimura, Satoshi Suzuki and Masayuki Goto	Contextual Bandit Algorithm with Decision Trees and Upper Confidence Bound for Adaptive Recommendation
76	Ayako Yamagiwa, Fugee Tsung and Masayuki Goto	Quantifying User Preferences for Pokémon Characters Using Pairwise Comparison Deep Learning Models
146 (Recorded)	Shiqi Li, Jing Bai, Zekai Li, Chen Zheng, Zhanxi Wang, Likun Xu, Ziyu Hu and Jie Wang	The method of module selection in product design based on intuitionistic fuzzy set

Day 3: 10:30 - 12:00
Room: K-B16-LG05-Columbo Theatre C
Chair (s): Associate Professor Devika Kannan

Session SS11: Computer-based Sustainable Logistic and Supply Chain Management IV		
Paper ID	**Authors**	**Paper Title**
322	Yida Xu, Enyuan Fu, Zhao Zhao and Zhaofang Mao	An adaptive large neighborhood decomposition search algorithm for the location-routing problem with pickup facilities
346	Keisuke Nagasawa, Katsumi Morikawa and Katsuhiko Takahashi	RESILIENT SUPPLY CHAIN FOR DISRUPTION WITH MITIGATION STRATEGIES BY AN OPTIMIZATION-BASED APPROACH

242	Krunal Padwekar, Kanchan Awasthi, Khalid Shamim and Subhas Chandra Misra	PRIORITISING BARRIERS TO IMPLEMENTATION OF METAVERSE IN AFSC WITH NEW SPHERICAL FUZZY SETS BEST WORST METHOD
359	Huang Jun and Zhao Qiuhong	Data-driven distributionally robust forest fire aviation emergency rescue network optimization problem
360/379	Huiying Zhang and Honghong Jia	The influence of platform digital investment on supplier software selection in the POP context
321	Zhao Zhao, Yida Xu and Zhaofang Mao	Enhanced Electric Vehicle Milk-Run Scheduling through Improved Simulated Annealing Algorithms Considering Time-of-Use Pricing

Day 3: 10:30 - 12:00
Room: K-B16-LG01 - Colombo LG01
Chair (s): Dr Simon Dunstall and Prof Reza Tavakkoli-Moghaddam

Session SS12: Operations Research with Industrial Applications VI		
Paper ID	**Authors**	**Paper Title**
220	Muhammad Ridwan Reza Nugraha, Young-Ji Byon, Adriana F. Gabor and Mouna Kchaou-Boujelben	Scoring Based Heuristic for a Platoon Formation Planning Problem with Charging Capacity
226	Kritika Karwasra and Narayan Rangaraj	Optimizing Shipper Transportation: Analyzing Allocation Policies for In-House and Outsourced Rail Rakes using Simulation Modeling
260	Katsumi Morikawa, Keisuke Nagasawa and Katsuhiko Takahashi	Job shop scheduling with automated processing during breaks
270	Jia Guo and Jonathan Bard	Weekly Scheduling for Freight Rail Engineers & Trainmen
275	Olasumbo Makinde	PRIORITIZATION OF PROJECT RISKS ENCOUNTERED AT A SOUTH AFRICAN POWER STATION DURING PANDEMIC PERIOD
214	Mehrnaz Najafi, Ali Ghodratnama, Zdeněk Hanzálek, Reza Tavakkoli-Moghaddam and Mohammad Rohaninejad	An Economic Production Quantity Model with Quantity Discounts, Rework, and Process Interruptions for Several Items on a Single-Machine Environment

Day 3: 10:30 - 12:00
Room: K-B16-LG02 - Colombo LG02
Chair (s): Associate Professor Honglei Xu

Session SS12: Operations Research with Industrial Applications VIII		
Paper ID	**Authors**	**Paper Title**
292	Micael Gonçalves, Paulo Martins and Guilherme Pereira	ELEMENT TYPES AND PROPERTIES TO REPRESENT TRANSPORT AND MATERIAL HANDLING SYSTEMS IN MANUFACTURING SYSTEMS

301	Drew Mitchell, Andreas Ernst, Pierre Le Bodic and Simon Dunstall	Approximation and aggregation schemes for accelerating Benders decomposition of power grid expansion planning.
303	Biswajit Kar and Mamata Jenamani	Identification of Prioritized Optimal Vaccine Distribution Hub using Regional Infection and Comorbidity Status
314	Jun Wang	Joint optimization of condition based maintenance and spare inventory control for redundant system considering stochastic lead time
329	Anders Thorstenson and Erland H. Nielsen	Queuing for a Free Lunch? M/G/1 Queues With Randomly Generated SEPT Priority
332	Yuan Yuan, Tingdi Zhao and Jian Jiao	Unmanned aerial vehicle swarm collaborative task allocation method under uncertain disturbance

Day 3: 10:30 - 12:00
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): A/Prof. Andrei Sleptchenko and A/Prof. Mecit Can Emre Simsekler

Session SS14: The Future of Education and Work in the new Digitized Society		
Paper ID	**Authors**	**Paper Title**
71	Saber Elsayed	Evolving Question Design to Mitigate the Impact of Generative AI Text Tools on Education
142	Eman Ouda, Andrei Sleptchenko and Mecit Can Emre Simsekler	Optimizing Emergency Department Operations: Systems Thinking for Healthcare Workers' Training and Development
204	Moustafa Abdelwanis, Mecit Can Emre Simsekler, Andrei Sleptchenko, Adriana Gabor and Mohammed Omar	EXPLORING DRIVERS AND BARRIERS OF ADOPTING AI-DRIVEN TECHNOLOGIES IN HEALTH SYSTEMS
238	Dyah Santhi Dewi and Annisaul Fadhillah Idi	THE EFFECT OF SOCIAL MEDIA USAGE ON STUDENT LEARNING BEHAVIOR WITH SOCIAL MEDIA FATIGUE AS A MEDIATING VARIABLE
250	Victoria Estrella, Josephine German, Ardvin Kester Ong and Anak Agung Ngurah Perwira Redi	ANALYZING FACTORS AFFECTING WORKPLACE BEHAVIOR OF GENERATION Z IN A DEVELOPING COUNTRY: APPLYING STRUCTURAL EQUATION MODELING WITH HIGHER-ORDER CONSTRUCT ANALYSIS
184	Firda Rahmadani, Mecit Can Emre Simsekler, Mohammed A. Omar, Ali Mohammed Al Shidi and Siddiq Anwar	HUMAN-CENTERED PREDICTION MODEL TO STREAMLINE DECISION-MAKING IN SEPSIS MANAGEMENT PATHWAYS

Day 3: 13:45 - 15:15
Room: K-E15-G044 - Quad G044- Quadrangle Building
Chair (s): Dr Yuqian Lu and Dr Jan Polzer

Session SS1: AI-empowered Industrial Systems: case studies, challenges, and future prospects V		
Paper ID	**Authors**	**Paper Title**
265	Suraj Gupta, Jhareswar Maiti and Akhilesh Kumar	EXPLAINABLE AI-DRIVEN DEEP LEARNING APPROACH FOR PREDICTING REMAINING USEFUL LIFE OF TURBOFAN ENGINE
266	Sourav Bagchi, Mamata Jenamani and Aurobinda Routray	A Noise-Resilient Missing Data Imputation during IoT enabled Reefer Container monitoring
272	Qinwen Wang, Juanru Zhao and Ning Li	Open-Set Domain Adaptation in Machinery Fault Diagnosis by Adversarial Network and Extreme Value Theory
280	Apsarini Pradipta and Iwan Vanany	Simulation Model for a Robotic Mobile Fulfillment System (RMFS) In Spareparts Warehouse
287	Ming-Shun Tsai, Che-Wei Chou and Chen-Fu Chien	AI-BASED OPEN PLATFORM FOR SMART MANUFACTURING: EMPOWERING SMES IN MACHINE TOOL INDUSTRY
299	Xingren Pan, Ferry Jie, Leisa Armstrong and David Cook	SEKansformer: Effective Tomato Classification with Kansformer Backbone and SENet Channel Attention Mechanism

Day 3: 13:45 - 15:15
Room: K-B16-LG04-Columbo Theatre B
Chair (s): A/Prof Ferry Jie and Dr Huadong Mo

Session SS6: From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling V		
Paper ID	**Authors**	**Paper Title**
282	Sina Ehsani and Jian Liu	From the Depths to the Surface: Navigating Spatial Temporal Data with DeepShallow Network
285	U. S. Pasaribu, N. A. Sari, N. F. Sa'Idah and S. B. Harmadi	OPTIMIZING CORRESPONDENCE ANALYSIS WITH SINGULAR VALUE DECOMPOSITION: A STUNTING DATA CASE STUDY
291	Alaa Selim, Huadong Mo, Hemanshu Pota, Chaojie Li, Jingxuan Zhou, Daoyi Dong and Xiaoyu Liu	State of Health Estimation of Lithium Batteries through Vision Transformer Analysis of Electrochemical Impedance Spectroscopy
294	Jeffrey Kelly and Brenno Menezes	SURROGATE SELECTION REGRESSION IN THE DOW DATA CHALLENGE PROBLEM FOR SOFT SENSOR DEVELOPMENT
295	Adilan Widyawan Mahdiyasa, Udjianna Sekteria Pasaribu and	ANALYSIS OF RECOVERY TIME HAZARD RATE FOR FEVER PATIENTS IN SOCIAL SECURITY AGENCY ON HEALTH (BPJS KESEHATAN) USING

	Kurnia Novita Sari	COX MODEL
313	Yasuhito Fujisawa, Kenta Nakamura, Sen Zhang and Haruka Yamashita	BUSINESS MODEL ESTIMATION FOR DISCOVERING BLUE OCEANS

Day 3: 13:45 - 15:15
Room: K-B16-LG01 - Colombo LG01
Chair (s): Dr Song Xu and Dr Hamed Aboutorab

Session SS11: Computer-based Sustainable Logistic and Supply Chain Management III		
Paper ID	**Authors**	**Paper Title**
154	Anchal Patil	Circular Economy Practices in Cyber Physical System Enabled Smart Manufacturing System
162	Yuhui Su, Ming Li and George Q Huang	A Privacy-preserving Trajectory Data Publishing Approach for Protocol Shipment Unit Tracking and Tracing in Cyber-physical Internet
182	Deniz Miller and Ripon Chakrabortty	Resource Allocation for Australian Bushfire Response Using Agent-Based Modelling and Simulation
190	Lankani J. Liyanathanthri, M. Madhava Jayalath, Amila Thibbotuwawa and Peter Nielsen	APPLICATION OF DIGITAL TWINS TO OPTIMIZE POST-HARVEST CIRCULAR GRAIN SUPPLY CHAIN
200	Ruchira Thanuja Wickramasinghe, Amila Thibbotuwawa, Peter Nielsen and Peshala Thibbotuwawa Gamage	SAFETY AND PRODUCTIVITY IN COLD STORAGE STOCKTAKING: UAV INTEGRATION AND ENERGY EFFICIENT ROUTING STRATEGIES
208	Rasyid Pratama and Elnaz Irannezhad	IMPROVING PERFORMANCE OF CONTAINER TERMINAL OPERATIONS: AN AGENT-BASED SIMULATION MODEL

Day 3: 13:45 - 15:15
Room: K-B16-LG01 - Colombo LG01
Chair (s): Associate Professor Honglei Xu and Prof. Reza Tavakkoli-Moghaddam

Session SS12: Operations Research with Industrial Applications VII		
Paper ID	**Authors**	**Paper Title**
277	Mesut Kumru	FUNCTIONAL OBJECTIVES COMBINATION (FOC): A COMPOSITE MEASURING APPROACH TO CORPORATE PERFORMANCE
368	Zainal Abidin Zailani, Ha Xichen, Muhammad Salihin Zakaria and Muhammad Firdaus Mohd Nazeri	COMPARATIVE MICROSTRUCTURAL ANALYSIS OF ALUMINUM ALLOY 7075 UNDER DRY AND CHILLED AIR DRILLING CONDITIONS

192	Haed Tavakkoli-moghaddam, Alexandre Dolgui, Simon Thevenin, Oncu Hazir and Maher Agi	An MILP Model for Budget-Constrained Scheduling of Human-Robot Collaboration in Assembly Line Balancing
284 (Recorded)	Jaganath Mohanty and Ram Mohanty	SMARAN: Integrating In-Memory Techniques for Secure and Efficient Genomic Data Processing in Constrained Devices
286	Haruka Ohba, Shingo Sadakuni, Takashi Matsuda and Shinya Mizuno	Constructing Ergodic Networks using Discrete Markov Chains
288	Amir Yousefli and Afshin Jafari	DATA-DRIVEN INSIGHTS FOR DEVELOPING 20-MINUTE NEIGHBOURHOODS IN MELBOURNE

Day 3: 13:45- 15:15
Room: K-B16-LG02 - Colombo LG02
Chair (s): Dr Simon Dunstall

Session SS12: Operations Research with Industrial Applications X		
Paper ID	**Authors**	**Paper Title**
366	Takayuki Kataoka, Katsumi Morikawa and Katsuhiko Takahashi	MULTI-OBJECTIVE OPTIMIZATION MODELS TO MINIMIZE THE NUMBER OF OPERATORS IN LABOR-INTENSIVE CELLULAR MANUFACTURING
375	Hyeseon Han and Byung Duk Song	OPTIMIZATION OF URBAN AIR MOBILITY OPERATIONS CONSIDERING SHARED RIDING AND VERTIPORT CAPACITY
174	Sanath Kahagalage, Hasan Hüseyin Turan, Pankaj Sharma and Sondoss Elsawah	A study on maintenance scheduling and workforce planning under deep uncertainty
344	Seyed Mohammad Khalil, Mohammad Mojtahedi, Christine Steinmetz-Weiss and David Sanderson	OPTIMISING EVACUATION PLANNING FOR VULNERABLE POPULATIONS: A TWO-STAGE STOCHASTIC PROGRAMMING AND BENDERS' DECOMPOSITION APPROACH
8	Xuehong Gao, Jianlan Zhou, Guozhong Huang, Wenzhao Li and Honglei Dong	OPTIMIZATION OF VEHICLE RECALL STRATEGY BASED ON TRIPARTITE EVOLUTIONARY GAME
25	Risa Iwai, Ryotaro Shimizu and Haruka Yamashita	A Study on Efficient Annotation Method for Single Annotators

Day 3: 13:45 - 15:15
Room: K-E15-G031 - Quad G031- Quadrangle Building
Chair (s): Dr Asef Nazari and Professor Norbert Trautmann

Session CT2: Operations Planning & Management II		
Paper ID	**Authors**	**Paper Title**
26	Jia-Hong Chou, Fu-Kwun Wang and Hsuan-Kai Chen	ADAPTIVE TRANSFER LEARNING MECHANISM WITH DEFORMABLE CONVOLUTION FOR WAFER MAP FAILURE PATTERN RECOGNITION
279	Xun Xiao	Learning Local Cascading Failure Patterns from Massive Network Failure Data
41	Yuhan Liu, Ying Liu, John McCrory and Xiao Guo	HIGH-FIDELITY DIGITAL TWIN MODELLING FOR PREDICTIVE MAINTENANCE: STATE-OF-THE-ART
92	Mohammad Ghasemi, Asef Nazari, Dhananjay Thiruvady, Reza Tavakkoli-Moghaddam, Reza Shahabi-Shahmiri and Seyed-Ali Mirnezami	A Bi-Objective Mathematical Model For The Multi-Skilled Resource-Constrained Project Scheduling Problem Considering Reliability: An AUGMECON2VIKOR Hybrid Method
128	Le Minh Hien Nguyen, A S M Monjurul Hasan and Andrea Trianni	INVESTIGATION OF FAMILIARITY, BARRIERS, AND DRIVERS TO INDUSTRY 4.0 TECHNOLOGIES– AN ANALYSIS THROUGH THE LENS OF SUSTAINABILITY IN THE MANUFACTURING INDUSTRIES
139	Wei Xiaotong, He Yingdong and He Zhen	INTEGRATION OPTIMIZATION BASED ON PRODUCTION QUALITY RISKS AND PREVENTIVE MAINTENANCE FOR SYSTEM WITH HIGH QUALITY REQUIREMENT

Day 3: 15:45- 17:15
Room: K-E15-G044 - Quad G044- Quadrangle Building
Chair (s): Professor Xun Xu and Dr Jan Polzer

Session SS1: AI-empowered Industrial Systems: case studies, challenges, and future prospects VI		
Paper ID	**Authors**	**Paper Title**
300	Zijue Chen, Dayalan Gunasegaram and Heng Wang	Orientation-Invariant Melt Pool Feature Extraction via Unsupervised Machine Learning for Metal Additive Manufacturing
381	Md Mizanur Rahman, Faycal Bouhafs, Sayed Amir Hoseini and Frank den Hartog	Feature Relevance for Detecting Address Resolution Protocol Spoofing in Smart Homes with Machine Learning
336	Minji Kim, Kyungjin Park, Jisung Moon, Cheolhyeon Han, Byunghun Song, Jieun Jung and Jumyung Um	Blockchain-based digital product passport using federated learning for recycling decision optimization

352	Jumyung Um, Jongsu Park and Shokhikha Amalana Murdivien	Generative artificial intelligence toward autonomous factories
353	Wu Xiaodan, Zheng Haopeng, Yin Xiaomin and Yue Yang	MULTI-AGENT DEEP REINFORCEMENT LEARNING FOR MULTI-ECHELON ORDERING DECISIONS UNDER DEMAND ALLOCATION
374	Reda Ghanem, Ismail M. Ali, Kathryn Kasmarik and Matthew Garratt	Comparative Analysis of Simulation Models for Evolving Robot Collective Motion in Industrial Coverage and Inspection Tasks

Day 3: 15:45 - 17:15
Room: K-B16-LG04-Columbo Theatre B
Chair (s): Prof. Reza Tavakkoli-Moghaddam

Session SS6: From Data to Action: Leveraging Artificial Intelligence and Machine Learning for Effective Process Modelling VI		
Paper ID	**Authors**	**Paper Title**
327	Bodrunnessa Badhon, Sreenatha G. Anavatti and Ripon K. Chakrabortty	Enhanced Interpretability in Project Risk Management: Interpreting the Antecedents by Capturing the Interdependencies in Risk Factors
338	Md Mahmudul Hasan, Sreenatha Anavatti and Ripon K Chakrabortty	Efficient Question Answering Model for the Customer Requirements Elicitation in Digital Supply Chain Network
357	Ritwik Dash and Mamata Jenamani	Analyzing Sensor Lifespan and Fault Identification in Cost-Effective Environmental Monitoring Systems
370	Kasinda Henderson and Ripon Chakrabortty	A Machine Learning Prediction Model for Bushfire Ignition and Severity: The Study of Australian Black Summer Bushfires
386	Bijan Jamshid-Nejad and Samira Alvandi	AN INTELLIGENT SIMULATION MODEL FOR FLOW SHOP SEQUENCING
387	Zahra Namazian, Peter Stuckey and John Betts	New Product Demand Forecasting for Beauty Retail using Seasonality

Day 3: 15:45 - 17:15
Room: K-B16-LG05-Columbo Theatre C
Chair (s): Dr Simon Dunstall and Dr Hasan Turan

Session SS12: Operations Research with Industrial Applications IX		
Paper ID	**Authors**	**Paper Title**
337	Nur Fatin Syamimi Kamaruddin, Nadirah Abdul Rahim and Mahayaudin M. Mansor	Corrective Maintenance Time Model Of The 2-Parallel Configuration Of The Earth Station System Using Curve Fitting
339	Li Guan, José M. Merigó, Alireza Abbasi and Ripon K. Chakrabortty	Improving Risk Management for International Construction Projects: An AI-empowered Approach to Proactive Decision Making

343	Parthkumar P. Sartanpara and Ramakanta Meher	Analytical Insights and Applications of the Fractional Riccati Differential Equation in Advanced Optimization and Control Systems
202 (Absent)	Jingzhe Lei and Way Kuo	Jigsaw-based load dispersion design for solar pavement systems
361	Yiqun Zhang, Liyuan Zhang, Shaoli Wang and Honglei Xu	A Hybrid Approach to Hyperparameter Optimization for Dual Neural Networks
364	Dae Young Ryu, Young Kwan Ko, Young Dae Ko and Byeong Ju Jo	Dynamic Pricing Strategy in Hotel Industry Under Competitive Situation

Day 3: 15:45 - 17:15
Room: K-B16-LG01 - Colombo LG01
Chair (s): Dr Damith Mohotti and A/Prof. Mecit Can Emre Simsekler

Session SS15: Advancements of Machine Learning and AI in Civil Infrastructure and Defence Applications		
Paper ID	**Authors**	**Paper Title**
256	D. P. P. Meddage, Damith Mohotti, Kasun Wijesooriya and Chi King Lee	MODELLING OF THE TRANSIENT WIND PRESSURE ON A TALL BUILDING USING MACHINE LEARNING
257	Chamodi Widanage, Damith Mohotti, Chi King Lee and Kasun Wijesooriya	PREDICTIVE MODELLING OF BLAST-INDUCED INCIDENT PRESSURE TIME HISTORIES USING A DEEP LEARNING-BASED FRAMEWORK
269	Md Sarwar Kamal, Sonia Farhana Nimmy, Wafa Alharbi, Ahnaf Tajwar and Nazia Hasan	Real-time Anomaly Detection in Cyber-Physical Systems Using Fourier Transform Features and Explainable AI
333	Ranit Senapati and Biswajit Mahanty	RELIABILITY ANALYSIS AND UNCERTAINTY QUANTIFICATION OF A SIX DEGREE OF FREEDOM PROJECTILE MODEL SUBJECT TO INPUT UNCERTAINTY
261	Syed Irtija Hasan, Sonia Farhana Nimmy and Md Sarwar Kamal	Predictive Maintenance for Industrial Drones in the Industrial Internet of Things Using Federated Learning and Explainable AI
59 (Recorded)	Ahmed Ghaithan and Abdullah Al-Khanfar	DATA-DRIVEN MODEL FOR PREDICTING FAILURE RATE OF UNDERGROUND POTABLE WATER DISTRIBUTION SYSTEM

Day 3: 15:45 - 17:30

Room: K-B16-LG02 - Colombo LG02

Chair (s): A/Prof Ahm Shamsuzzoha and Dr Hang Tanh Bui

Session CT4: Future of Supply Chain		
Paper ID	**Authors**	**Paper Title**
3	William Ho and Agus Putra Wicaksana	DECODING RESILIENCE IN OPERATIONS AND SUPPLY CHAIN MANAGEMENT: A REVIEW BASED ON ENGINEERING AND EVOLUTIONARY PERSPECTIVES
24	Syariza Abdul-Rahman, Noor Nabeel and Juliana Wahid	Vehicle Routing Problem with Time Window for a Postal and Courier Service: A case study in Malaysia
27	Shingo Kawamura, Kenta Nakamura, Zhang Sen and Haruka Yamashita	A study on verifying the effects on stock prices due to announcements of share repurchases based on Causal Impact.
221	Manna Huang, Ting Qu, Ming Wan and George Q. Huang	THE MULTI-COMPARTMENT VEHICLE ROUTING PROBLEM IN WASTE MANAGEMENT BASED ON DUAL INCENTIVE MECHANISM
235	Xiao-Hui Qiu, Ting Qu, Hai-Nan Huang, Lin Ma and Du-Xian Nie	OPTIMIZATION METHOD OF THE INDUSTRIAL VALUE CHAIN CONFIGURATION HEADQUARTER-CENTERED GROUP-TYPE MANUFACTURING ENTERPRISES CONSIDERING SYNERGY RELATIONSHIPS
106 (Recorded)	Ahmed Ghaithan, Laith Hadidi, Awsan Mohammed and Shehab Mostafa	ECONOMIC-ENVIRONMENTAL ASSESSMENT OF CONCENTRATED SOLAR POWER FOR SEAWATER DESALINATION
47	Ahm Shamsuzzoha, Bening Mayanti and Petri Helo	COMPUTER-ENABLED CONFIGURABLE PRODUCT FAMILY DESIGN AND DEVELOPMENT FOR SUSTAINABLE LOGISTICS AND SUPPLY CHAIN MANAGEMENT: A CASE STUDY

Day 3: 15:45 - 17:15

Room: K-E15-G031 - Quad G031- Quadrangle Building

Chair (s): A/Prof. Andrei Sleptchenko

Session CT3: Healthcare Management Systems		
Paper ID	**Authors**	**Paper Title**
21	Himari Seino and Haruka Yamashita	PREDICTION OF USER WITHDRAWAL FROM PREGNANCY/CHILDCARE Q&A SITE AND ANALYSIS OF ITS FACTORS
29	Li-Chih Wang and Tung-Chin Chen	LEAN SIX SIGMA APPROACH FOR HOSPITAL MATERIAL INVENTORY MANAGEMENT IN THE HEALTHCARE INDUSTRY

42	Chi Liu, Linna Zhou, Yujuan Wang, Xingyu Wen and Feng Wu	Identification of Unilateral Breast Loss User Needs for Prostheses and Mastectomy Bras Based on Grounded Theory
93	Soham Das and Varun Ramamohan	Quantification of effects of screening and treatment policies on epidemiology of hepatitis C virus infection in Indian Punjab
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300	XIAOYUE	WANG	Beijing Technology and Business University
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John P.T. Mo (RMIT University) and Boyd A. Nicholds (Agileserve Pty Ltd). *ASSESSING EFFECTIVENESS OF PLANNED SYSTEM CHANGES.*

Abstract. Making changes in any organisation is risky. This is particularly critical to complex systems such as manufacturing where multi-disciplinary activities are involved with many users and influencing factors interacting. Any obstruction to daily production activities is almost certain to give a negative impact on all key performance measures. It is normal that many improvement projects are competing for resources. However, deciding which proposal should be adopted is still an intuitive, emotional outcome for many organisations. To alleviate this problem, a new data-driven method known as "Performance Reliability Estimation Model" (PREM) is introduced in this paper. PREM uses the concepts of capability scores and performance effectiveness function to assess if an organisation has good chance of making successful change. This process is designated as "forward PREM". However, estimating performance effectiveness function can still be an intuitive exercise. The "reverse PREM" process uses historical performance data set to compute the organisation's performance effectiveness function so that chance of project success can be more accurately evaluated. To illustrate how PREM works, this paper outlines the theoretical framework as well as illustrates the methodology with a warehouse delivery example. The outcome provides guidance to adjust deployment of resources to maximise change effectiveness in entire duration of the project thereby ensuring chance of project implementation success.

Keywords: system performance, reliability of performance, change effectiveness, capability score, system regression modelling

William Ho (The University of Melbourne) and Agus Putra Wicaksana (The University of Melbourne). *DECODING RESILIENCE IN OPERATIONS AND SUPPLY CHAIN MANAGEMENT: A REVIEW BASED ON ENGINEERING AND EVOLUTIONARY PERSPECTIVES.*

Abstract. This study utilized a hybrid scholarly network analysis by combining citation-based and text-based approaches to understand the conceptualization, measurement, and antecedents of operational resilience in the supply chain risk management literature. Specifically, we employed a Bibliographic Coupling Analysis in the research cluster formation stage and a Co-words Analysis in the research cluster interpretation and analysis stage. Our analysis reveals three major research clusters of resilience research in the SCRM literature, namely (1) supply chain network design and optimization, (2) organizational capabilities, and (3) digital technologies. We portray the research process in the last two decades in terms of the problems studied, commonly used approaches and theories, and solutions provided in each cluster. We then provide a conceptual framework on the conceptualization and antecedents of resilience based on studies in these clusters and highlight potential areas that need to be studied further. Finally, we leverage the concept of abnormal operating performance to propose a new measurement for resilience. This measurement overcomes the limitation of most current measurements that focus on the resistance or recovery stage - without capturing the growth stage.

Keywords: Supply chain, Resilience, Literature review, Bibliographic coupling analysis, Co-words analysis

Charvi Hasmukh Shukla (XLRI- Xavier School of Management, Jamshedpur). *IS THE FUTURE WHERE HUMANS AND COMPUTERS MEET? STATE OF THE ART IN THE HUMAN-COMPUTER INTERACTION FIELD IN THE 21ST CENTURY.*

Abstract. Where will technology take us tomorrow? Addressing this question in the context of ongoing technological advancements becomes vital for researchers and practitioners. A person's day starts and ends around technology. From simple computers to modern machines using artificial intelligence, augmented reality, and other digital innovations, attention has shifted to interpreting human-computer relationships today. The people-process-technology (PPT) framework is one such idea that aims at balancing the three aspects concerning the people who perform the work, the process that makes this work more productive, and the technology that aids both to help with effective and efficient organization management collectively.

This paper uses the PPT framework to review the literature on human-computer interactions (HCI) to understand the state of the art of the HCI research field in the 21st century. The PRISMA method is employed to conduct a systematic review from 2001 to 2023 to provide a comprehensive understanding and suggest future directions to researchers.

Keywords: People-Process-Technology (PPT) framework, Human computer symbiosis relationship, Technological advancement, Systematic review

Ahmad Shah Hizam Md Yasir (Faculty of Resilience, Rabdan Academy), Nik Mohd Zuki Nik Mohamed (Faculty of Manufacturing and Mechatronics Engineering Technology, University Malaysia Pahang), Nor Aiman Sukindar (School of Design, Universiti Teknologi Brunei), Azizul Qayyum Basri (Faculty of Technical and Vocational, Sultan Idris Education University) and Khairilmizal Samsudin (Universiti Sains Malaysia). *Simulation-based Optimization Framework for Assembly-Line Efficiency: Case Study of Special Purpose Vehicle.*

Abstract. Research on optimized solutions in automotive manufacturing processes is largely focused on commercial vehicles and rarely considered the manufacturing of special-purpose vehicles. Owing to their high-end fabrication, the manufacturing of special-purpose vehicles is significantly challenging in terms of their production efficiency. In this study, we develop a global framework specifically designed to optimize the efficiency of assembly lines by using computer-based simulations. In addition, a case study involving the layout of a special-vehicle facility was conducted to demonstrate the applicability and effectiveness of the proposed framework. First, correlated data gathering is performed in an industrial premise and the simulation procedure is developed. We then analyze the actual production layout and the posture of the workers by using the WITNESS and DELMIA simulations, respectively. Next, we combine the simulation outcomes by using the systematic-layout planning to establish a new optimized layout with improved efficiency. The suggested framework is expected to improve the total output in a manufacturing system, especially in special-purpose vehicle manufacturing.

Keywords: Human Factors and Ergonomics, Plant layout, Assembly Line Balancing, Simulation Optimization, Special Purpose Vehicle

Xuehong Gao (University of Science and Technology Beijing), Jianlan Zhou (University of Science and Technology Beijing), Guozhong Huang (University of Science and Technology Beijing), Wenzhao Li (University of Science and Technology Beijing, SAMR Defective Product Recall Technical Center) and Honglei Dong (SAMR Defective Product Recall Technical Center). *OPTIMIZATION OF VEHICLE RECALL STRATEGY BASED ON TRIPARTITE EVOLUTIONARY GAME.*

Abstract. In the process of vehicle recall, information is not only asymmetrical among participants but also inconsistent in their pursuit of interests, which may lead to difficulties in guaranteeing the effect of recall. To solve this problem, a tripartite evolutionary game model of vehicle recall is established, aiming at finding the optimal evolutionary stabilization strategy of the vehicle recall, to promote the implementation of vehicle recall and safeguard the safety and rights of consumers. Through the simulations, we analyze the influence of different factors on the choice of behavioral strategies of game subjects. It is found that some influencing factors such as regulatory cost, recall cost, reputation, etc. are able to change the decision of the game subjects, which indicates that the implementation of vehicle recall can be promoted from the perspective of cost-benefit.

Keywords: Vehicle recall, Evolutionary game theory, Optimization

Ashish Raj (Indian Institute of Management Mumbai) and Debabrata Das (Indian Institute of Management Mumbai). *OPTIMAL COORDINATION BETWEEN Q-COMMERCE COMPANIES AND DELIVERY RIDERS BY INTEGRATING LIMITED TRUST EQUILIBRIUM.*

Abstract. Quick Commerce (Q-commerce) has transformed the retail landscape by offering superfast delivery services to customers within 10-15 minutes of ordering. However, the efficient coordination between Q-commerce companies and delivery riders remains a critical challenge. In the paper we propose a new methodology to address this challenge by introducing the concept of Limited Trust Equilibrium (LTE) to foster trust-based interactions between Q-commerce companies and delivery riders. We conceptualize the interaction between players as a repeated game with heterogeneous interactions, where the payoffs for each game are drawn from a distribution. In traditional game-theoretic models, rationality and self-interest dominate, whereas LTE allows for incorporating trust dynamics, in which players exhibit varying levels of trust (δ) towards each other. In our LTE framework, Q-commerce companies and delivery riders engage in repeated games, where the level of trust each player is willing to extend affects their strategic decisions.

Q-commerce companies can influence the trust levels of delivery riders by incorporating trust through actions such as fair compensation, good incentives, and training. Similarly, by consistently meeting performance expectations and communicating effectively, delivery riders can enhance trust levels with Q-commerce companies. We analyze the existence and properties of LTE in the context of Q-commerce coordination by assessing the individual utility of the Q-commerce company and the delivery rider and the overall net utility. We compare the utility generated by LTE against traditional equilibrium concepts such as Nash equilibrium, by using numerical simulations and empirical trials. Our findings demonstrate that LTE fosters mutually beneficial outcomes where the gains from trust outweigh the costs incurred by sacrificing (δ) from their individual utility. By promoting trust-based interactions and fostering collaborative relationships between Q-commerce companies and delivery riders, LTE emerges as a promising framework for achieving optimal coordination and enhancing the efficiency of Q-commerce operations.

Keywords: Q-commerce, Limited-trust Equilibrium, Game-theory, Delivery Rider, Trust

Xuze Wang (Institute of Precision Guidance and Control, Northwestern Polytechnical University), Fei Xiao (Institute of Precision Guidance and Control, Northwestern Polytechnical University), Bingwen Li (School of Astronautics, Northwestern Polytechnical University), Maitri Paramitha (School of Astronautics, Northwestern Polytechnical University), Zhenhang Chu (Institute of Precision Guidance and Control, Northwestern Polytechnical University) and Min Zhou (Institute of Precision Guidance and Control, Northwestern Polytechnical University). *Overview of Intelligent Fault Diagnosis Technologies for Solid Fuel Rockets.*

Abstract. Solid-fuel rockets, crucial for space missions,face various potential failures due to internal and external environmental factors.the engine, being central to the rocket's propulsion system,directly impacts mission success. Historical research from various countries since the last century has yielded numerous results in fault detection systems and methods.this paper discusses fault types in solid-fuel rockets, their impacts on missions, and outlines the intelligent fault diagnosis concept.it also establishes a universal framework and mathematical model for intelligent fault diagnosis of solid rocket engines, exploring the application methods of intelligent fault diagnosis technologies in solid-fuel rockets. The findings may offer valuable insights for future advancements in rocket fault diagnosis.

Keywords: Solid-fuel carrier rockets, Fault diagnosis, Intelligence

Taho Yang (National Cheng Kung University), Yu-Chun Kao (National Cheng Kung University) and Yiyo Kuo (Ming Chi University of Technology). *A STUDY ON OPTIMIZING PROCESS PARAMETERS TO MINIMIZE WEAVING PROCESS INVENTORY.*

Abstract. The main manufacturing processes for textile manufacturing include: fiber, spinning, weaving, dyeing, and garment production. Due to the volatile market demands, it usually follows the make-to-order production plan to avoid excessive inventory. Further challenges come from the small order size, product variety, demanding lead time constraints. The spinning and weaving processes are the front workstations. Their changeover time is very long, maybe as long as eight hours, that limits the frequent changeovers to reduce overproduction. Thus, high weaving work-in-process (WIP) is often a concern but there is no effective solution to alleviate this problem. In addition to the inventory cost, it also causes quality problem to its material aging effects. Particularly, this problem deteriorates for smaller order-size demands.

The present study proposes a response surface methodology (RSM) based approach to solve the high weaving WIP problem. The control parameters are first identified that are influential factors to weaving inventory. Then, a mathematical model is built to predict the relationship between control factor levels and resulting overproduction. Next, central composite design (CCD) is proposed to for design of experiment (DOE). Finally, the RSM is built, and then is used to optimize the production parameters.

A practical case is adopted from a big textile manufacturer in Taiwan for the empirical illustration. The overproduction is more serious for smaller order-size demands. Thus, the experiment is designed to three order-size scenarios: ranging from 5,000~10,000 yards, ranging from 10,000~20,000 yards, and ranging from 20,000~30,000 yards. The optimized results show improvements of 29%, 46%, and 71%, respectively. The results are promising and are adopted for practical use.
Keywords: Central composite design, Design of experiment, Parameter design, Response surface method, Textile manufacturing, Weaving process.

Mudassar Rauf (College of Mechanical and Electrical Engineering, Wenzhou University, Wenzhou, P.R. China.) and Jabir Mumtaz (College of Mechanical and Electrical Engineering, Wenzhou University, Wenzhou, P.R. China.). *Self-Learning Multi-Criteria Inventory Management Technique Based on Deep Reinforcement Learning.*

Abstract. Inventory management is an integral part of an organizational supply chain management system. Overestimation and early reordering can cost millions of dollars to warehouses in terms of storage costs, thus increasing overhead costs. On the other hand, lower estimation and later reordering can also cause significant damage to the organization regarding stockout, lower sale volume, and opportunity cost. Organizations usually face three major questions while managing inventory: 1) How to classify items, 2) when to reorder, and 3) how much to reorder. One of the most well-known inventory management techniques is ABC, which classifies items into different categories. The aim is not to lose focus on the few most critical items, that is, category A, while keeping the cost low. The ABC classification technique has some drawbacks. First, the ABC classification technique uses weights to group items into categories. The weight assigned to each item is based on the criteria and is generally fixed. Second, it can only be applied to a single criterion. However, organizations have to operate in a very competitive environment. They must keep the cost low while maintaining high quality and availability. The average unit cost, average annual usage, critical factor, and lead time were identified as essential criteria for organizations. Therefore, a self-learning multi-criteria inventory management (SLMCIM) technique is proposed for this problem. SLMCIC integrates the ABC classification technique with the multi-criteria decision-making (MCDM) technique and deep reinforcement learning-based genetic algorithm (DRL-GA). The technique for order preference by similarity to ideal solution (TOPSIS) ranks items based on multiple criteria, whereas the ABC technique classifies items into groups based on TOPSIS's ranking. DRL-GA is used to dynamically adjust the criteria weights during TOPSIS implementation for various problems. Furthermore, the DRL-GA is applied to calculate each item's reordering point and reordering size while minimizing the service-cost performance measure. The performance of the proposed SLMCIM technique was tested on a benchmark dataset from a Hospital Respiratory Therapy Unit (HRTU). The experimental results indicate that the proposed SLMCIM technique is an effective and simple inventory management tool.

Keywords: Inventory management, Multi-criteria decision-making, Deep reinforcement learning, genetic algorithm, ABC classification

Amin Zakhirehkar Sahih (School of Engineering and Technology UNSW Canberra), Milad Ghasri (School of Engineering and Technology UNSW Canberra) and Alireza Abbasi (School of Systems & Computing UNSW Canberra). *A TECHNICAL AND ECONOMIC EVALUATION OF UTILIZING COMMUNITY-WIDE TRADING DECISIONS OPTIMIZERS IN P2P RENEWABLE ENERGY MARKETS.*

Abstract. Optimizing renewable energy resources in local communities through peer-to-peer (P2P) trading is gaining momentum in research and practice as traditional electricity consumers are evolving into prosumers being able to sell excess solar power to their neighbors. This study explores the impact of prosumers using a newly developed trading decision optimizer in a P2P renewable energy market. While P2P trading decision optimizers benefit individuals, their community-wide effects are unknown. We simulated a P2P market with varying optimizer adoption rates. The results show a significant reduction in average electricity bills for the entire community as optimizer use increases. Importantly, those not using an optimizer experience no negative economic impact. Additionally, higher optimizer penetration improves local grid self-sufficiency, which is greater local matching. The effect on profit distribution is inconclusive as there is no evidence that increased optimizer adoption distributes profits unequally. This research sheds light on the potential benefits and drawbacks of widespread decision optimizer adoption in P2P markets, informing future policy decisions in these emerging markets.

Keywords: P2P trading, decision making, dynamic programming, uniform price double auction, renewable energy, decentralized markets

Himari Seino (Faculty of science and technology, Sophia University) and Haruka Yamashita (Faculty of science and technology, Sophia University). *PREDICTION OF USER WITHDRAWAL FROM PREGNANCY/CHILDCARE Q&A SITE AND ANALYSIS OF ITS FACTORS.*

Abstract. Q&A sites are sites where users' questions and answers to them are solicited.In this study, we focused on "Mamari", a Q&A site for mothers before and after giving birth. Since its launch, Mamari has steadily increased the number of registered users, and the size of the site is on the rise; for it to grow further as a Q&A site, it is desirable that a large number of diverse questions be posted. On the other hand, the number of question submissions has remained flat. One reason for this is that many users only ask questions once and immediately stop using the site. This phenomenon is referred to as user disengagement from questioning behavior in this study, and the aim is to clarify the causes.

Yamamoto suggested that whether a user has experience posting on a company's website is an important factor in leaving the website. Therefore, in this study, withdrawal is predicted by the specific behavior of users within Mamari. However, user behavior is likely to vary according to attributes. Therefore, this study proposes a hierarchical model for the behavioral parameters of the prediction model, which is constructed in the framework of Hierarchical Bayesian Modelling to clarify complex relationships.

In this study, we analyzed the data extracted from Mamali using the proposed model. As a result, by interpreting the characteristic behaviors of users who are likely to abandon the site and the hierarchical model of each behavior, it was also possible to identify the user groups most likely to engage in each behavior. In this way, As a result, we were able to identify the behavioral characteristics of users who are likely to leave the site and the users who are likely to fall under those behavioral characteristics. This result suggests the validity of the proposed model.

Keywords: Q&A Sites, Hierarchical Bayesian Modelling, Predictive Modeling

Huangyi Qu (Hong Kong University of Science and Technology), Yi Cai (Hong Kong University of Science and Technology) and Yi Wang (University of Missouri). *A Hybrid Structure-based Semantic Segmentation Method for Industrial Measurement of Form and Position Tolerance on Chip Sockets.*

Abstract. A chip socket is a mechanical and electrical system that establishes reliable electronic interconnection paths between the chip and the test board to facilitate signal transmission. Form and positional tolerance control is key to determining the quality of the chip socket. When faced with highly precise CPU chip sockets containing thousands of contacts distributed over a very small area, current technologies still struggle to meet the demands for high-precision, rapid, and real-time measurements simultaneously. This presents a significant challenge to process stability and product quality. To address this issue, a hybrid model of tandem structure stitching (HTSS) is proposed to effectively and efficiently measure the form and position tolerance of CPU chip sockets. The front-end model is a improved BiSeNet (IMP-BiSeNet) semantic segmentation network, which improves the convolutional module by incorporating a self-attention mechanism. Meanwhile, a structural reparameterization in the style of RepVGG is designed to separate the architectures used during training and inference, thereby reducing the training time and inference time. Furthermore, the overlay maps extracted from the modified BiSeNet network are inputted into the OTSU model for additional processing. The chip contact form and positional tolerance are then obtained through target size and position calculation. The accuracy of the HTSS model is validated through tolerance inspection experiments conducted on a robotic vision measurement system. The results show that IMP-BiSeNet improves the mIoU by 5.69% compared to BiSeNet. All the measured tolerance values are less than 0.1 mm, which meets the tolerance requirements. The model offers an effective and efficient approach to enhancing the accuracy of tolerance measurement for precision devices.

Keywords: Chip socket, vision inspection, convolutional neural network, industrial measurement, intelligent manufacturing, artificial intelligence, quality monitoring

Akhilnandh Ramesh (Department of Mechanical and Mechatronics Engineering, University of Auckland, New Zealand) and Yuqian Lu (Department of Mechanical and Mechatronics Engineering, University of Auckland, New Zealand). *DIGITAL TWIN-ENABLED DYNAMIC FLEXIBLE JOB SHOP SCHEDULING/RESCHEDULING.*

Abstract. Mass Customization and Mass Personalization have resulted in the emergence of High-Mix-Low-Volume manufacturing as a production paradigm. The resulting product versus variety challenge, characterized by small batch production with varied process plans in Flexible job Shops, has necessitated the incorporation of dynamicity and real-time responsiveness with the Flexible Job Shop Scheduling Problem (FJSP). Flexible Job Shop Scheduling algorithms must provide real-time visibility and accommodate changes to production schedules in the wake of disruptive events such as machine breakdown, job cancellations, new job arrivals and delays in task progress due to dynamic production bottlenecks. As a solution, we present a digital twin-enabled dynamic, flexible job shop scheduling framework, which can serve as the production planner's decision support system by generating pre-emptive reschedules. Firstly, a five-dimensional architecture of an FJSP digital twin is presented. This is followed by a discussion of a service-oriented real-time production scheduling control mechanism that can enable real-time visibility of manufacturing task progress, identify disruptive events and predict rescheduled scenarios. The proposed framework and mechanism are integrated into a dynamic production scheduling algorithm that utilizes genetic algorithms to optimize makespan, total weighted tardiness and schedule stability. A real-world case study from a machine shop involved in manufacturing precision-engineered valves is utilized to validate the developed digital twin-based rescheduling framework.

Keywords: Digital Twin, Flexible Job Shop Scheduling Problem, Rescheduling, Genetic Algorithm

Syariza Abdul-Rahman (Universiti Utara Malaysia), Noor Nabeel (Northern Technical University) and Juliana Wahid (Universiti Utara Malaysia). *Vehicle Routing Problem with Time Window for a Postal and Courier Service: A case study in Malaysia.*

Abstract. Postal and courier companies including Pos Malaysia face pressure to reduce operational costs while satisfying demands for ever-higher service levels. High commitment from the route of collection and delivery is crucial to make sure the job is successful and able to reduce operational costs. We model the collection problem of Pos Malaysia as a vehicle routing problem with time window (VRPTW) with the aim of minimizing the total cost including penalty cost. The problem involves collecting mail and parcels at the collection points to a sorting center as a depot. A two-phase constructive approach is proposed, which first orders the collection points based on their demands and then considers the vehicles' capacity. If any collection points remain unassigned, neighborhood structures are applied to the already assigned customers to create more space for accommodating the unassigned customers, thereby aiming to produce a feasible solution. In the second phase, neighborhood structures were applied to produce a range of feasible solutions. The findings from a comprehensive computational study are presented.

Keywords: Vehicle routing problem, Postal and courier, Collection problem, Constructive heuristics
Topics:

Risa Iwai (Sophia University), Ryotaro Shimizu (ZOZO Research) and Haruka Yamashita (Sophia University). *A Study on Efficient Annotation Method for Single Annotators.*

Abstract. One method for building machine learning models related to human cognition is to provide training data with human annotations and estimate the model from the created training data. In this case, a large amount of training data is required, so as many annotators as possible are needed. However, when building machine learning models for the cognition tasks of a specific person, a single person must perform the annotations, so an annotation method that minimizes the burden on the annotator is needed. Therefore, this study proposes a method that allows a single annotator to provide evaluations for the samples efficiently. In competition, a method called rating estimates the strength of a competitor or a team based on the results of multiple competitions. It has been widely used as a credible indicator. In addition, there is a method called tournament to obtain win or lose data to evaluate the strength of a team efficiently. Therefore, incorporating the structure of tournaments and the rating methods used in competitions enables efficient evaluation annotation. In this study, we propose the following annotation procedure: First, we apply k-means clustering to extract a realistic number of annotation target data for creating training data. Then, we construct a tournament. A single annotator performs the evaluations, and we propose calculating the data ratings using two rating methods (e.g., Elo rating). This approach is expected to reduce the burden on the annotator and provide ratings that reflect the annotator's preferences. Finally, we demonstrate the effectiveness of the proposed method using data from the largest fashion outfit-sharing application.
Keywords: Annotation, Rating, Tournament, Fashion

Jia-Hong Chou (erichou22110957@gmail.com), Fu-Kwun Wang (fukwun@mail.ntust.edu.tw) and Hsuan-Kai Chen (shps97040905@gmail.com). *ADAPTIVE TRANSFER LEARNING MECHANISM WITH DEFORMABLE CONVOLUTION FOR WAFER MAP FAILURE PATTERN RECOGNITION.*

Abstract. The CNN-based model has been widely used for wafer map defect pattern recognition. However, it often fails to detect patterns effectively after a few months of deployment due to shifts in data distribution, usually linked to aging inspection tools or recipe changes. To address this issue, researchers have turned to transfer learning techniques. However, most of these methods require labeled data from the target dataset, which is time-consuming and labour-intensive. Unsupervised domain adaptation (UDA), a type of transfer learning, requires no human labeling and performs better than traditional methods. This research introduces Deformable Convolutional Encoder Adversarial Discriminator Domain Adaptation (DC-ADDA), which adapts the Deformable Convolutional Network (DC-Net) using Adversarial Discriminative Domain Adaptation (ADDA). Using Mixed38 as the source dataset and WM811K as the target, DC-ADDA outperforms other methods across three comparative scenarios. The proposed method achieves an accuracy, precision, recall, and F1-score of 62.13%, 62.17%, 65.34%, and 63.15%, respectively.

Keywords: Wafer map defect pattern recognition, Unsupervised domain adaptation, Deformable convolutional network, Adversarial discriminator domain adaptation

Shingo Kawamura (Graduate School of Science and Technology Sophia University), Kenta Nakamura (Figurout Co., Ltd), Zhang Sen (Figurout Co., Ltd) and Haruka Yamashita (Faculty of Science and Technology Department of Information and Communication Sciences Sophia University). *A study on verifying the effects on stock prices due to announcements of share repurchases based on Causal Impact.*

Abstract. Share buybacks are one measure firms undertake to increase the value of their shares. Prior studies have demonstrated that this measure has a positive impact on stock price fluctuations. However, rigorously evaluating the extent of this impact is challenging, and various biases that may intervene must be addressed. This study aims to eliminate the noise caused by these biases and quantitatively assess the degree of influence of pure stock repurchases. Causal Impact is frequently utilized to evaluate an intervention's effect more reliably by effectively removing noise in a time series. This approach employs a Bayesian Structural Time-Series Model (BSTS) for modeling and necessitates careful estimation of the underlying data structure. Despite the complexity, it has the potential to successfully mitigate biases in the analysis process. In this study, we employ modeling based on this method to examine the effect of share buybacks on stock prices. Specifically, we analyze the impact of the share buyback program by focusing on the deviation between the actually observed share price and the counterfactual value estimated by the model. At this stage, other factors that may affect the stock price, excluding the effect of the share buyback, are treated as noise. Furthermore, it is important to note that these factors' influence can vary over time. The specific input data for the modeling in this study are as follows: The objective variable is the stock price, while the explanatory variables include an index representing the trend of stock price fluctuations and market conditions, interest rates, and the exchange rate between the dollar and the yen. Based on the aforementioned data, we will examine the effect of stock buyback announcements on stock prices using the Causal Impact.

Keywords: Effect verification, CausalImpact, bisiness data analytics

Li-Chih Wang (1 Department of Industrial Engineering and Enterprise Information, Tunghai University, Taichung 407705, Taiwan, R.O.C.) and Tung-Chin Chen (2 Changhua Hospital, MOHW, Changhua 51341, Taiwan, R.O.C.).
LEAN SIX SIGMA APPROACH FOR HOSPITAL MATERIAL INVENTORY MANAGEMENT IN THE HEALTHCARE INDUSTRY.

Abstract. Taiwan is renowned for its technological advancements. 1995, the "National Health Insurance" was launched, shifting the medical fee system to national insurance pricing. This led to decreased revenue for medical institutions, necessitating careful financial management. A study was conducted to improve drug cost management, accounting for about 20% of the hospital's medical revenue. It has gained international recognition nearly 30 years after the implementation of Taiwan's national health insurance system. The study aimed to present the hospital management reform process implemented in the 9th year after the launch of the National Health Insurance.

In this research case, we followed the DMAIC steps of Lean Six Sigma to identify critical-to-quality from customer feedback and a Value Stream Map (VSM). We also used Lean production tools to identify non-value-added operations in the process. As a result, the pharmaceutical warehouse's inventory turnover rate has significantly increased, leading to a higher cash flow required for hospital operations. The benefit evaluation in this study demonstrates the significant impact of the Lean Six Sigma approach in reducing hospital drug warehouse inventory costs.

Keywords: Lean Six Sigma, Value Steam Map (VSM), Hospital Management

Mingqing Ma (Jinan University), Congdong Li (Jinan University), Yelin Fu (Shenzhen University) and Xingyu Chen (Jinan University). *Brand Spillover in Emerging Technology Development.*

Abstract. When a weak brand firm and a strong brand firm collaborate to develop the emerging technology, the weak brand firm may disclose this relationship to promote its brand value. This paper explores a potential co-opetitive supply chain, in which a weak brand firm is committed to developing the emerging technology, and a strong brand firm purchases the general technology from upstream supplier or achieve a technical collaboration agreement with the weak brand firm by sharing technology development cost. By employing a game-theoretical model, we investigate the supply chain members' preferences towards technical collaboration. We find that when the firms' brand value difference is small, technical collaboration will inhibit investment in technology development. Furthermore, brand spillover can enhance the incentive of the weak brand firm to collaborate with its competitor to develop the emerging technology. Interestingly, the adoption of brand spillover strategy by the weak brand firm can always benefit the strong brand firm. We also extend the analysis to the case of complete brand spillover, where the firms' preferences towards technical collaboration remain unchanged.

Keywords: technical collaboration, brand spillover, coopetition, emerging technology development

Ya-Xuan Xiao (Beihang University, School of Economics and Management) and Ren-Qian Zhang (Beihang University, School of Economics and Management). *Multi-sourcing for Product Service Considering Cost Heterogeneity and Demand Uncertainty.*

Abstract. This paper investigates the service contract decision problem a manufacturer faces using reverse auction (RA) to outsource service capacity with multiple service providers. In the multi-sourcing process, the manufacturer first proactively sources service capacity before the actualization of demand and then sources the shortage services capacity from the spot market. We propose a two-stage service sourcing contract under conditions of heterogeneous service cost and uncertain customer demand. We first examine the optimal number of winning service providers, service capacity, and price. Then, we assess the impact of cost heterogeneity and demand uncertainty on the contract's performance. The analytical results reveal that increasing service providers' cost heterogeneity leads to a decrease in the optimal number of winning service providers. Additionally, when the mean value of customer demand is below a certain threshold, an increase in demand uncertainty results in a higher optimal number of winning service providers. Conversely, when the mean value of demand exceeds the threshold, an increase in demand uncertainty leads to a decrease in the optimal number of winning service providers. These results provide novel insights into product services' multi-sourcing and capacity planning within the product service system.

Keywords: Product-service system, heterogeneous cost, asymmetric information, service capacity, reverse auction

Ayushi Chauhan (Indian Institute of Management Mumbai Vihar Lake Marg, Powai Mumbai - 400087), Debabrata Das (Indian Institute of Management Mumbai Vihar Lake Marg, Powai Mumbai - 400087) and Priyanka Verma (Indian Institute of Management,Mumbai Vihar Lake Marg, Powai Mumbai - 400087). *Evaluating trade-offs for Multiple Objectives in Humanitarian Aid Distribution using Experts' Preferences.*

Abstract. Humanitarian organizations face challenges because of the complexities of transporting relief commodities for effective aid distribution in disaster aftermath. Over recent years, academicians and practitioners have developed modelling approaches to improve and augment effective aid distribution processes. Some are single objectives, such as (minimizing transportation costs, response time, or maximizing throughputs). In contrast, some are multi-objective (such as optimizing cargo delivery and its cost, balancing aid prioritization and its coverage). One of the drawbacks of single-objective functions is that they cannot capture the trade-offs in decision-making processes of aid distribution, which multi-objective functions can. However, choosing appropriate objectives in multi-objective functions is also critical; otherwise, the model will perform worse than single-objective functions, leading to suboptimal solutions with reduced applicability and practical relevance. Therefore, objectives should consider disaster complexity and align with the priorities of the practitioner's opinion, considering factors like uncertainties, stakeholder priorities, fairness in aid and resource distribution, and logistical efficiency.

In this paper, an approach for effective aid delivery planning by measuring the performance of critical attributes that are also validated by expert preferences is studied. We used a conjoint analysis survey of 17 humanitarian experts to develop a piecewise linear utility function that guides the formulation of the objective functions in various optimization and modeling approaches. The five key attributes are cargo delivered, item prioritization, location prioritization, delivery speed, and cost. The utility function created in this work puts into practice relief aid distribution objectives and accesses the trade-offs among them. Our findings suggest that item prioritization has highest impact among all the attributes while cost has least. Our work also provides several insights related to aid distribution strategies in emergency response.

Keywords: Humanitarian Logistics, Relief Aid Distribution, Multi-Objective Utility Function, Conjoint Analysis, Expert Preferences

Dingcheng Zhang (sichuan university), Chenyang Jiao (sichuan university) and Yang Yu (City University of Hong Kong). *A DEEP GENERATIVE MODEL FOR REMAINING USEFUL LIFE PREDICTION OF AERO-ENGINES.*

Abstract. Predictive maintenance is helpful for building smart, sustainable, and resilient mechanical systems. Remaining useful life (RUL) prediction is the core procedure for estimating the operation time of systems before repair or replacement. Recent, deep learning-based RUL prediction methods have achieved good performance in some cases. However, the assets with same type have different RUL which results in the sample imbalance problem. In real operating condition, samples with healthy status are the majority of training samples. Few researches discussed the problem decreasing accuracy of prediction models. In this work, a deep generative model based on bidirectional long short-term memory network (Bi-LSTM) and graph neural network is proposed for RUL prediction of aero-engines considering the sample imbalance problem. The Bi-LSTM is firstly used to generate samples with minority labels by regression and the exponential weighted moving average technique (EWMA) was used to smooth the synthetic samples. Next, the graph convolution layers are used to fusing multi-sensor signals and a deep encoder-decoder structure is proposed to adaptively extract latent features. Finally, the latent features are input the predictor for RUL prediction. C- MAPSS aircraft engine simulator data is used to test the deep generative model in this work. The experiment results show that the proposed method improving prediction accuracy byshoveling the sample imbalance problem.

Keywords: Remaining useful life prediction, graph neural network, deep generative model, sample imbalance problem

Bochao Xu (University of Technology Sydney, School of Mechanical and Mechatronic Engineering), Matthias Rudolf Guertler (University of Technology Sydney, School of Mechanical and Mechatronic Engineering) and Nathalie Sick (University of Technology Sydney, School of Mechanical and Mechatronic Engineering).

Leveraging the capability perspective to streamline the adoption of technology solutions in enterprises.

Abstract. Technology adoption and management are crucial to bringing new capabilities and opportunities to an enterprise. However, successful adoption goes beyond merely acquiring technology. Additional considerations, such as what capabilities the technology brings, how it can be integrated into existing systems, and how to upskill workers, are critical successful factors to the adoption. Focusing on capability-based planning can help enterprises comprehend the changes in business processes resulting from the adoption. However, current perspectives on capability are human- or process-centred and lack connections to technology. In the era of Industry 4.0 and the rise of Generative AI, technology also gains the independent capability to serve an enterprise's process. Moreover, for the human-robot-collaboration practices in Industry 5.0, humans and technology can play a combined role in establishing the capability of a business process.

Additionally, inter-enterprise collaboration and adopting capability-sourcing strategies diversify the approaches to implement capability and deliver values. There is a need for a structured understanding of the capability offered by modern technology solutions. This paper supports the adoption of technology solutions by taking a capability perspective to understand the architecture of an enterprise and technology solutions. This research begins with a comprehensive literature review of current capability-based approaches and identifies aspects of capability implementation. Technology solutions are taken from the literature and online case studies and analysed through a capability lens. Based on the review, a new capability reference architecture is proposed to represent the capability structure of an enterprise, a solution, and the mapping to its implementation. The validity and practicality of the proposed reference architecture are discussed with academic and industrial experts. This capability reference architecture offers a theoretical framework for understanding capability implementation in enterprises. It also serves as a reference for future discussions on the capabilities underlying the technology solutions offered by, e.g., Industry 4.0 and Industry 5.0. It also has practical contributions to streamlining the adoption of technology solutions and the development of capability in enterprises.

Keywords: technology adoption, capability-based planning, Industry 4.0, reference architecture

Dandan Su (Asian Institute of Technology), Lucy Dowdell (University of Newcastle) and Marcella Papini (University of Newcastle). *Green Routing Strategies: A Comparative Analysis of Electric and Bi-Objective Location Routing Problems.*

Abstract. The adoption of electric vehicles (EVs) has emerged as a promising solution to reducing environmental impacts from the transport sector. Although EVs could help reduce traffic emissions, they are subject to several limitations. Therefore, could a different routing strategy reduce as much CO2 emissions as adopting EVs? To answer this question, the paper's goal is to compare two different green routing problems: the Electric Capacitated Location Routing Problem (E-CLRP) and the Bi-Objective CLRP. While the former minimizes the costs of facility placement and EV delivery routes, the latter simultaneously minimizes network operation costs and environmental costs. For comparison purposes, we apply the well-established Genetic Algorithm (GA) to solve these two problems on instances from the literature and in a real-world application. The comparison is made in terms of total costs and CO2 emissions due to facility deployment and transportation. This research provides valuable insights for logistical decision-making amid emerging environmental pressures and the trend toward electric vehicle logistics.

Keywords: Bi-objective Optimisation, Location-routing problem, Electric vehicles, Genetic Algorithm, Green Logistics

Kenshiro Tsubota (sophia university) and Haruka Yamashita (sophia university). *Proposal of a Personalized Answer Display System Considering User Preferences on Q&A Sites.*

Abstract. Numerous Q&A sites exist on the internet where users can post questions and answers, accumulating various information. In Q$A sites, besides questioners and respondents, there are many users who seek information from these sites (defined as "viewers" in this study) through the questions and answers. Although Q&A sites develop a recommendation system for such viewers by presenting questions similar to those being viewed, answers are usually displayed in the order they are posted, making it time-consuming for viewers to find relevant information. Rearranging answers based on user interest can create a more user-friendly site design for viewers. Recently, Q&A sites have incorporated functions that allow viewing users to add reactions (such as useful, funny, thank you, or moved). These reactions can be considered evaluations of the answers by viewers. This study proposes a method to predict user reactions for each question based on past reactions and optimize the display order of answers to improve user reactions. This aims to create a more user-friendly and attractive Q&A site for viewers. On the other hand, there is the NPA (Neural Personalized Attention) model, which has shown excellent results in personalized news recommendation systems. This model accurately learns from previously viewed news and predicts the next news to be displayed. The NPA model can be adapted to predict reactions to answers for any given question on a Q&A site. In this study, we propose a model based on the NPA model that takes questions and answers as input and predicts the reaction of viewers. Specifically, we will convert questions and answers into vector representations and construct an accurate prediction model. Furthermore, we will propose a method to order the answers for each question based on the predicted reaction values. The performance of the proposed model will be evaluated using real-world data.

Keywords: User Reactions Prediction, Answer Display Optimization, Neural Personalized Attention (NPA) Model

Jabir Mumtaz (College of Mechanical and Electrical Engineering, Wenzhou University, Wenzhou, P.R. China.), Mudassar Rauf (College of Mechanical and Electrical Engineering, Wenzhou University, Wenzhou, P.R. China) and Kaynat Afzal Minhas (University of Engineering and Technology Taxila, Pakistan). *A TWO-PHASE IMPROVED SPIDER MONKEY OPTIMIZATION ALGORITHM FOR MULTI- OBJECTIVE SCHEDULING AND LOT STREAMING PROBLEMS OF PCB ASSEMBLY.*

Abstract. In this paper, the two-phase-SMO algorithm for PCBA workshop multi-objective scheduling considering batch flow is studied. In this study the objective is to minimize completion time, total energy consumption TEC and total delay time DT simultaneously. To solve this multi-objective problem a two- phase SMO algorithm is introduced. The first stage of the two-phase-SMO algorithm aims to optimize the component allocation problem and component placement sequencing problem within the SMT process and uses the algorithm to obtain the solution with the smallest completion time of one PCB at SMT assembly line. The second stage is based on the results of the first stage and uses the SMO algorithm to obtain the smallest Pareto solution set of objective functions for the batch flow problems at the shop floor, including the three sub-problems of order batching, order sequencing and batch allocation. The performance of the algorithm is improved through the following three modules: (1) a hybrid heuristic method is designed to generate partial initial solutions and improve the quality of initial solutions; (2) Different individual renewal methods are selected according to the evolutionary state of the population to achieve a balance between algorithm exploration and development capabilities; (3) The parameter adjustment method of Q-Learning strategy is adopted to realize the adaptive adjustment of algorithm parameters. The results show that the two-phase-SMO algorithm outperforms other algorithms.

Keywords: Spider monkey optimization algorithm, Multi-objective optimization, Q-Learning, PCB assembly line

Tianyu Zhou (Cardiff University), Ying Liu (Cardiff University) and Maneesh Kumar (Cardiff University). *AI-POWERED CHATBOTS FOR IMPROVING INTERACTIVE USER EXPERIENCE: STATE-OF-THE-ART.*

Abstract. Recent advancements in chatbot technology, driven by Natural Language Processing (NLP) and machine learning techniques, have led to the widespread adoption of Artificial Intelligence (AI) chatbots across various sectors. These AI chatbots are designed to enhance user and customer experience by providing customized services. While existing literature on chatbots normally covers technical aspects, impact, and applications across disciplines, there is limited research from the perspective of users and customers that focuses on user experience (UX) improvement during the interaction process. To offer a more thorough analysis of the interactive user experience between users and AI chatbots, this paper reviews relevant studies from databases Scopus, Web of Science, and IEEE over the past decade. The review highlights the significance of user-centered design for AI chatbots, identifying key factors influencing UX from pragmatic and hedonic quality. It points out how AI technology empowers chatbots to deliver tailored and personalized services to enhance UX. Moreover, the review reveals that current methods for evaluating UX with AI chatbots lack objectivity and comprehensiveness, emphasizing the necessity of establishing evaluation frameworks and standardized metrics for effective cross-system comparison. Finally, the review outlines future research directions for academic exploration of AI-powered chatbots and UX.

Keywords: AI chatbot, User experience, Customer experience, Chatbot design, Interactive design, UX evaluation

Yuhan Liu (Cardiff University), Ying Liu (Cardiff University), John McCrory (Cardiff University) and Xiao Guo (Cardiff University). *HIGH-FIDELITY DIGITAL TWIN MODELLING FOR PREDICTIVE MAINTENANCE : STATE-OF-THE-ART.*

Abstract. High-fidelity modelling techniques provide high-precision simulations required for the construction of digital twin (DT), facilitating high-level mapping of physical systems in virtual space. The integration of DT and high-fidelity modelling enables real-time monitoring, fault diagnosis, performance evaluation and optimization of physical entities.

These techniques have been explored in different industrial sectors and on various topics in recent years, such as predictive maintenance (PdM). Existing literature on high-fidelity DT has extensively covered major aspects such as framework construction and applications, advances in applications in various fields, and integration with the Internet of Things (IoT) or machine learning (ML) technologies. However, there is limited research on how high-fidelity modelling methods interact with DT to aid and optimize PdM. To comprehensively analyze the state-of-the-art of high-fidelity DT modelling in PdM, this paper focuses on how high-fidelity DT modelling facilitates three key PdM tasks: health indicator estimation, remaining useful life prediction and fault diagnosis. For each task, discussion will be subdivided into two parts: 1) high-fidelity modelling methods, and 2) the process of integrating these methods into DT-driven predictive analytics. The advantages of high-fidelity DT modelling brings to PdM are also summarized. Finally, challenges and opportunities for future research are discussed.

Keywords: High-fidelity Modelling, Digital Twins, Predictive Maintenance, Real-Time Monitoring, Fault Diagnosis

Chi Liu (Xi'an Polytechnic University), Linna Zhou (Xi'an Polytechnic University), Yujuan Wang (Xi'an Polytechnic University/Kyiv National University of Technologies and Design (KNUTD)), Xingyu Wen (Xi'an Polytechnic University) and Feng Wu (Xi'an Jiaotong University). *Identification of Unilateral Breast Loss User Needs for Prostheses and Mastectomy Bras Based on Grounded Theory.*

Abstract. In order to explore the diverse demands of unilateral breast loss patients regarding breast prostheses and mastectomy bras, based on grounded theory, in-depth interviews were conducted with 55 unilateral breast loss patients. Using Nvivo 12 software, a three-level coding analysis was conducted on the interview text. A total of 24 initial categories, including compensation, contour symmetry, adaptability, and breathability, were extracted and summarized into 7 main categories: aesthetic sensation, stylish and upright, compensation and fit, safety guarantee, physiological needs, practical convenience, and economic benefits. A demand model for breast prostheses and mastectomy bras for unilateral breast loss patients was constructed from the three major demand dimensions of aesthetic appeal, safety and health, and practical benefits. Research has found that young and highly educated breast cancer survivors have higher aesthetic requirements for prosthetic breasts and mastectomy bras. The conventional shape of breast prostheses on the market is difficult to meet the fitting needs of breast cancer survivors. They tend to purchase discounted and promotional prostheses and mastectomy bras to reduce the family's financial burden. This model provides a reference for optimizing prostheses and mastectomy bra designs for lingerie companies.

Keywords: Unilateral breast loss patients, Breast prostheses, Mastectomy bras, User needs, Grounded theory

Daniela Estefania Escobar Rosero (Universidad del Valle) and Jimena Galeano Sánchez (Universidad del Valle). *REDESIGN OF THE INVENTORY CONTROL POLICIES OF A FMCG DISTRIBUTOR IN THE CITY OF CALI.*

Abstract. In a globalized and competitive business environment, effective inventory management becomes crucial for growth and efficiency. This work addresses the need to implement adequate inventory control systems, especially in companies distributing fast-moving consumer goods. Based on quantitative research, it proposes redesigning inventory control policies for a distributor in Cali, Colombia, operating in the store-to-store channel. The methodology is structured in three phases: selection of forecasting methods, determination of control parameters, and design of a tool for policy updating. The study aims to improve the distributor's service level, optimize costs, and ensure product availability. Through the implementation of this research, it is expected to contribute to strengthening competitiveness and profitability in the fast-moving consumer goods sector.

Keywords: inventory, service level, fast-moving consumer good, inventory control policies

Kazuma Obara (sophia university) and Haruka Yamashita (sophia university). *Recommendation Model for Motivating Best Answer Responses to Unresolved Questions on Q&A Sites.*

Abstract. Q&A sites are a platform for users to resolve their questions, and they should receive high-quality answers. For this purpose, it's effective to have users who have appropriate knowledge to answer questions. The objective of this study is to encourage users who have obtained the best answer to answer other similar unanswered questions. We aim to build a recommendation model to motivate users to answer by presenting information on the probability of getting the best answer for that question and what kind of content led to the best answer.

To realize such a recommendation, it's necessary to extract unresolved questions similar to the questions, calculate the probability that the answers to the extracted questions are chosen as the best answers, and develop a model that clarifies why the answers are selected as the best answers. The task of extracting unanswered questions similar to answered questions is already known to be effective in calculating similarity by vectorization using Sentence-BERT. No studies exist that simultaneously realize the other two tasks. The Bidirectional Encoder Representations from Transformers (BERT) model has been widely applied to a wide range of natural language processing tasks. In this study, we propose an interpretable recommendation system by utilizing attention mechanism. Based on BERT, we train a model that predicts the probability that a given answer will be chosen as the best answer based on the question and the multiple answers to it. Furthermore, the probability of being selected as the best answer can be calculated by inputting the unanswered questions similar to the question selected as the best answer, the question, and the best answer into the learned model. To evaluate the effectiveness of the proposed model, experiments will be conducted to assess the performance of the model.

Keywords: Q&A recommendation system, motivate to answer, Best Answer Prediction

Reina Komoda (Sophia University) and Haruka Yamashita (Sophia University). *Estimating the Optimal Advertisement Serving Media with Hierarchical Bayesian Model Using Customer Attribute Data.*

Abstract. Internet advertising expenditures have been increasing in recent years, and the market is expected to grow in the future. Because the individual lifestyles of each consumer are diverse, and the media used for obtaining information in daily life vary, it can be effective to deploy advertisements optimized for each individual to enhance advertising effectiveness. However, although there have been many studies on Internet advertising, there has been no research on the optimization of advertising media based on consumer attributes. Accordingly, In the current management of advertisements, advertisements are placed based on the subjective judgment of advertisers. Therefore, it would be a great advantage for companies if they can clarify the optimal advertisement serving media for each consumer and improve the advertising effectiveness of managed advertisements.

In this study, we develop a hierarchical Bayesian model to estimate the optimal Internet advertisement serving media, taking into account differences in consumer attributes. This model assumes that the most effective distribution media vary based on these attributes, providing a flexible framework for accurate analysis. First, the hierarchical Bayesian model is used to analyze the relationship between consumer attributes, changes in purchase intention for a given product, and the frequency of use of each advertisement serving media. Furthermore, the obtained parameter values are used to calculate the effectiveness of each media in terms of the attributes of the target consumer, and the optimal advertisement media is determined. Using the proposed model, we analyze the effectiveness of each advertising media and optimize the advertising media for individual consumers in the panel data related to Netflix usage, which is considered to have high sensitivity to advertisements, and present practical examples.

Keywords: MCMC, Hierarchical Bayesian Model, Internet advertising, Advertising effectiveness

Wenjing Song (Inner Mongolia University), Jianwei Ren (Inner Mongolia University) and Chongyu Ma (Inner Mongolia University). *Measuring the Performance of Medical Waste Recycling Systems in China's New First-Tier Cities with a Novel Bounded Adjusted Measure Model.*

Abstract. This paper for the first time proposes a two-stage GBAM (GBAMU) model with undesirable inputs and outputs is proposed by combining the generalized bounded adjustment measure (GBAM), the two-stage data envelopment analysis (DEA) method and the DEA considering undesirable inputs and outputs. Furthermore, to mitigate the impact of time-lagged variables on efficiency, a two-stage modified GBAMU model is proposed. The advantages of the two-stage modified GBAMU model are: (1) it allows for the selection of appropriate sample units (SUs) according to the decision-maker's demands; (2) this approach can unveil the specific reasons affecting the efficiency of the decision-making units (DMUs) by opening the 'black box'; (3) using this method reduces the impact of time-lagged variables on the accuracy of efficiency. This paper in practice to evaluate the medical waste (MW) recycling in China's new first-tier cities (CNFCs). It offers advice on making the recycling process more efficient and managing MW safely and sustainably. The research findings indicate: (1) the efficiency of MW recycling systems in CNFCs generally shows an increasing trend, but the efficiency had slightly decreased due to the surge in MW caused by the COVID-19 pandemic in 2020; (2) Chongqing, Hangzhou, Tianjin, Hefei, and Foshan are efficient cities, while Qingdao, Nanjing, Xian, and Zhengzhou are inefficient; (3) the efficiency of the medical waste collection and transportation subsystem (MWCS) in CNFCs is lower than that of the medical waste treatment subsystem (MWTS), which is an important factor inhibiting the efficiency of MW recycling systems; (4) labor, transportation cost, and government financial support show the most redundant inputs.

Keywords: Generalized Data Envelopment Analysis, , Time-lag, , Efficiency evaluation, , Medical waste recycling

Ahm Shamsuzzoha (University of Vaasa), Bening Mayanti (University of Vaasa) and Petri Helo (University of Vaasa). *COMPUTER-ENABLED CONFIGURABLE PRODUCT FAMILY DESIGN AND DEVELOPMENT FOR SUSTAINABLE LOGISTICS AND SUPPLY CHAIN MANAGEMENT: A CASE STUDY.*

Abstract. This study deals with the complexity of supply chain management while maintaining the environmental sustainability by measuring climate change impact to identify main sources of emissions and implement reduction strategies. It focuses on solving the challenges of a case company, which is engaged in global energy business, to manage its large variety of products. This study specially focuses on computer-enabled configurable solution of a specific component within the product family of the case company. This configuration process is designed and developed through various up-to-date software solutions that supports order handing process in case-by-case situations of companies while maintaining environmental sustainability. The sustainability aspect is integrated into supply chain using life cycle assessment (LCA) that can quantify environmental impacts at all product life cycle stages from cradle-to-grave. It will enable the company to track and trace the climate change impact of its product from the vendors to the end customers. The LCA is also parameterized based on product family to provide a rapid calculation of the climate change impact. Users can update the impacts as the input parameters are changed, such as the transportation distance from the vendors or products' weight. The outcomes from this study help the case company and its customers to ensure environmental sustainability at the end. They also support environmental transparency which is a first step toward an improvement. This research study is concluded with overall outcomes along with future research directions too.

Keywords: Computer-enabled, Supply chain transparency, Configuration, Sustainability, Case study, Life cycle assessment

Wenjing Song (Inner Mongolia University), Jianwei Ren (Inner Mongolia University), Qianwei Niu (Inner Mongolia University), Chunhua Chen (Inner Mongolia Agricultural University,) and Chenxi Feng (Inner Mongolia University). *A hybrid 3-4 level reverse network structure for Medical Waste Reverse Logistics Network Design.*

Abstract. A hybrid 3-4 level medical waste (MW) reverse logistics network is proposed for the first time to promote efficient and safe recovery of MW under normal conditions, thereby advancing urban sustainable development. This paper constructs a bi-objective mixed-integer linear programming (MILP) mathematical model aimed at minimizing the total cost, which includes facility construction and operation costs, vehicle acquisition and usage costs, time window penalty costs, and CO2 emission costs, as well as minimizing transportation route risks and facility construction risks. In terms of problem solving, the paper first utilizes the WK-means clustering algorithm to select candidate MW temporary transfer centers. Secondly, ArcGIS buffer analysis is employed to exclude sensitive areas, and the whale optimization algorithm is used for location decision-making. The vehicle routing problem is determined by comparing it with random planning and nutcracker optimization algorithm. Finally, the applicability and feasibility of the proposed network and model are analyzed using the example of MW collection in Xi'an, China, and the results are discussed.

Keywords: Reverse logistics network, WK-means, ArcGIS, Nutcracker optimization algorithm, Medical waste

Paul Okolie (NNAMDI AZIKIWE UNIVERSITY AWKA, ANAMBRA STATE) and Nnamdi Nwambu (NNAMDI AZIKIWE UNIVERSITY AWKA, ANAMBRA STATE). *Predictive and Optimization of the Tensile Behaviour of Unaged and Hygrothermally Aged Asymmetric Helicoidally Stacked CFRP Composites with Taguchi Method.*

Abstract. This paper focused on the effects of hygrothermal ageing on the tensile behaviour of assymetric helicoidally stacked carbon fibre reinforced plastic (CFRP) composites. MR70 12P carbon fibre epoxy prepreg sheets were manufactured into laminated composites comprising constant inter-ply pitch angles ranging from 0◦ to 30◦. The composites were tested in tension (according to BS ISO 527-5:2009) as either dry unaged specimens or following hygrothermal ageing in seawater at the constant temperatures of 40 ◦C and 60 ◦C for 2000 h. Both tensile modulus and tensile strength are found to be detrimentally affected by hygrothermal ageing, and the extent to which ageing affects these properties is a function of the inter-ply pitch angle.

Higher hygrothermal ageing temperatures are found to decrease the tensile modulus and strength ratios of asymmetric helicoidally stacked composites when compared against UD composites subjected to the same conditions and the strength and stiffness ratios of all composites when compared against unaged equivalents. Significantly, therefore, we show that the degradation of helicoidal composite properties under hygrothermal conditions, in general, occurs more rapidly than it does in UD composites, and thus the long-term use of helicoidal composites in immersed environments should take into account these differences. Experiments were conducted based on Taguchi L18 orthogonal array considering two design parameters viz. inter-ply stacking angles and % filler wt. The experimental data were analyzed using Taguchi optimization method. Optimal settings of the process parameters for dynamic mechanical analysis were determined. Experimental data obtained were statistically analyzed and the optimized sets of values of the various parameters were depicted. Analysis of variance (ANOVA) analysis was carried out to obtain the significant factors. It was observed from the analysis that inter-ply stacking angles are the main significant factor affecting the dynamic mechanical values at 95% confidence level. A confirmation test was carried out to validate the optimized results and it was found that there were improvements in S/N ratios from initial to optimal setting

Keywords: asymmetric composites, helicoidal, Bouligand structure, CFRP, bioinspired composites, Taguchi Method

Muhammad Rusman (Hasanuddin University), Rosmalina Hanafi (Hasanuddin University), Syarifuddin Parenreng (Hasanuddin University) and Rustan Tarakka (Hasanuddin University). *A Dynamic Simulation-Optimization Model for Revenue Optimization Study Case in Communication Company.*

Abstract. We introduce Dynamics System Simulation to solve company revenue management (RM) problems. The leading company and partners have run various programs to increase site revenue, but they still need to maximize company profit. Therefore, it is necessary to analyze the current system. Based on these problems, research is conducted to determine the variables that can increase site revenue and design the best scenario to optimize site revenue. The method used in this research is dynamic system simulation. The data that has been collected will be processed and identified to determine the parameters and variables that influence the revenue acquisition system. The software used to perform the simulation is AnyLogic Professional 8.7.2. The simulation results can help the company choose the best scenario to increase revenue.

Keywords: Dynamics System Simulation, Revenue Management, Optimization

Vincent F. Yu (Department of Industrial Management, National Taiwan University of Science and Technology, Taipei 106, Taiwan), Sy Hoang Do (Department of Industrial Management, National Taiwan University of Science and Technology, Taipei 106, Taiwan), Ngoc Minh Nguyen (Department of Industrial Management, National Taiwan University of Science and Technology, Taipei 106, Taiwan) and Hsiu-I Ting (Department of Information and Finance Management, National Taipei University of Technology, Taiwan). *INTEGRATED OPERATION PLANNING FOR MULTIPLE HYDROPOWER DAMS CONSIDERING IRRIGATION, FLOOD CONTROL AND DELTA SALINIZATION: A CASE STUDY IN VIETNAM.*

Abstract. Optimally operating a multi-purpose reservoir system presents a significant challenge and attracts considerable research interest due to its complexity and practical applications. This study investigates the operation of a system of multiple hydropower dams serving various purposes. A mathematical programming model is developed to maximize profits from power generation while ensuring water availability for irrigation, flood control, and prevention of delta salinization. The model's performance is accessed using a case study of five hydropower plants located on the Ma River in Vietnam. Due to the model's complexity, finding an exact solution is time-consuming. To improve computational efficiency, a matheuristic approach that combines a mathematical programming model with a genetic algorithm is proposed and tested on both small and large benchmark instances. The results indicate that the proposed matheuristic approach obtains optimal solutions for small instances and near-optimal solutions for large instances, with an average percentage gap of 0.116% within reasonable computing time. Compared to the strategy of optimizing individual dams, the proposed integrated optimization approach provides better objective values, with an average percentage gap of 0.3482%. Furthermore, when compared to current practice, the proposed model demonstrates significantly improved objective values, with an average percentage gap of 22.32%. These findings highlight the economic benefits and enhanced efficiency of the proposed model, indicating its potential to improve the management and profitability of multi-purpose reservoir systems.
Keywords: Hydropower reservoir, Multiple reservoirs, Optimal operation, Multi-purpose reservoir

Setyo Tri Windras Mara (University of New South Wales), Ruhul Sarker (University of New South Wales), Daryl Essam (University of New South Wales) and Saber Elsayed (University of New South Wales). *Evolutionary Approach for a Green Logistics System with Drone-as-a-Service Providers.*

Abstract. Motivated by the potential of drone-as-a-service concept, this paper considers a futuristic multi-modal logistics system. The system comprises a tandem electric vehicle (EV) and a drone, where a set of recharging stations and third-party drone stations are available to be used. This paper presents a mathematical model for such a system, and to solve this model, an evolutionary algorithm with innovative solution representation and a local search procedure is designed. Evaluation through a set of numerical experiments shows that our algorithm performs around 9.18-9.73% better than the state-of-the-art algorithm.
Keywords: drone stations, drone-as-a-service, electric vehicles, sustainable logistics, evolutionary algorithm

Zhongyuan Liao (The Hong Kong University of Science and Technology) and Yi Cai (The Hong Kong University of Science and Technology (Guangzhou)). *Computer Vision-based Decision-making Framework for Reconfigurable Soft Robot Manipulation.*

Abstract. As the complexity of manufacturing systems increases, there is a concomitant need for industrial robots to adapt their configurations in response to specific tasks and the surrounding environment. Such adaptability necessitates a sophisticated interplay between machine and human cognitive processes for decision-making regarding these changes. This paper offers a systematic examination of the application of artificial intelligence (AI)-enhanced decision-making frameworks aimed at augmenting the functionality of reconfigurable soft robots (RSRs) by incorporating computer vision technology.

The concept of decision-making discussed herein underscores the collaborative integration of machine learning algorithms and human expertise to augment the efficiency and adaptability of RSRs. The deployment of computer vision, with a specific focus on the employment of the Open Source Computer Vision Library (OpenCV), is scrutinized for its role in object recognition and the calculation of spatial attributes. The research highlights the importance of an iterative feedback loop between the human operator and the AI system, which is crucial for the continual refinement of the decision-support system. The case study demonstrates the successful attainment of configuration recommendations for RSRs utilizing an AI-integrated platform. The findings substantiate the feasibility and effectiveness of the proposed methodological approach.
Keywords: Reconfigurable Soft Robot, Manipulation, Computer Vision, Decision-making

Nina Ackermann (University of Bern), Tamara Bigler (University of Bern) and Norbert Trautmann (University of Bern). *Integer programming modeling approaches for workload-balanced resource-constrained project scheduling.*

Abstract. In project management, the resource-allocation problem consists in determining a schedule for the set of project activities, which are interrelated by prescribed precedence relations and require some time and some scarce resources to be performed. The objective is to minimize the project duration, or time-to-market. This problem arises also in a single-item or a small-series production environment.

In many cases, each resource represents a team of people with specific skills, such as engineering or marketing specialists. To foster team productivity and cohesiveness, a balanced workload of individual resource units is often desired. We analyze two alternative approaches for formulating respective workload-balancing constraints in a mixed-binary linear optimization problem.

Keywords: Project Management, Resource Allocation, Integer Programming

Paulina Kus Ariningsih (Nottingham University Business School China), Chandra Ade Irawan (Nottingham University Business School China), Antony Pauraj (NEOMA Business School Reims France) and Jing Dai (Nottingham University Business School China). *An Optimization for Efficient Multi-Tiers Pharmaceutical Distribution Network.*

Abstract. This study aims to propose a pharmaceutical allocation strategy through an optimisation procedure. The strategy is developed through a multi-period stochastic model. The proposed model determines decisions on strategic and tactical variables considering supply cycle, and multi-sources. The proposed model is applied to the dataset of Indonesia. An optimum condition of the proposed model is obtained. Here, we present the results of the numerical experiments solved using a commercial solver. Future potential research is also presented.

Keywords: combinatorial optimization, pharmaceutical, distribution network, facility location, multi-period

Nilesh Kumar (School of Psychology, Zhejiang Normal University) and Changfeng Wang (College of Economics and Management, Zhejiang Normal University). *HOW DIGITAL TRUST AMONG EMPLOYEES NURTURES COLLABORATIVE INNOVATION: THE MEDIATING ROLE OF PARTNERSHIP CAPACITY AND MODERATING EFFECT OF RED TAPES.*

Abstract. In Industry 4.0, employees and organizations are required to engage with outside entities to boost the internal knowledge base for new innovation. In this regard, collaborative innovation has turned out be an imperative business model among organizations for resource sharing and support. Such collaboration, including knowledge inflows and exchanges, occurs in an unconventional setting where organizations use technological tools (e.g., IoT, big data, CPS, and blockchain) for operational activities. Consequently, an individual's tech-embedded trust appears not only as a strategic advantage but also as a foundational part for sustained collaborative innovation. Therefore, leveraging social exchange and trust theories, this study examines the critical role of tech-embedded trust in driving collaborative innovation. Hypothetically, it explores the impact of tech-embedded trust on employees' partnership capacity in cultivating collaborative innovation. Furthermore, it examines the moderating effect of communication and information red tapes on these relationships. Methodologically, two studies across distinct sectors (SMEs and Banking) within Pakistan were conducted. The methodological approach includes a scenario experiment in Study 1 (N=228 employees) and a questionnaire survey in Study 2 (N=367 employees). Data analyses employ SPSS, incorporating manipulation checks and linear regression analysis for Study 1 and AMOS for model fitness, coupled with SPSS-Process Macro for mediation-moderated analysis in Study 2. Study 1 validates that tech-embedded trust acts as a catalyst, improving employees' partnership capacity, while Study 2 establishes a positive relationship between tech-embedded trust and collaborative innovation, partially mediated by employees' partnership capacity. Additionally, communication and information red tapes demonstrate moderating effects, signifying a decline in positive effects at higher levels. Theoretically, it contributes to the literature methodologically by developing scenario test to explore the effects of different circumstances on participants' behavior, and by clarifying the cognitive mechanism through which tech-embedded trust accelerates collaborative innovation, addressing a gap in empirical research in organizational psychology. Practical recommendations highlight the need for organizations to capitalize in cultivating a trust culture, simplifying processes, and incorporating technology solutions.

Keywords: Digital Trust, Tech-embedded trust, Partnership capacity, Red tapes, Collaborative innovation, Industry 4.0.

Ahmed Ghaithan (King Fahd University of Petroleum and Minerals) and Abdullah Al-Khanfar (King Fahd University of Petroleum and Minerals). *DATA-DRIVEN MODEL FOR PREDICTING FAILURE RATE OF UNDERGROUND POTABLE WATER DISTRIBUTION SYSTEM.*

Abstract. The failures of underground water pipe networks create severe consequences for water network operators. Thus, forecasting pipeline failure rates is crucial to ensure a reliable, sustainable water supply system and cost-effective network maintenance and replacement plans. Thus, this paper proposes an innovative approach based on artificial neural network (ANN) for predicting underground potable water pipe failure rates. First, the factors affecting the pipe failure are identified from the literature and validated by subject-matter experts. Second, ANN is developed to predict failure rates. The model is further optimized to determine the most effective sequence and choose the optimal subset of input variables. The study findings reveal that the ANN model is highly efficient in predicting the failure rate of underground water pipes with high accuracy. The developed model can assist decision makers to prepare long-term corporate pipe maintenance and replacement plans.
Keywords: Artificial Neural Network, Prediction, Water pipe, Failure rate

Amirhossein Mostofi (Auckland University of Technology). *NAVIGATING THE BIOFUEL TRANSITION: A 360-DEGREE LENS ON SUSTAINABILITY DIMENSIONS.*

Abstract. This paper introduces a novel framework for evaluating the performance of biofuels compared to fossil fuels. Moving beyond traditional economic analysis, this research employs a comprehensive "Traffic Light" system to assess four critical dimensions: social, environmental, cultural, and economic impacts.

The study underscores the urgency of addressing climate change and highlights the potential of biofuels to contribute significantly to global sustainability goals. Through a multi-level analysis encompassing global, national, regional, industry, and community perspectives, the paper reveals the multifaceted benefits of biofuels, such as reduced greenhouse gas emissions, enhanced energy security, and economic growth. Special attention is given to New Zealand's context, demonstrating how biofuels can support national energy strategies and regional development. This holistic approach provides valuable insights for policymakers, industry leaders, and stakeholders, advocating for informed and balanced energy policy decisions that promote a sustainable, equitable, and resilient future.

Keywords: Sustainability assessment, Traffic light framework, Energy transition, Holistic evaluation

Venkata Krishna Rao Pabolu (Shiv Nadar University), Shivam Dhiman (Shiv Nadar University) and Divya Shrivastava (Shiv Nadar University). *ARTIFICIAL INTELLIGENCE TO RECOGNIZE ACTIVE WORK ENGAGEMENT OF AN ASSEMBLY-LINE WORKER.*

Abstract. Worker active work engagement or active work participation is important for productivity and product quality. It is a tricky task for an assembly-line manager to observe and understand the active involvement of an assembly-line worker. This research aims to use artificial intelligence applications to recognize the active work engagement of an assembly-line worker. Knowledge-based Intelligent System (KBIS) methodology is adopted using computer vision, motion tracking, and machine learning techniques. A learning-based knowledge model is made from historical observations of assembly worker's work engagement. An Intelligent system is made to recognize the active work engagement of an assembly worker from their monitored work video. Details of work's work monitoring, making of knowledge function, and intelligent active work engagement recognition framework are elaborated. A use-case illustration is given to explain the application of the proposed framework for a manual assembly line production system.

Keywords: Knowledge-based Intelligent System, Assembly-line Worker, Computer-Vision, Motion Tracking, Machine-Learning Classification

Yusuf Amidu (Khalifa University), Adriana Gabor (Khalifa University) and Khaled Elbassioni (Khalifa University). *Data-Driven Techniques for Large Scale Resource Allocation Problems.*

Abstract. In this research, we present an efficient primal-dual algorithm for addressing online resource allocation problems, with a focus on resource allocation problems occurring in parking allocation. We consider scenarios where there are limited available parking spaces, and there are numerous vehicles with stochastic occupancy duration under constrained capacity. The algorithm is designed to maximize the total expected reward by capturing the duration and all the possible extensions made by a set of vehicles arriving over time. We analyze the algorithm theoretically and show that the expected regret and constraint violation is O(m\sqrt{n}) where n is the number of vehicles and m is the number of parking spaces. Additionally, we test its practical performance via extensive numerical experiments based on real life scenarios.

Keywords: Online optimization, Resource allocation, Primal-Dual algorithms

Bingqing Tan (Shenzhen Technology University), Yishu Yang (The University of Hong Kong), Svetlana Besklubova (University of Hong Kong) and Ray Y. Zhong (Department of Industrial and Manufacturing Systems Engineering). *MULTI-ATTRIBUTE EVALUATION MODEL FOR THE FEASIBILITY OF A PREFABRICATION HUB IN HONG KONG.*

Abstract. This study proposes a comprehensive evaluation method for assessing the feasibility of prefabrication hub (PH). Unlike current approaches that only evaluate from an economic perspective, our method considers multiple aspects such as the environment, society, and technology. The method combines the Analytic Hierarchy Process (AHP) and the multi-attribute utility method, making full use of their advantages to eliminate the influence of subjective preferences and obtain more accurate evaluation results through utility calculations in a three-dimensional space. A questionnaire survey report conducted by the research team in Hong Kong is used as a case analysis. The research findings demonstrate that the comprehensive evaluation method is more rational and provides insights for the holistic assessment of different PH projects. Future research can further expand the evaluation methods to contribute to the prefabricated construction industry.

Keywords: Prefabrication Hub, Analytic Hierarchy Process, Multi-attribute Utility Method, Comprehensive Assessment

Andy Chen (The University of New South Wales) and Hasan Turan (The University of New South Wales). *ARTIFICIAL INTELLIGENCE FOR WORKFORCE PLANNING AND MANAGEMENT.*

Abstract. Employee attrition significantly impacts organizational capability, resources, finance, and workforce planning, making accurate prediction crucial for management. Traditional statistical analysis methods have been the preferred tool for predicting attrition; however, Machine Learning (ML) is becoming increasingly popular due to its increased accuracy. Still, ML solutions are often expensive, and highly specialised to specific datasets and use cases. Conventionally, an ML expert analyses a particular dataset and makes decisions on how the data is to be pre-processed and formatted to then be inputted into their crafted ML model. This paper develops and tests the viability of custom autonomous ML (AutoML) models that can adapt to a variety of different datasets to minimise the need for expert intervention. Using a combination of various Python ML models and a programmed rule-based decision-making matrix. This approach aims to streamline ML applications in organisational retention, increasing efficiency, and serving as a cost-effective solution for large organisations with diverse datasets that need to apply multiple similar ML models to different aspects of their organisation where a standard dataset format may not exist.

Keywords: Workforce Planning, Retention, Attrition, Autonomous Machine Learning (AutoML)

Xinbo Zhang (City University of Hong Kong), Yanzhi Li (City University of Hong Kong), Huiqiang Mao (Alibaba Group), Liming Li (Alibaba Group), Xiaoqing Wang (Alibaba Group) and Yuming Deng (Alibaba Group). *OPTIMAL DISPATCHING FOR ORDER FULFILLMENT.*

Abstract. Timely order delivery is critical to the service level and competitiveness of online retailers. In this paper, we consider an order dispatching problem for an e-tailer that needs to fulfill orders with its on-hand inventory periodically. Periodically, the e-tailer tries to satisfy the orders that have arrived over a time period as many as possible by making use of the available inventory. The problem can be considered as a multidimensional bounded knapsack problem, which is new to the literature although its simpler versions have been well studied. Because of the large scale of the problem and the need to yield dispatching plans quickly, often in a matter of minutes or even seconds, we develop a tailor-made algorithm to efficiently solve the problem. We construct a co-occurrence graph and show that by identifying the articulation nodes (i.e., products), the original graph can be divided into subgraphs, each with a much smaller problem scale. We therefore develop a Lagrangian relaxation-based approach by dualizing the constraints corresponding to these articulation products. We show the resulting problem can be decomposed into many subproblems, each solvable exactly by a primal-dual dynamic programming algorithm. A high-quality solution can then be constructed based on the Lagrangian relaxation, with the solution time adaptable according to the need. We test the approach with a real order data set from Tmall supermarket and show that it is able to yield high-quality solutions in a much shorter time compared to commercial IP solvers. Notably, our approach does not need to invoke commercial optimization solvers, a property often desired by the practitioners.

Keywords: Order Fulfillment, Order Dispatching, Knapsack Problem

Sawyasachi Awasthi (Indian Institute of Management Mumbai), Priyanka Verma (Indian Institute of Management Mumbai) and Balkrishna E. Narkhede (Indian Institute of Management Mumbai). *Production Routing Problem with Crowdshipping.*

Abstract. The Production Routing Problem (PRP) combines lot-sizing and vehicle routing problems. In PRP, a production unit determines the production timelines, quantities, and delivery plans to meet customer demands using a vendor-managed inventory principle. In contrast, with the emergence of sharing platforms like Ola, Uber, Bla-Bla Car, and Airbnb, owners of underutilized assets serve users seeking to utilize such assets. In Crowdshipping (CS), the underutilized assets are delivery vehicles, and the users are retailers willing to utilize these empty spaces for delivery.

This study introduces the Production Routing Problem with crowdshipping (PRPCS), where along with the regular vehicles, workers or employees from a production unit, after their shifts, can choose to deliver goods to customers using the empty capacity of their vehicles or public transport on their way back, with minimal to no detours, receiving some compensation. One of the advantages of this approach is the guaranteed deliveries, thereby eliminating the limitation of CS, when local individuals are used for delivery. The objective of this research is to minimize total costs associated with PRPCS, including production, inventory, routing, and worker compensation. We developed a mixed-integer linear programming model and applied relax-and-fix heuristics to solve the problem. Our computational experiments provide valuable insights into leveraging workers/employees for deliveries under various assumptions. This approach is also carried for real world size instances and the results underscore the potential benefits of involving workers/employees in the delivery process, offering a cost-effective solution to PRP.

Keywords: Production Routing Problem, Vehicle Routing Problem, Lot-Sizing Problem, Crowdshipping

Amruta Adbe (Indian Institute of Technology Kanpur) and B Vipin (Indian Institute of Technology, Kanpur). *Customers Strategic And Myopic Purchase For Vaccine Manufacturer's Direct Selling.*

Abstract. Vaccination is important and has become a free choice to the people. With the view to understand these customers purchase decision, we study the direct selling of the vaccines in a single selling season as a two-period game. Vaccine manufacturer sells perfectly substitutable vaccines to N heterogeneous customers. The vaccination choice of purchasing agents is either strategic or myopic affecting the valuation of the vaccines. The attributes of the game are namely the manufacturer's play, customer fraction, innovation level and depreciation factor. In the first period of the game, a vaccine is offered as a single rollover while the second period offers the customers with leftovers from previous period along with the newly launched substitute. We solve this game setup and conduct a numerical illustration with the real-time data from Pfizer Limited for the US population. We arrive at a sustainable strategy for the system from the numerical findings and it is found to benefit the environment, the people, the government and the manufacturer. Also, it was observed that innovation level does not act as a good indicator to define the vaccine quality. This game-theoretical setup is applicable to any pharmaceutical industry provided the products are perfect substitutes. Further, the work can be extended towards studying the impact of the customers horizontal interactions.

Keywords: customers, direct selling, manufacturer, two-period game, vaccination

Juhong Gao (Tianjin University) and Xiaowen Qiu (Tianjin University). *DYNAMIC PRICING GAME ANALYSIS OF CLOSED-LOOP SUPPLY CHAIN UNDER SUB-CHANNEL SALES.*

Abstract. The remanufacturing supply chain system distribute homogeneous new products and remanufactured products through different channels. Considering retailer's fairness concern and final consumption preference, different regional games of price adjustment speed of two kinds of products are analyzed. The dynamic change of the manufacturer's pricing strategies and their effects on profits are studied. It is found that when the manufacturer adjusts the wholesale price of new products and the sales price of remanufactured products. The manufacturer should speed up the price adjustment of one side and slow down the price adjustment of the other side, which can keep his own profit stable. There is a critical value of market price fluctuation from dynamic stability to chaotic state. When the price adjustment speed is less than the critical value, the fairness concern is strengthened, consumers' purchase preference for remanufactured products increases, and manufacturers can adjust product prices to obtain more profits. When the price adjustment speed is at the critical value, half of the consumers' preference for remanufactured products increases. The manufacturer slows down the production of new products and speed up the recycling and remanufacturing of products, which is conducive to the replacement of products. When the price adjustment speed is greater than the critical value, the supply chain system will appear chaotic uncontrollable disturbance. It is difficult for the manufacturer to obtain the expected profit.

Keywords: fairness concern, consumer preference, dynamic game, pricing, closed-loop supply chain

Mosaab Hamed (Capability Systems Centre, School of Systems and Computing, University of New South Wales, Canberra, Australia), Hasan Huseyin Turan (Capability Systems Centre, School of Systems and Computing, University of New South Wales, Canberra, Australia), Sondoss El Sawah (Capability Systems Centre, School of Systems and Computing, University of New South Wales, Canberra, Australia), Oguz Sahin (Capability Systems Centre, School of Systems and Computing, University of New South Wales, Canberra, Australia) and Daniel D Prior (School of Business, University of New South Wales, Canberra, Australia). *The Current Rare Earth Elements Market: A System Archetype Perspective.*

Abstract. The rare earth elements (REEs) are critical for various modern technologies, but the global supply chain is highly concentrated, with China dominating the market. This paper analyzes the dynamics shaping the REE supply chain using system archetypes to understand its phased evolution, underlying drivers, and policy impplications. The analysis reveals that the current vulnerability can be understood through three archetypes: “Shifting the Burden,” “Success to the Successful,” and “Escalation.” Computational experiments validate the presence of these archetypes. The paper highlights the need for a deeper understanding of the complex dynamics to inform interventions and strategies for building a resilient and diversified supply chain.

Keywords: Rare Earth Elements, Market Evolution, System Archetypes, Supply Chain Management

Saber Elsayed (UNSW Canberra). *Evolving Question Design to Mitigate the Impact of Generative AI Text Tools on Education.*

Abstract. This paper proposes an approach to mitigate the impact of artificial intelligence text generation tools, like ChatGPT, on education by evolving question generation that these tools have low confidence in answering. Therefore, an evolutionary algorithm is designed to evolve the set and number of Bloom's Taxonomy keywords that can be used in generating questions. In addition, to address the variability in responses from tools like ChatGPT, the paper handles this challenge as an uncertainty optimisation problem. The study also broadens the scope of Bloom's taxonomy keywords, enhancing the capability to generate questions. Through a case study utilising a university programming course, this research demonstrates the effectiveness of these advancements. The findings highlight the potential of this approach in aiding educators in crafting questions that not only challenge those tools but also encourage critical thinking and deeper learning in students.

Keywords: Evolutionary computation, AI generative text tools, ChatGPT, Bloom's taxonomy

Noriko Ogasawara (Waseda University), Ayako Yamagiwa (Waseda University), Hiroshi Ikeda (Meiji Yasuda Life Insurance Company) and Masayuki Goto (Waseda University). *An Analysis Model of Inquiry and Complaint Data Considering Customers' Emotion for Improving Business Process.*

Abstract. In recent years, there have been active attempts to improve their products and services by conducting Voice of the Customer (VOC) analysis on call log data accumulated in call centers by applying natural language processing (NLP). In the analysis, it is important to appropriately extract quality factors of products and services that lead to customer dissatisfaction. In some cases, call log data does not record the entire content of a conversation but only a summary note made by the person who handled the call. In such cases, it is not easy to analyze the data because the amount of information in the response is small, and the note-taking style differs among responders. In addition, the content of the call log may not only be a clear complaint, but also a complaint but not lodged as a complaint. In such cases, call logs often do not contain emotional words, making it difficult to extract complaints through general sentiment analysis.

In this study, we propose a method for identifying customer dissatisfaction from Japanese call log data that does not contain emotional words and is not written in a standardized manner, using large language models (LLMs). Specifically, we use the sentence comprehension ability of LLMs to learn to obtain clues to dissatisfaction from the context described in the logs. The goal is to discover implicit dissatisfaction and to utilize customer feedback in a more comprehensive manner.

By implementing this method, companies can discover significant viewpoints for improvement in their products and services even when customers do not explicitly express dissatisfaction. As a result, it is possible to approach dissatisfaction that may develop into a complaint in the future at an early stage, and to improve quality more effectively to increase customer satisfaction.

Keywords: Voice of Customer Analysis, Call Log Analysis, Japanese Natural Language Processing, Quality Elements, Large Language Models

Jiahong Zhang (Department of Industrial and Systems Engineering, University of Southern California), Hexin Li (Department of Industrial and Systems Engineering, University of Southern California), Negin Ashrafi (Department of Industrial and Systems Engineering, University of Southern California), Zhijiang Yu (Department of Industrial and Systems Engineering, University of Southern California), Greg Placencia (Department of Industrial and Manufacturing Engineering, California State Polytechnic University, Pomona, California) and Maryam Pishgar (Department of Industrial and Systems Engineering, University of Southern California).
Prediction of In-Hospital Mortality for ICU Patients with Heart Failure.

Abstract. Heart failure affects millions of people worldwide. It greatly reduces quality of life and is associated with high mortality rates. Despite extensive research, the statistical connection between heart failure and mortality rates for ICU patients remains underexplored, indicating the need for improved prediction models.

This study identified 1,177 patients over 18 years old from the MIMIC-III database using ICD-9 codes. Preprocessing consisted of handling missing data, deleting duplicates, treating skewness, and oversampling to alleviate data imbalances. 18 features were selected within a LightGBM model by checking Variance Inflation Factor (VIF) values, LASSO Regression, and univariate analysis. The final output of the LASSO Logistic Regression model had the highest test AUC-ROC of 0.8766 (95% CI 0.8065 - 0.9429) and accuracy of 0.7291 compared to other baseline models, including Logistic Regression, Random Forest, LightGBM, Support Vector Machine (SVM), and Decision Trees. All models demonstrated good calibration with relatively low Brier scores, highlighting their reliability in predicting in-hospital mortality.

Our models predicted deaths of heart failure ICU patients better than the best results found in both literature and baseline models. These results were based on preprocessing missing values via improved imputation strategies and improved feature selection based on an expanded literature search and improved experiences selecting key features. With the Grid-Search, we had a near-perfect predictive model. These methods greatly increased the predictive accuracy of in-hospital mortality in ICU patients with heart failure.

Keywords: Heart Failure, In-Hospital Mortality, MIMIC-III, Machine Learning

Wanshi Zhang (zhangwanshi_swjtu@163.com), Yifei Lin (linyifei@stu.cqu.edu.cn), Peiji Liu (liupeiji@cqu.edu.cn) and Xu Wang (wx921@163.com). *Flexible job shop scheduling problem considering energy storage system operation strategies.*

Abstract. With the transformation of the energy structure and the promotion of the "Dual-Carbon" Policy, the energy storage system is an important means of consuming unstable renewable energy at a high ratio and reducing electricity costs (EC) by combining demand response, has been more and more widely used in manufacture industries. Most production scheduling in industries does not consider the operation strategy of the energy storage system and the impact of time-of-use (TOU) rates on EC, which results in a large amount of economic waste. To investigate the potential of joint scheduling of energy storage system and production, this work establishes a multi-objective flexible job shop scheduling problem (MOFJSP) model with the optimization objective of minimizing the EC and makespan while considering operation strategies of energy storage system under the condition of TOU rates. To address this model, an improved multi-objective NSGA-II optimization algorithm based on a hybrid iterative greedy algorithm is proposed to reduce the EC while ensuring the on-time delivery of products. To illustrate the usability of the hybrid algorithm and its application in practice, an extended Brandimarte standard dataset is utilized and an experiment is performed in a typical discrete manufacturing plant. The results show a proposed algorithm realizes the effective reduction of EC while guaranteeing the production schedule. The pareto frontier solution can help firms make decisions to achieve a smooth reduction in makespan and EC at the same time.

Keywords: Multi-objective optimization, Flexible job shop scheduling, Energy storage system, Greedy algorithm, Discrete manufacturing plant

Ayako Yamagiwa (Waseda University), Fugee Tsung (The Hong Kong University of Science and Technology) and Masayuki Goto (Waseda University). *Quantifying User Preferences for Pokémon Characters Using Pairwise Comparison Deep Learning Models.*

Abstract. The first series of Pokémon was released in 1996, and the game series is still loved worldwide. Each game has a limited number of characters (Pokémon), and there are currently more than 1,000 Pokémon characters. The choice of which Pokémon appear in a game is an important factor that affects the game's attractiveness; in fact, Pikachu and other popular Pokémon have appeared in many games. However, the attractiveness of a game to players is a subjective evaluation value that varies from person to person, making it difficult to quantify. In order to evaluate the value of app games used in everyday life and further improve their appeal, it is important to estimate the attractiveness of each Pokémon, which differs depending on users. For example, in Pokémon Sleep, a sleep measurement app, it is more important that Pokémon are loved than that they are strong. In this study, we propose a method to estimate the attractiveness of Pokémon that leads to "I choose you!" Specifically, we exploit the fact that when a pairwise comparisons can be conducted for all combinations of two Pokémons, it is possible to estimate the true evaluation value using the synergistic mean of the obtained pairwise comparisons. However, it is difficult to perform pairwise comparisons for all combinations of many evaluation targets by hands. Therefore, we consider constructing a machine learning model that estimates pairwise comparison values for all combinations between two Pokémons by using a part of the pairwise comparisons given by a user as the training data set. This study shows that the attractiveness of each Pokémon can be estimated by using actual Pokémon data and the pairwise comparison results for attractiveness. Furthermore, we show that it is possible to analyze which aspects of a Pokémon a player finds attractive using the estimated attractiveness and the analysis results.

Keywords: Pokémon, Attractiveness, Analysis of Reason, Pairwise Comparison

Leena Ghrayeb (University of Michigan), Shanthi Muthuswamy (Northern Illinois University) and Purushothaman Damodaran (Northern Illinois University). *GRASP FOR MAKESPAN MINIMIZATION OF A BATCH PROCESSING MACHINE WITH UNEQUAL READY TIMES.*

Abstract. Batch Processing Machines (BPMs) are commonly used in metal working, contract electronics manufacturing, semi-conductor manufacturing, and chemical processing – to name a few. A BPM scheduling problem with makespan objective is considered in this research. Job processing times, ready times and sizes are given. BPM is capacitated, hence, each batch of jobs processed cannot exceed the machine's capacity. Two interdependent decisions are required: group jobs to form batches and schedule batches on the machine. The processing and ready times of the batch depend on the composition of the batch. Batch ready time is equal to the largest ready time of all the jobs in a batch. Similarly, the batch processing time is equal to the largest processing time of all the jobs in a batch. As the problem under study is NP-hard, a Greedy Randomized Adaptive Search Procedure (GRASP) is proposed. The performance of GRASP is evaluated by comparing its solution quality and run time with a commercial solver, which was used to solve a mathematical formulation. The experimental study shows that the GRASP approach is fast in finding good solutions as the problem size increases. The proposed approach greatly benefits the schedulers of contract electronics manufacturer to improve the utilization of the BPM.

Keywords: Batch Processing Machine, Makespan, GRASP

Purushothaman Damodaran (Northern Illinois University) and Shanthi Muthuswamy (Northern Illinois University). *A COLUMN GENERATION HEURISTIC TO SCHEDULE BATCH PROCESSING MACHINES IN A TWO-STAGE FLOWSHOP.*

Abstract. Scheduling batch processing machines has garnered significant research interest due to its practical relevance in manufacturing and service industry. This paper was motivated by an application found in electronics manufacturing and testing facility. In a two-stage flowshop with batch processing machine in each stage, the objective is to group jobs into batches and schedule the batches such that the makespan or the completion time of the last batch of jobs is minimized. The job processing times on both the stages and their sizes are known. The batch processing machines can process a batch of jobs simultaneously, if the total size of all the jobs in the batch does not exceed the machine's capacity. Furthermore, the waiting time between the two stages for each job is limited. This scheduling problem is NP-hard. Consequently, commercial solvers require prohibitively long computational time to solve the mathematical formulation and find an optimal solution. This research proposes a column generation-based heuristic to find good solutions in short run times. An experimental study was conducted to compare the results from the column generation approach with the commercial solver and some heuristics. The experimental study highlights the usefulness of the proposed approach.

Keywords: Batch Processing Machine, Flowshop, Makespan, Column Generation

Wenyou Guo (Jinan University), Ting Qu (Jinan University) and Kai Zhang (Jinan University). *A Blockchain Enabled Cyber-Physical Space for Enhancing Security and Decentralization in Smart Factory.*

Abstract. The adoption of Industry 4.0 technologies is profoundly reshaping the landscape of production operations management. These new technologies facilitate the coordination and data sharing among various manufacturing resources, eliminating data silos. However, this also imposes new requirements on the security and efficiency of production operations. This study proposes a Cyber-Physical Space architecture centered on blockchain, combined with other Industry 4.0 technologies, aimed at empowering the production operations of smart factories. Based on this architecture, we design a relatively comprehensive blockchain solution incorporating consensus mechanisms, smart contracts, and multi-chain collaboration mechanism.

Keywords: smart manufacturing, blockchain, CPS, production operations

Kriti Karmakar (Indian Institute of Technology Kharagpur) and Pradip Kumar Ray (Indian Institute of Technology Kharagpur). *DISCRETE EVENT SIMULATION FOR PRODUCTION PLNNING OF BLOOD COMPONENTS.*

Abstract. Blood is one of the most critical resources of any healthcare system. With the advancement of modern medical science, blood component therapy has become very popular because of its ability to serve more than one patient by componentizing one whole blood unit to various blood components for different medical conditions. However, while producing one kind of blood component with the help of centrifugation, several other blood components are also produced. In order to analyze the quantity of the blood components to be produced, a discrete event simulation model is developed using the data from a blood bank situated in Kolkata, India. The model simulated the activities of the blood bank and tested the effect of different production levels. The model suggests the production level affects the availability of the blood components and the total cost incurred by the blood bank. Thus, determining the optimal level of blood component production level is very important for any blood banking system.

Keywords: Blood Bank, Blood Components, Production Planning, Simulation

Shogo Miyazaki (Sanyo-Onoda City University) and Akimasa Otsuka (Sanyo-Onoda City University).
GENERATION OF SKIN MODEL SHAPES CONSIDERING PARALLELISM AND PERPENDICULARITY.

Abstract. In the development process of machine products, product quality assurance is considered to build a relationship of trust with customers. Although improvement of the quality of product development is an important task, it is also time-consuming and costly. Therefore, the product development process must be shortened, and simulation using CAE (Computer Aided Engineering) is indispensable in the process. In CAE, the shape of a product is usually modeled as a collection of geometric ideal shapes (such as surface, cylinder, sphere, etc.) and then calculated using the ideal shapes. The product shape modeled in CAE has no irregularities, and the model differs from the actual product's shape. Surface irregularities affect the durability and airtightness of the product from a mechanical engineering perspective. Therefore, various research using surface models with irregularities (skin models) has been developed in recent years. Skin model is defined in ISO17450-1 as surface models of non-ideal geometry. Skin models represented by point clouds, polygons, or mathematical functions are called skin model shapes, which can be used for tolerance analysis and other purposes. Various generation methods of skin model shapes are developed, and no method imitates machining marks. In our previous research, a generation method of skin model shapes with cutter and machining marks was developed by applying wavelet transform. As an application of SMS, this study creates a cubic or rectangular SMS, taking into account parallelism and perpendicularity. When surface models with given deviations are combined to form a cube, gaps, and intersections occur at the junctions of the surfaces. These gaps and intersections are related to parallelism and perpendicularity, so we can create a more realistic SMS by taking the base of the cube as a reference and considering the parallelism and perpendicularity of the corresponding five surfaces when they are connected.

Keywords: Orientation deviation, Skin Model Shape, Machining error, Genetic Algorithm, Quality Design

Yuma Hino (Sanyo-Onoda City University) and Akimasa Otsuka (Sanyo-Onoda City University). *TOPOLOGY OPTIMIZATION CONSIDERING FORM DEVIATIONS.*

Abstract. In recent years, design methods based on optimization are being used effectively. Although the designed shape is an ideal shape, the actual product has machining errors. If the variation in shape could be generated randomly at design stage, it would be useful for tolerance design for mass-produced products. In this study, we investigated a method of randomly adding shape deviations to the shape obtained by topology optimization.

Keywords: Machining error modelling, Form deviation, Topology optimization, Randomization

Shu-Chu Liu (National Pingtung University of Science and Technology) and Po-Jen Ko (National Pingtung University of Science and Technology). *A MULTI-OBJECTIVE DIFFERENTIATED SERVICE MODEL FOR MOBILE PHONE REPAIR.*

Abstract. Since customer relationship management (CRM) has become a widely adopted marketing strategy, the demand for differentiated services has increased accordingly. In the past, ordinary service (single service) that provided the same service time (repair time) and price for all customers, based on the criterion of maximizing profit, failed to satisfy the demand for priority or special services. Additionally, the factor of customer satisfaction was often ignored in the service model. This paper proposes a multi-objective differentiated service model for mobile phone repair based on the objectives of maximizing profit and customer satisfaction. Customer preference information is considered, and market segmentation is appropriately reflected through simulation to determine the relative service time and price combinations. Since this proposed model is a combinatorial problem, a hybrid multi-objective heuristic method is proposed integrating particle swarm optimization and large neighborhood search. Real case data is used to verify the effectiveness of the proposed method, comparing it with some existing methods for the multi-objective single service model. Sensitivity analysis was also conducted on the order mean arrival rate. The proposed differentiated service model proves to be an effective method to make the best use of resources and satisfy customers' demand for better sustainability.

Keywords: Mobile phone repair, Multi-objective differentiated service, Hybrid multi-objective heuristic method

Ravi Seethamraju (The University of Sydney), Krishna Sundar Diatha (Indian Institute of Management Bangalore) and John Wentzel (University of Pretoria). *FINANCIAL INCLUSION IN SOUTH AFRICA: AN EMPIRICAL STUDY EXTENDING TECHNOLOGY ACCEPTANCE MODEL (TAM).*

Abstract. Financial inclusion has been proposed as a mode of alleviating poverty. This study examines the behavioural intention of people at the bottom of the pyramid in South Africa to adopt financial services through post office as an intermediary. It employs an extended Technology Acceptance Model (TAM) and a large cross-sectional survey across South Africa. The results confirm that the proposed TAM based model accounting for more than 90% of the variance in behavioural intention and validates the effects of perceived usefulness and ease of use on behavioural intent in South African and financial inclusion context. It highlights the critical importance of social influence and hedonistic factor on behavioural intention to adopt the service by the poor in South Africa. Implications for academic research and practice are discussed

Keywords: Financial inclusion, Bottom of the pyramid, Technology Acceptance Model, South Africa

Md. Abdul Moktadir (The Hong Kong Polytechnic University), Yousaf Ayub (The Hong Kong Polytechnic University) and Jingzheng Ren (The Hong Kong Polytechnic University). *RESILIENCE CHALLENGES MITIGATION STRATEGIES FOR WASTE MANAGEMENT 5.0 DRIVEN CIRCULAR WASTE UPCYCLING PROCESS: AN INTELLIGENT DECISION SUPPORT MODEL.*

Abstract. Waste Management 5.0 (WM5.0) driven circular tannery solid waste (TSW) upcycling generally depends on building a resilient TSW supply chain. Although the TSW upcycling process is not widely implemented in developing countries, it is usually disposed of in open spaces, contributing to environmental pollution. Therefore, to build a resilient TSW-to-energy supply chain, it is essential to identify and measure the resilience challenges and mitigation strategies. In addition, the supply chain resilience issues have been extensively explored in literature, but developing a resilience index for the TSW-to-energy supply chain by offering a novel framework and covering the broader scale of uncertainty is completely lacking in the literature. In this regard, this study, for the first time, proposes an advanced decision-making model combining the Decomposed Fuzzy Set (DFS) Analytical Hierarchy Process (AHP) with DFS-Quality Function Deployment (QFD) based MILP optimization model to get more insight into the mitigation strategies for making TSW-to-energy supply chain more resilient. Results indicate that the most critical resilience challenge is "Uncertainty in maintaining a continuous flow of waste feedstock (RsC4)". The most effective mitigation measure is "Design critical supporting infrastructure (e.g., storage facilities, pre-treatment equipment) to withstand natural disasters, extreme weather events, and other disruptions (St5)". The highest resilience efficiency is achieved as 0.43809 from the system performance by meeting the budgetary constraint. The findings of this study have made remarkable contributions to both scientific research and policymaking, which can help build resilient TSW-to-energy supply chains in developing countries, promoting circularity and sustainability in the leather business.

Keywords: Resilience Challenges, Mitigation Strategies, Waste Management 5.0, Circular Economy, Intelligent Decision Support Model, Decomposed Fuzzy AHP

Negin Ashrafi (Department of Industrial and Systems Engineering, University of Southern California), Armin Abdollahi (Department of Electrical Engineering, University of Southern California), Greg Placencia (California State Polytechnic University, Pomona) and Maryam Pishgar (Department of Industrial and Systems Engineering, University of Southern California). *Process Mining/ Deep Learning Model to Predict Mortality in Coronary Artery Disease Patients.*

Abstract. Patients with Coronary Artery Disease (CAD) are at high risk of death. CAD is the third leading cause of mortality worldwide. However, there is a lack of research concerning CAD patient mortality prediction; thus, more accurate prediction modeling is needed to predict the mortality of patients diagnosed with CAD. This paper demonstrates performance improvements in predicting the mortality of CAD patients. The proposed framework is a modification of the work used for the prediction of 30-day readmission for ICU patients with heart failure.

Our framework demonstrates better performance with an Area Under the ROC Curve (AUC) score of 0.871 for the Neural Network (NN) model compared to traditional baseline machine learning models that we developed. Our framework uses the medical history of patients, the time related to the variables, and patients' demographic information for prediction. This framework has the potential to be used by medical teams to make more accurate decisions for treatment and care for patients with CAD, increasing their life expectancy.

Keywords: Process Mining, Mortality Prediction, Coronary Artery Disease

Munwon Lim (Hanyang University) and Suk Joo Bae (Hanyang University). *Degradation Modeling and Condition-Based Maintenance for Manufacturing Process via Change-Point Gaussian Process.*

Abstract. Advanced sensing technologies like smart sensors and IoT have significantly enhanced the health assessment of machine tools in manufacturing. With the transition from time-based maintenance to condition-based maintenance (CBM), data-driven condition monitoring and fault diagnosis are crucial for ensuring reliable operations and timely maintenance. Unlike traditional methods, CBM continuously monitors the health status of machines, detecting optimal maintenance times to prevent failures and reduce unnecessary maintenance costs. This research, motivated by an automotive manufacturing process, addresses the gradual degradation of machine tools due to operation. A machine-vision system monitors tool wear, recommending maintenance strategies based on real-time image data. Such systems are essential for maintaining product quality and reliability in unmanned machining processes. In this study, we propose a spatio-temporal Gaussian process with change-points (CP-STGP) to model the degradation of manufacturing tools. This model addresses the challenges of interpreting complex spatio-temporal data by capturing degradation patterns both over time and across spatial domains. The CP-STGP model uses stochastic partial differential equations (SPDEs) and the Fourier-based Kalman filter algorithm to manage computational complexity, enabling accurate and efficient parameter estimation. By integrating CP with STP, the model effectively identifies transition points between normal and abnormal tool states, facilitating optimal tool replacement times. This approach enhances condition-based maintenance, improving the health monitoring of production tools, and contributing to greater operational efficiency and product reliability.

Keywords: Health monitoring, Image degradation, Predictive maintenance, Spatio-temporal process

Marcus Murilo Alves Basilio (Department of Industrial Engineering, State University of Pará), Fabíola Domingues Maciel (Department of Industrial Engineering, State University of Pará), Claudio Felipe Costa Mescouto (Department of Industrial Engineering, State University of Pará), Muhammad Hamza Naseem (School of Transportation and Logistics Engineering, Wuhan University of Technology), Mario Henrique Callefi (Chair of Factory Planning and Intralogistics, Chemnitz University of Technology) and Léony Luis Lopes Negrão (Department of Industrial Engineering, State University of Pará). *Lean Manufacturing System metrics and Contingency Theory in the Manufacturing Industry in the Amazon.*

Abstract. This research examines the effects of lean manufacturing metrics in an emerging economy with inherent contingency factors. A systematic literature review was conducted to understand lean manufacturing metrics, followed by a case study with direct observations and investigations. The findings reveal insights into production capacity sizing, cycle times of each macro process stage, generated stocks, and production bottlenecks. By identifying processes and machines with the longest waiting times or idleness and the most stock generation, the study proposes standardization measures that can be implemented in production macro processes through an action plan.

Keywords: Lean manufacturing, lean practices, lean metrics, Amazon

Yanxi Liu (The University of New South Wales), Mohammad Mojtahedi (The University of New South Wales) and Jinwoo Brian Lee (The University of New South Wales). *Off-site Construction Logistics Planning: A Simulation-Optimisation Conceptualisation Framework for Economic and Environmental Sustainability.*

Abstract. The global construction industry is transitioning towards more sustainable and efficient off-site construction (OSC). Despite various benefits, OSC adoption in Australia has been slower than expected, with prefabricated module transport being a major challenge. Previous research on OSC logistics management is limited, particularly for volumetric prefabricated modules, overlooking unique module characteristics regarding excessive dimensions and weights. Additionally, while the construction industry moves towards decarbonisation, the environmental impacts of module transport activities, particularly carbon emissions from heavy-duty trucks, have received limited attention. Past studies predominantly focused on cost minimisation, resulting in a lack of integrated consideration for cost and emission control. To address these gaps and promote sustainable logistics planning for OSC, this study conceptualises a simulation-based optimisation framework to enhance both economic and environmental performance in module delivery from factory to construction site. A bi-objective mathematical optimisation model is proposed, encompassing decisions on vehicle assignment, routing and scheduling, and incorporating real-world logistics constraints like restricted road access for heavy vehicles. The Australian Transport Assessment and Planning (ATAP) interrupted flow fuel consumption model is adopted to improve the accuracy of vehicle emission calculation. The combinatorial optimisation problem will be solved using agent-based simulation in AnyLogic software and the embedded OptQuest optimiser. This research aims to explore how logistics decisions on assignment, routing and scheduling impact one another and overall costs and emissions performance via 'what-if scenarios', and determine the optimal logistics plans. This research contributes to theory and practice in OSC logistics planning by proposing a conceptual framework that integrate economic and environmental impacts into decision making process. The proposed framework and model are expected to help logistics planners reconcile potential conflicts in cost and emission minimisation objectives, promoting sustainable operations in the delivery of volumetric prefabricated modules.

Keywords: Decarbonisation, Decision-Making, Logistics Planning, Off-site Construction, Simulation Optimisation, Sustainability, Vehicle Routing Problem

Mohammad Ghasemi (School of Information Technology, Deakin University, Geelong, 3216, Vic, Australia), Asef Nazari (School of Information Technology, Deakin University, Geelong, 3216, Vic, Australia), Dhananjay Thiruvady (School of Information Technology, Deakin University, Geelong, 3216, Vic, Australia), Reza Tavakkoli-Moghaddam (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran), Reza Shahabi-Shahmiri (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran) and Seyed-Ali Mirnezami (Department of Industrial Engineering, Faculty of Engineering, Shahed University, Tehran, Iran). *A Bi-Objective Mathematical Model For The Multi-Skilled Resource-Constrained Project Scheduling Problem Considering Reliability: An AUGMECON2VIKOR Hybrid Method.*

Abstract. In recent years, resources with multiple skills have received attention as an extension of the resource-constrained project scheduling problem known as MSRCPSP. Although the disruption rate is well-estimated in today's manufacturing projects, its impact on project makespan and cost need further investigation. Hence, this study presents a novel mathematical model for MSRCPSP considering a single project with machine disruptions, namely MSRCPSPR. The model proposes both objectives of minimizing project makespan and project cost. The MSRCPSP is an NP-hard problem, and including reliability constraints, as proposed in this paper, makes solving the problem more intractable. To cope with the computational challenges of solving the problem, a combination of an enhanced version of the epsilon-constraint method as well as an augmented version of the VIKOR algorithm, namely AUGMECON2VIKOR, is employed to solve benchmark instances j10 and j20 from PSPLIB. A comparative analysis demonstrates the performance of the proposed method, and the sensitivity

analysis represents the effects of positive reliable constraints on the objective functions. Employing the proposed method, the project makespan and cost are reduced by nearly 2.55% and 2.80% in j10 on average. CPU time is also decreased by about 543 seconds in comparison to the epsilon-constraint method.

Keywords: Multi skill, Project scheduling, Queuing system, Reliability, AUGMECON2VIKOR algorithm

Soham Das (Department of Mechanical Engineering, Indian Institute of Technology Delhi, Hauz Khas, New Delhi, 110016, Delhi, India) and Varun Ramamohan (Department of Mechanical Engineering, Indian Institute of Technology Delhi, Hauz Khas, New Delhi, 110016, Delhi, India). *Quantification of effects of screening and treatment policies on epidemiology of hepatitis C virus infection in Indian Punjab.*

Abstract. Recent surveys have shown that the northern Indian state of Punjab has a high hepatitis C virus (HCV) antibody prevalence (3.6%) as well as a high active infection or RNA prevalence (1.8%). Although HCV progresses slowly, it causes more deaths than HIV-AIDS in India. While there are directly-acting antivirals (DAAs) which can cure HCV infection in early stages, for advanced disease stages, liver transplant remains the only option to improve survival. But the cost of liver transplant is nearly twelve times higher than the per-capita income of India. Capturing infections early and treating them with DAAs can cure them with high efficacies while also preventing secondary infections. In this study, we explore the effects of different DAA-based intervention policies modelled in the form of screening and treatment camps on the following epidemiological outcomes- HCV antibody prevalence, HCV RNA prevalence, liver transplants needed and contribution of HCV-related deaths to overall mortality. For this, we developed a comprehensive agent-based simulation model for HCV transmission on a dynamic cohort, the first of its kind to incorporate all major modes of spread. Disease progression is modelled using a previously validated and widely used discrete-time Markov chain adopted from the literature. The transmission model is calibrated, verified and validated by execution over a fifty-year period. Then, screening and treatment was modelled over a ten-year intervention period. The intervention policies are varied in terms of treatment uptake rates (10-90% of infections caused in the sixty-year period), and frequency and timing of the camps. Our objective was to quantify the impacts of these policies on the epidemiological outcomes. We found that a policy of annually screening and treating patients by uniformly stepping up the coverage over the ten-year period to achieve 90% treatment uptake rate gives the optimal epidemiological outcomes among the policies explored.

Keywords: Hepatitis C virus infection epidemiology, Indian Punjab, Agent-based simulation, Treatment using directly-acting antivirals, Treatment uptake rates

Agus Wicaksana (University of Melbourne) and William Ho (The University of Melbourne). *ENABLING SUPPLY CHAIN RESILIENCE THROUGH DATA-DRIVEN DIGITAL TECHNOLOGIES.*

Abstract. This study aims to critically evaluate the discourse on data-driven digital technologies in Operations and Supply Chain Management (OSCM) to achieve resilience. Adopting a hybrid Scholarly Network Analysis by combining a citation-based approach (i.e., Bibliographic Coupling Analysis) and a text-based approach (i.e., Co-word Analysis), this study presents a systematic literature review of 126 resilience-related articles published in high-rank journals in OSCM from 2001 to mid-2023 that discuss the role of digital technologies. Guided by the co-words analysis, we discuss the characteristics of this topic in terms of problems, objectives, methods, and solutions.

We find that scholars working on this topic utilize a holistic unit of analysis from a single firm, dyadic, triadic, to network level. We also highlight several influential articles based on citation to pinpoint the beacons of this topic. Further, we discuss the conceptualization of resilience in this topic to see whether it reconciles the traditional and evolutionary resilience perspectives. Reviewing the measurement of resilience employed in the majority of articles, we reveal that scholars working on this topic have moved forward beyond the response and recovery capabilities to growth capability in defining resilience. Finally, we propose a parsimonious diagram that depicts critical success factors of resilience from the perspective of data-driven digital technologies. They are (1) data acquisition and distribution, (2) data analysis and decision-making, and (3) technology usage and learning patterns. Therefore, this study contributes to the literature by thoroughly illuminating the role of data-driven digital technologies in helping firms achieve resilience.

Keywords: literature review, resilience, data, technology

Yue Yin (The Hong Kong Polytechnic University), Chengxi Li (The Hong Kong Polytechnic University) and Pai Zheng (The Hong Kong Polytechnic University). *A Mixed Reality and Digital Twin-Enabled Multimodal Human Demonstration System for Efficient Robot Learning.*

Abstract. The integration of human intelligence can significantly improve production flexibility in smart manufacturing. Meanwhile, effectively transferring human skills and knowledge to robots can enhance robot's cognition and capabilities. However, this requires intuitive human-robot interaction interfaces and advanced robot learning algorithms. To address this need, this work proposes a mixed-reality and digital twin-enabled multimodal human demonstration system for robot learning, further enhancing symbiotic human-robot collaboration (HRC). This system comprehensively encompasses multimodal data collection, policy learning, and deployment processes. Human operators can use their bare hands to complete tasks and collect demonstrative data via a mixed reality head-mounted display, without needing a physical robot existence. Moreover, multimodal demonstration data such as audio, gestures, and RGB images with more semantic information can be collected intuitively. With well-designed state and action representations, human behaviour patterns can be extracted by learning from demonstration algorithms and deployed on the physical robot. We conduct pilot case studies of the learning stage and showcase how the proposed system could gather multimodal demonstration data and support the deployment phases. Finally, potential robot learning-based motion generation approaches are discussed, which could be integrated into our system to equip robots with higher cognition.
Keywords: Smart Manufacturing, Digital Twin, Mixed Reality, Robot Learning, Human-robot Collaboration

Yiming Chen (Beihang University), Wenbing Chang (Beihang University), Linchao Yang (North China Electric Power University) and Shenghan Zhou (Beihang university). *DISTRIBUTIONALLY ROBUST OPTIMIZATION MODEL FOR AIRCRAFT ROUTING PROBLEM CONSIDERING PROLONGED DELAYS.*

Abstract. The paper proposes a distributionally robust optimization model based on the Wasserstein metric to solve the aircraft routing problem. The model comprehensively considers the impact of both total propagated delays and prolonged delays on the operational costs of airlines. Given the suddenness and multifaceted nature of flight delays, the study construct an ambiguity set based on the Wasserstein metric with the empirical distribution formed by historical delay data to characterize flight delays. Then a data-driven distributionally robust (DR) chance constraint was proposed to limit the number of prolonged delays on routes. The optimization model is constructed using historical flight schedule data and delay data, and the model's performance is validated with simulated delay data. In the computational experiments, the proposed model demonstrated superior performance compared to the comparison model, indicating that the proposed model is more resilient to the impact of delays on routes, which is a crucial aspect in the operational management of airlines.
Keywords: aircraft routing, prolonged delays, propagation delay, robust optimization

Min Liu (China University of Petroleum (East China)) and Ling Jian (China University of Petroleum (East China)). *Deep reinforcement learning for robot real-time operations with battery constraints in robotic mobile fulfillment systems.*

Abstract. Robotic mobile fulfillment systems (RMFSs) are a recent type of automated warehouse used in e-commerce, where mobile robots transport pods to workstations for pickers to retrieve purchased products.

While these automated parts-to-picker systems can improve picking efficiency, they also introduce new operational challenges: (1) coordinating multiple robots to serve a large number of orders is difficult; (2) meeting customers' ever-shortening delivery expectations and managing orders with unpredictable arrival times place higher demands on the real-time responsiveness and robustness of RMFSs; (3) robots run on electricity, and their battery charging activities impact the execution of transportation tasks. Therefore, this paper focuses on real-time decision-making for large-scale robot scheduling and pod positioning problem with battery constraints. We first present a mixed-integer programming model (MIP) with the objective of minimizing the total operational cost incurred by all robots. Considering the slow response times of static optimization algorithms (i.e., metaheuristics) and the poor optimization performance of assignment rules, we formulate the MIP model as a Markov Decision Process and design a fast solution algorithm based on dueling double deep Q-learning (D3QN) with prioritized experience replay. We conduct numerical experiments based on a real-world case to validate the efficacy and efficiency of the model and algorithm. Instances with 400-2000 orders, 800-1200 pods, and 8-16 robots can be solved to near optimality within several seconds due to pre-trained neural network-based agent. Our results reveal that D3QN-PER excels in real-time scheduling of multiple robots for large-scale orders in complex RFMS environments.

Keywords: Robot scheduling, Pod repositioning, Battery constrains, Real-time decision making, Deep reinforcement learning, Robotic mobile fulfillment systems

Laura Tomidei (University of Technology Sydney), Nathalie Sick (University of Technology Sydney) and Luke Mathieson (University of Technology Sydney). *DATA-DRIVEN VALUE STREAM ANALYSIS USING PROCESS MINING AND MACHINE LEARNING.*

Abstract. Identifying key value streams is a crucial task in Industrial Engineering as a key enabling step for the application of Lean methodologies such as Value Stream Mapping, Pull Production, and Production Levelling. As production processes become more complex, "seeing" the different value streams becomes more challenging. At the same time, over the last decade, the increasing adoption of Industry 4.0 technologies has unlocked the opportunity to extract increasing amounts of data from various sources and equipment on the factory floor. This ability, combined with the capabilities of data analytics, enables the generation of valuable insights that can assist production planning and control decisions. This paper develops a method for identifying value streams from production data using process mining and machine learning techniques. Such method is developed by following the fundamental principles of Production Flow Analysis, that have guided the analysis of complex material flows for decades. However, as manufacturing processes become more complex and flexible, traditional approaches for value stream analysis reach their limits. The method developed in this research exploits machine learning and process mining capabilities to enable the identification of product families and associated work operations, as well as the visualisation of related process models. Since the characteristics of data collection and management systems used by companies may vary across the industry, this method also takes into consideration use cases with different levels of data quality. To demonstrate the practical contribution of our proposed approach, we present a case study that exemplifies and validates its application.

Keywords: Production Flow Analysis, Value Stream Analysis, Industry 4.0, Process Mining, Data Analytics, Machine Learning

Zhiyuan Ouyang (The Hong Kong Polytechnic University), Zhaolin Yuan (The Hong Kong Polytechnic University), Ming Li (The Hong Kong Polytechnic University) and George Q. Huang (The Hong Kong Polytechnic University). *A PROTOCOL-BASED DECISION FRAMEWORK FOR TRANSPORTING PREFABRICATED CONSTRUCTION MODULES THROUGH CYBER-PHYSICAL INTERNET.*

Abstract. Just-in-time shipment for construction modules plays an important role in achieving efficient on-site assembly. However, the shipment decisions are difficult to execute as planned because various uncertainties may occur during the shipment process. Recently, a novel logistics paradigm, namely Cyber-physical Internet (CPI) has been proposed with the aim to achieve efficient and resilient shipment decisions in the logistics network, just like controlling data packet transmission in the computer network. This paper proposes a new decision framework by designing a suite of CPI protocols to control the good shipment in the manner of computer networks. Several key components and problems are identified in the protocol-based decision framework for future research.

Keywords: Shipment protocol, Cyber-physical Internet, Prefabricated construction module logistics

Mingming Zhang (The University of Auckland), Jan Polzer (The University of Auckland), Shi Cheng (Shaanxi Normal University), Qunfeng Liu (Dongguan University of Technology) and Xun Xu (The University of Auckland). *Efficient Welding Quality Inspection Using Lightweight 1D CNN and Signal Data from Images.*

Abstract. Industries demand high-quality welding processes to ensure the integrity and reliability of manufactured components. Traditional welding defect detection methods are often time-consuming and subjective. In this study, we propose an efficient method for welding defect detection using image feature extraction techniques. Our approach converts welding images into one-dimensional signal data and employs a one-dimensional convolutional neural network (1D CNN) for classification. The preprocessing methods, including contrast enhancement, Gaussian blurring, and morphological gradient, enhance the signal-to-noise ratio and facilitate accurate feature extraction. Our results demonstrate that the 1D CNN outperforms the traditional two-dimensional convolutional neural network (2D CNN) in distinguishing between good welds and welding defects, providing a reliable assessment with a 99.67% accuracy rate. Most importantly, our method significantly reduces the process time. This methodology shows strong potential for integration into real-time systems, offering improved accuracy and efficiency in welding quality inspection.

Keywords: Anomaly detection, machine learning, lightweight, signal processing, convolutional neural network

Mathieu Payette (Université du Québec à Trois-Rivières), Georges Abdul-Nour (Université du Québec à Trois-Rivières), Toualith Jean-Marc Meango (Hydro-Québec), Miguel Diago (Hydro-Québec) and Alain Côté (Hydro-Québec). *Leveraging Natural Language Processing for Enhanced Maintenance Data in Power System Management.*

Abstract. Maintenance is essential to ensure the reliability and safety. The consequences of the loss of electricity can be catastrophic for society, as demonstrated by the crisis in Texas in 2021, or the 1998 ice storm in Quebec. The maintenance of the grid is therefore crucial for an asset-intensive industry that has such an impact on all aspects of society. To do this, the reliability of network components must be carefully studied, to maintain the system while keeping costs affordable for customers. These assessments are largely based on the analysis of maintenance data collected over the years. This work proposes a method for classifying maintenance work in order to improve the quality of the data used to model the life cycle of assets. Natural language processing (NLP) techniques, derived from artificial intelligence, include text classification tools that are ideal for this type of problem. However, analysis of maintenance texts requires that the NLP tools be adapted. Furthermore, another level of complexity is added as the data analyzed are in French, but contains plenty of anglicisms. This article compare the classification of maintenance orders using off-the-shelf tools with annotation tools adapted to the context of power systems.

The results show a significant improvement in classification accuracy when pre-processing and annotation techniques are employed to refine and adapt technical texts. This work highlights the necessity of intensive preprocessing and custom annotation when using state-of-the-art NLP algorithms in real industrial cases.

Keywords: Natural Language Processing, Maintenance Data Quality, Text Classification, Power System

Junbo Wang (Macao Polytechnic University) and Song-Kyoo Kim (Macao Polytechnic University). *Versatile Machine Learning Based Brain Attention Detection Systems.*

Abstract. Electroencephalogram (EEG) can reflect changes in brain activity under different states. The electrical signals of the brain are observed to exhibit varying amplitudes. These combinations of consciousness are responsible for forming a person's internal and external behaviors, emotions, and learning performance. The assessment of a personal level of attention which refers to the ability to consciously focus on something can also be facilitated by these signals. Research on brain attention aids in the understanding of the mechanisms underlying human cognition and behavior. Based on the characteristics of EEG signals, this research identifies the most effective method for detecting brain attention by adapting various pre-processing and machine learning techniques. The results indicate that KNN with the feature importance feature extraction method performed the best, achieving 99.56% accuracy, 99.67% recall, and 99.44\% precision with the rapid training time.

Keywords: Brain attention, electroencephalogram (EEG), biomedical signal processing, machine learning, emotion detection.

A S M Monjurul Hasan (University of Technology Sydney), Filipe Mattos Batista de Moraes (University of Technology Sydney) and Andrea Trianni (University of Technology Sydney). *LOOKING AT QUALITY MANAGEMENT AND SUSTAINABLE PERFORMANCE THROUGH THE LENS OF INDUSTRY 4.0 TECHNOLOGIES* .

Abstract. The paper aims to investigate the nexus among Quality Management Practices (QMPs), sustainable performance, and Industry 4.0 (I4.0) in selected manufacturing industries within Australia. This study reveals that QMPs are applied variably across different industry types and sizes, with large industries more consistently implementing QMPs compared to small and medium enterprises (SMEs). Among the QMPs, Lean principles are the most prevalent and positively impact operational performance, notably in enhancing labour productivity. In terms of sustainable performance, the manufacturing industries emphasize waste reduction. However, the adoption of I4.0 technologies for QM and sustainable performances in these industries is still in its early stages, and many have yet to fully harness their potential benefits, particularly regarding improvements in quality management (QM) and sustainable performance. This study renders significant value to the manufacturing stakeholders by furnishing initial insights contextualized locally to navigate towards QMPs, sustainability, and I4.0 technologies.

Keywords: Quality management, Sustainability performance, Industry 4.0, Manufacturing

Congdong Li (Jinan University), Qian Liu (Jinan University), Yelin Fu (Shenzhen University) and Ting Qu (Jinan University). *A FUZZY OVERLAPPING MODULE PARTITION APPROACH OF COMPLEX PRODUCTS CONSIDERING CHANGE PROPAGATION INFLUENCE.*

Abstract. The unexpected change propagation caused by design change has emerged as a primary risk factor in the successful development of complex products, presenting significant challenges to product continuous innovation in the dynamic and intricate environments. To effectively predict the influence of change propagation and improve the efficiency of complex products development, addressing the complicated and fuzzy community structure in the complex products design change propagation network, a three-phase model of multilayer network construction of product design change propagation is proposed. On this basis, a two-stage fuzzy overlapping community detection method combining the Louvain algorithm and membership degree measurement method is proposed to accurately divide the parts of complex products.

Keywords: complex products, module partition, design change propagation, multilayer network, fuzzy overlapping community detection

Ahmed Ghaithan (King Fahd University of Petroleum and Minerals), Laith Hadidi (King Fahd University of Petroleum and Minerals), Awsan Mohammed (King Fahd University of Petroleum and Minerals) and Shehab Mostafa (King Fahd University of Petroleum and Minerals). *ECONOMIC-ENVIRONMENTAL ASSESSMENT OF CONCENTRATED SOLAR POWER FOR SEAWATER DESALINATION.*

Abstract. Concentrated solar powered-desalination technology can be used to desalinate water which will resolve water scarcity and minimize the negative impact of fossil fuels on our planet. In this regard, this study aims to fulfill the demand for freshwater and reduce air pollution generated by water desalination by replacing fossil fuels with concentrating solar power. Different energy scenarios including full grid, Concentrated Solar Power (CSP), and CSP-grid have been explored to assess the potential of running Reverse Osmosis (RO) desalination. The assessment was examined with the help of System Advisor Model (SAM) and Desalination Economic Evaluation Program (DEEP) software. SAM enables the design of a concentrated solar energy plant and demonstrates the plant's performance, while DEEP permits the design of a water desalination unit and its integration with a concentrated solar power plant. The three scenarios have been evaluated from economic and environmental perspectives. It is found that the CSP technology is not economically feasible for running desalination compared to using fossil fuel, however, taking into consideration removing fuel subsidized and greenhouse gas emissions reduction, the CSP is an appealing option as greenhouse gas emissions will be reduced by 96% compared to the grid.

Keywords: Concentrating solar power, Reverse Osmosis desalination, Seawater, Renewable Energy, Saudi Arabia

Nidhi Nidhi (NIT Surat) and Sudeep Singh Sanga (NIT Surat). *Optimal management of repairable machining system with working breakdown and multiple imperfect coverage.*

Abstract. The present study examines the optimal management of a repairable machining system (RMS) with working breakdown and imperfect fault coverage. The concepts of imperfect fault coverage (i.e., reboot and recovery) are incorporated to depict real-time manufacturing/production systems involving automated machines. The faults of failed machines are automatically detected and fixed with a coverage probability. In case of unsuccessful recovery, the fault is cleared by a reboot operation. In this system, failed machines are repaired by a single server who can provide the repair at a slower rate in the partially failed also. To analyze the system's steady-state behavior, we formulate the Chapman–Kolmogorov equations and solve them using the recursive method, resulting in closed-form solutions. By establishing performance indices and conducting numerical experiments, we gain practical insights into system performance under varying parameters. Moreover, a cost function is developed to achieve the minimum system cost with optimal decision parameters.

Keywords: Repairable machining system, Working breakdown, Reboot, Recovery, Cost

Yingjie Zhao (Department of Data Science, The University of Queensland, Brisbane) and Abolghasemi Mahdi (School of Mathematical Sciences, Queensland University of Technology, Brisbane). *Local vs. Global Models for Hierarchical Forecasting.*

Abstract. Hierarchical time series forecasting plays a crucial role in decision-making in various domains while presenting significant challenges for modelling as they involve multiple levels of aggregation, constraints, and availability of information. This study explores the influence of distinct information utilisation on the accuracy of hierarchical forecasts, proposing and evaluating locals and a range of Global Forecasting Models (GFMs). In contrast to local models, which forecast each series independently, we develop GFMs to exploit cross-series and cross-hierarchies information, improving both forecasting performance and computational efficiency. We employ reconciliation methods to ensure coherency in forecasts and use the Mean Absolute Scaled Error (MASE) and Multiple Comparisons with the Best (MCB) tests to assess statistical significance. The findings indicate that GFMs possess significant advantages for hierarchical forecasting, providing more accurate and computationally efficient solutions across different levels in a hierarchy. Two specific GFMs based on LightGBM are introduced, demonstrating superior accuracy and lower model complexity than their counterpart local models and conventional methods such as Exponential Smoothing (ES) and Autoregressive Integrated Moving Average (ARIMA).

Keywords: Global Models, Hierarchical Time Series, Forecasting, Machine Learning

Wei Chen (Data and Systems Engineering, The University of Hong Kong), Yelin Fu (College of Economics, Shenzhen University), Ray Y. Zhong (Data and Systems Engineering, The University of Hong Kong), Ming Li (Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University) and George Q. Huang (Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University). *A Federated Semi-Supervised Learning-enabled Analytics Scheme for Data Authenticity in ESG Disclosure.*

Abstract. Both academia and industry have expressed significant interest in Environment, Social, and Governance (ESG) disclosure to advance sustainable development and investment. However, the issue of data authenticity in ESG disclosures remains a pressing and unresolved challenge. This study introduces an innovative approach to address the issue. Initially, the researchers propose an inventive ESG reporting system (BI-ESG) that leverages both blockchain and IoT. The system smoothly combines IoT and blockchain technologies, streamlining automated data collection and transmission in the ESG disclosure process while ensuring data authenticity, consistency, and transparency. Secondly, within BI-ESG, the data authenticity analytics is conducted based on the federated semi-supervised learning (FSSL) method. The analytics consists of gateway level and cloud level based on the TensorFlow Federated. Specifically, a portion of the dataset from the system is labeled with an authenticity index following spatial-temporal analytics, and a neural network model for data authenticity analytics is built using Keras. The model is trained in a federated manner, utilizing labeled data in the central server and unlabeled data in the clients. In addition, the discussion analyses the benefits and possible challenges of adopting the proposed solution in ESG disclosure. This research is expected to benefit both industry and academia by facilitating the application of the solution in comparable situations and sparking innovative concepts.

Keywords: Federated Semi-supervised Learning, Data authenticity, ESG disclosure, Spatial-temporal analytics

Tomáš Tichý (VSB-TUO), Ales Kresta (VSB-TUO) and Frantisek Zapletal (VSB-TUO). *Evaluation of selected market risk models with MCDM techniques.*

Abstract. An inherent part of financial engineering is to select a model, which is the most suitable for pricing, hedging and risk estimation. Only with proper risk management process the institutions can follow the strict standards of a relevant supervisor body. Necessary part of risk management is financial time series modelling, which is a challenging task due to specific features of data series, such as unpredictable rare events, which can lead to huge losses (drops in the portfolio value), non-symmetry of the returns (large decline in the price is mostly followed by moderate increases), specific patterns of dependency functions of multivariate portfolios (Pearson linear coefficient of correlation is not sufficient to estimate the risk level properly). The decision making units in financial institutions consider various criteria, the most important being the correctness of the obtained results. Notwithstanding, some complex decision making tasks require model evaluation under various circumstances or with different input data. In most cases it happens that a model, which seems to be perfect under given settings, is outperformed by another model, when the conditions change, and that there is no model that dominates under all circumstances. In this paper we extend our previous results on the topic by application of suitable MCDM techniques.

Keywords: financial institution, market risk, multicriteria decision making, ranking, stochastic process

Yugi Watanabe (University of Tsukuba), Noi Kashimoto (University of Tsukuba) and Sumika Arima (University of Tsukuba). *PRODUCTION AND JOB ROTATION PLANNING CONSIDERING DISABILITIES AND HEALTH CONDITIONS.*

Abstract. In the manufacturing industry, there exists a gap between production planning and daily production outcomes. Managing this discrepancy to nearly zero has been a long-standing challenge for companies, aimed at enhancing execution accuracy. Traditional production plans often fail to adapt to employees' abilities and daily conditions, being primarily based on organizational targets to be broken down. Additionally, with the projected 10% workforce reduction over the next decade in Japan as the fastest aging society, there is a need for new mechanisms to maintain high productivity without overburdening the limited workforce. This study focuses on the human factors causing discrepancies in manufacturing and aims to optimize plans to reduce this gap. Considering the variance in workload due to age and health, we strive to equalize the burden among employees. Applying the NSGA-II (Non-dominated Sorting Genetic Algorithm II) metaheuristic approach, we optimize a multi-objective problem for maximum production, minimum total workload, and minimum workload disparity. Numerical results demonstrate that our proposed method effectively maintains high productivity while significantly reducing total and differential workloads. Note that similar results were found performance evaluation of the six different production lines with different conditions and randomity. In other words, we can say that the reproducibility that does not depend on the model itself is confirmed. Furthermore, using task distribution bias as an indicator, we can select solutions that not only meet production requirements but also evenly distribute tasks, thereby efficiently developing human resources. Future challenges include incorporating real-world analysis results of the impact of human factors, which were virtually set in this study, to develop a more realistic model. Additionally, we aim to investigate why both positive and negative correlations appear in task distribution bias, which has a strong correlation with production numbers, total workload, and workload disparity.

Keywords: Production Plan, Human Factors, Multi-objective optimization, Workload disparity

Ahmed Saad (Khalifa University), Mecit Simsekler (Khalifa University), Abroon Qazi (American University in Sharjah) and Mohammed Omar (Khalifa University). *Exploring Cancer Patient Experience Dynamics Using Bayesian Belief Network Analysis: Opportunities and Challenges.*

Abstract. The trajectory of cancer patients is marked by a multifaceted journey, including diagnosis, medical consultations, in-hospital and home-based treatments, and the post-treatment phase. Ensuring a positive experience throughout this complex journey is imperative for delivering high-quality care to cancer patients. Despite numerous studies recognizing diverse factors influencing Cancer Patient Experience (CPE), there has been a lack of research systematically exploring the interrelatedness among these factors and their relative importance in cancer patient experience outcomes. This study reviews the current approaches used for assessing CPE and evaluates the potential use of Bayesian Belief Network (BBN) models in visually mapping the CPE network, highlighting the probabilistic interactions among influencing factors. Additionally, it emphasizes the impact of various k-means discretization approaches in the model. This study can assist healthcare providers and managers in better understanding the complex nature of the patient journey and leveraging data-driven BBN models with sensitivity and scenario analysis to analyze CPE within dynamic health systems in different circumstances.

Keywords: Cancer patient experience, Bayesian Belief Network, Patient satisfaction, Healthcare quality

Ryosuke Saraya (Waseda University), Tokimasa Isomura (Waseda University), Ryotaro Shimizu (Waseda University) and Masayuki Goto (Waseda University). *GAUSSIAN-SAINT: A Probabilistic Predictive Deep Learning Model for Uncertainties with Interpretation from Two Perspectives.*

Abstract. When making decisions based on regression forecasts for high-uncertainty events (stock market, interest rate, horse racing, etc.), there is a high risk of being disadvantaged if the forecast results differ significantly from the actual results. Here, uncertain events refer to those that generate data containing noise that is independently determined by each observed value. Single regression models, such as point estimation that predicts the target variable with a single value, cannot represent noise determined by each input data point, making them insufficient as a basis for decision-making that considers uncertainty. On the other hand, distribution estimation models can represent uncertainty in uncertain events by estimating noise as variance within a probability distribution.

Simple methods such as Bayesian linear regression, Gaussian process regression, and tree-based methods like NGBoost exist as distribution estimation models but lack model interpretability. In particular, when dealing with tabular datasets, which consist of different types of variables, such as continuous and categorical variables, and have structural information in both row and column directions, it is challenging to provide interpretability regarding their correlations. Meanwhile, using two types of attention mechanisms, the Self-Attention and Intersample-Attention Transformer (SAINT), achieves high-precision predictions and intuitive interpretations for tabular datasets. However, SAINT's focus on point estimation limits its utility in contexts where probabilistic forecasts are essential. Therefore, this study proposes Gaussian-SAINT, which enables distribution estimation for tabular data and allows for multifaceted interpretation of prediction results directly from the model using its two attention mechanisms. We conducted an evaluation experiment using real-world data to observe Gaussian-SAINT results and analyzed the outcomes. Furthermore, we confirmed that Gaussian-SAINT can contribute to decision-making by providing multifaceted interpretations of the experimental results using two types of attention mechanisms. This demonstrates the usefulness of the proposed method for both probabilistic prediction and decision-making using interpretations obtained directly from the model, which conventional methods were insufficient.

Keywords: Probabilistic Prediction, Transformer, Uncertainties, Interpretable AI, Business Analytics

Natalie Haskell (QUT School of Design), Muge Belek Fialho Teixeira (QUT School of Architecture and Built Environment), Marianella Chamarro-Koc (QUT School of Design), Wei Win Loy (QUT School of Design), Komal Chhikara (QUT School of Mech., Medical & Process Engineering), Sinduja Suresh (QUT School of Mech., Medical & Process Engineering), Marie-Luise Wille (QUT School of Mech., Medical & Process Engineering,), Brigitte Hughes (QUT School of Teacher Education and Leadership,), Paige Little (QUT School of Mech., Medical & Process Engineering) and Amanda Beatson (QUT School of Advertising, Marketing & Public Relations,).
ENHANCED SUPPLY CHAIN 5.0 ADVANCED MANUFACTURING WORKFLOWS FOR REGIONAL HEALTHCARE RESILIENCE.

Abstract. The future of health care is changing led by advanced manufacturing, digital transformation technologies and workflows that allow for mass customisation and equitable access. These enabling technologies and workflows contribute to enhanced Supply Chain 5.0 eco-systems that respond to the complex needs of remote areas and regional communities. The three drivers of Supply Chain 5.0: resilience, sustainability and human centricity are central to the shifts evident in supply chains adapting to Industry 5.0. These drivers become even more important when looking at regional health care delivery and the manufacturing of mass customised solutions, as the remoteness can provide additional challenges to traditional supply chain approaches. Advanced manufacturing leaders facilitate these future-focused health care systems that are driven by digital transformation, with advanced manufacturing enabling technologies as core components of mass customisation and point of care data collection and manufacturing workflows. The Australian context is explored, to demonstrate how embedded Additive Manufacturing (AM) digital workflows for high volume manufacturing within healthcare applications for personalised orthotics can enhance supply chains in regional contexts. Supply Chain 5.0 drivers of resilience (SCR), human-centricity (HCSC) and sustainability (SCS), are used to map AM capabilities within a local company to create an evidence-based approach for emphasising key characteristics for Supply Chain 5.0 viability in regional settings.

Keywords: Supply Chain 5.0, Industry 5.0, Supply chain resilience (SCR), Supply chain sustainability (SCS), Human-centric supply chain (HCSC), Regional, Healthcare, Additive Manufacturing, Advanced Manufacturing, Mass Customisation

Siqing Shan (School of Economics and Management, Beihang University), Jingyu Su (School of Economics and Management, Beihang University), Yinong Li (School of Economics and Management, Beihang University) and Ziyi Wang (School of Economics and Management, Beihang University). *IDENTIFICATION OF DISASTER DEMAND INFORMATION: A HEURISTIC-BASED DEEP LEARNING MODEL.*

Abstract. Accurate identification of disaster need information is critical to the timeliness and effectiveness of disaster relief efforts. Although social media platforms become an important channel for information dissemination during disasters, it is still a challenge to quickly identify critical need information from them. Existing research mostly focuses on the techniques of recognizing information, but tends to ignore the actual situation of data surge and time constraints during emergencies. To fill this research gap, this paper proposes a heuristic-based deep learning model that aims to improve the efficiency and accuracy of recognizing disaster demand information. By using a real-world disaster dataset, we trained and tested the model. The experimental results show that our proposed model has significant improvements in accuracy compared to existing methods. The model proposed in this study will provide relevance and effectiveness for disaster relief operations and contribute to the development of the disaster management field.

Keywords: disaster management, key information identification, deep learning, heuristic algorithm

Takahiro Uemukai (Graduate School of Creative Science and Engineering Waseda University), Ryotaro Shimizu (Institute of Data Science, Waseda University Waseda University) and Masayuki Goto (School of Creative Science and Engineering Waseda University). *Zero-Shot Explainable Time Series Forecasting based on Large Language Model.*

Abstract. Previous works have suggested that GPT-3 and LLaMA-2 perform well in zero-shot time series forecasting by encoding time series data as strings of numbers and treating them as next-token forecasting problems using large-scale language models (LLMs). These models have the same or better accuracy than conventional time series forecasting models because they naturally capture characteristics such as the diversity and seasonal patterns of time series data. However, these methods rely too much on periodicity and patterns, making it difficult to make accurate predictions when sudden events occur or patterns break down. This paper proposes a paradigm that leverages LLM's ability to handle text and numerical data simultaneously and improves prediction accuracy for complex time data by providing supplementary information. Specifically, it is possible to enable highly accurate predictions by explicitly inputting the statistical characteristics of time series data and important descriptions of the data set into LLMs and incorporating them into prompts. In addition, we explore the possibility of performance improvement of explainability, which allows prediction results to be explained in natural language. In time series forecasting using LLMs, numerical data are treated as individual tokens, and each numerical token is independent, making it difficult for the model to explain relationships and patterns between numbers in natural language. Therefore, we propose a new paradigm that can consider the relationships of numerical tokens to improve the explainability of prediction reasons. Our paradigm enables effective and highly accurate time series prediction for complex time data on the zero-shot situation and further improves the explainability of the prediction model.

Keywords: Large Language Models, Time Series Forecasting, Zero-shot Learning, Explainable AI, In Context Learning

Siqing Shan (School of Economics and Management, Beihang University, Beijing, China), Ziyi Wang (School of Economics and Management, Beihang University, Beijing, China), Yinong Li (School of Economics and Management, Beihang University, Beijing, China) and Jingyu Su (School of Economics and Management, Beihang University, Beijing, China). *Design and Implementation of a Supply Chain Performance Evaluation System Based on Profiles in the Big Data Environment.*

Abstract. This paper presents the design and development of a supply chain performance evaluation system based on big data and data profiling techniques. The objective is to address the inefficiencies and lack of effective evaluation system support in supply chain management for manufacturing enterprises. The system aims to optimize supply chain management and provide decision support through performance evaluation.

The paper begins by discussing the importance of supply chain management and the necessity of performance evaluation. It then analyzes the requirements of the system, followed by the system design. This includes the overall architecture design, with a specific focus on the design of the supplier profiling algorithm and the supply chain performance evaluation algorithm. Finally, the paper describes the implementation of the system and presents the results of testing, validating the effectiveness of the system. The supply chain performance evaluation system can support supplier performance evaluation and selection decision, and help enterprises improve the efficiency and quality of supply chain management, thus benefiting supply chain elasticity.

Keywords: Supply chain management, Supply chain performance evaluation, Supplier profiling, System implementation

Kosuke Sakurai (Waseda University), Ryotaro Shimizu (Waseda University) and Masayuki Goto (Waseda University). *PRIORITY DATA AUGMENTATION BASED ON REGIONAL EMBEDDING WITH VISION-LANGUAGE MODEL.*

Abstract. Collecting “high-quality” training data for all possible domains in image classification task is both time-consuming and costly. Latent augmentation using Regional Embedding (LARE), which was proposed as a data augmentation method, facilitates cost-effective and rapid data augmentation across various possible domains on the latent space trained by vision-language models such as CLIP and CoCa. Augmenting data on latent space not only reduces labeling costs and training time from real images but also leverages the semantic and domain knowledge of images embedded in vision-language models. Regional embedding of LARE enables to be extensive and persistent data augmentation by sampling data (latent vectors) from regions within the latent space. It enhances accuracy even for unseen domains not included in the original training data. However, generating large amounts of data in the latent space at high speed can also produce poor quality or redundant (e.g., already trained) data, leading to inefficient training and reduced target model performance. Moreover, since data augmentation is conducted on the latent space, filtering based on visual information is impossible. To address this problem, we propose Priority Latent Augmentation using Regional Embedding (PLARE), which integrates a data selection method based on Reducible Holdout Loss (RHO-Loss) into LARE to filter only “high-quality” data from the large augmented dataset within the region created by LARE. The proposed method involves an active model learning process that preferentially selects data that the current model cannot confidently classify. By prioritizing essential data for training, PLARE achieves “high-quality,” “low-cost,” and “robust” data augmentation, enabling image classification that adapts to various unseen domains. Our evaluation experiment results show that PLARE outperforms the standard fine-tuning model CoCa by up to 1.7% and surpasses LARE by up to 0.4% in image classification accuracy for unseen domains on the CUB-Painting data set.

Keywords: Data Selection, Data Augmentation, Domain Adaptation, Vision-Language Model, Image Classification, Regional Embedding

Josephine German (Mapua University), Anak Agung Ngurah Perwira Redi (Sampoerna University), Ardvin Kester Ong (Mapua University), Michael Young (Mapua University), Kristien Paola Robas (Mapua University), Maria Angelica Bare (Mapua University), Deceree Anne Haboy (Mapua University) and Matthew Solivio (Mapua University). *CONSUMER PREFERENCE ANALYSIS OF HEAVY-DUTY TRUCKS (HDT) FOR FREIGHT TRANSPORT IN THE PHILIPPINES: AN APPLICATION OF CONJOINT ANALYSIS.*

Abstract. The transportation sector performs an essential role in delivering goods and services. Heavy-duty trucks are highly utilized for freight distribution due to their capacity and cost-efficiency. Therefore, it is critical to identify the attributes of a roadworthy truck to ensure the timely delivery of goods and services and the driver's safety and its environment. This study examined the customers' preferences in purchasing heavy-duty trucks using a conjoint analysis approach. The study considered the attributes and various levels of brand, driver-eye height, loading capacity, price, tank-to-wheel emissions, and fuel efficiency. Results indicate that tank-to-wheel emissions (54.81%) are considered the most significant, followed by brand (31.96%), fuel efficiency (6.69%), price (4.37%), driver eye height (1.88%), and loading capacity (0.30%). Filipino consumers demonstrate significant interest in using a sustainable transportation mode to satisfy freight shipment to its clients. In addition, customers in the Philippines showed a willingness to sacrifice the price if the type of heavy-duty truck purchased is trustworthy, sustainable, and efficient. The findings contribute to identifying the customers' preferences on heavy-duty trucks for goods delivery in the Philippines. The study also presents suggestions to manufacturers of the transportation industry to consider sustainability in the design of their products. The results and implications considered in this study may be applied and extended by other transportation sectors worldwide.

Keywords: Transportation, Heavy-duty trucks, Sustainability, Tank-to-Wheel Emission, Conjoint Analysis

Rahmad Inca Liperda (Universitas Andalas), Deffanda Vista Putri (Universitas Pertamina), Anak Agung Ngurah Perwira Redi (Sampoerna University), Meilinda Maghfiroh (Muscat University), Josephine German (Mapua University) and Filscha Nurprihatin (Sampoerna University). *GIS-INTEGRATED OPTIMIZATION OF ELECTRIC AMBULANCE ROUTES FOR EMERGENCY EVACUATION.*

Abstract. An efficient yet sustainable mass evacuation process is crucial, especially in disaster-prone areas. This study examines the integration of Geographic Information System (GIS) and optimization to enhance electric ambulance routing in emergency evacuation scenarios. This study primarily focuses on the Multi-Depot Electric Vehicle Routing Problem with Specialty and Priority (MDEVRPSP). It highlights the crucial importance of GIS in developing effective routing and recharging strategies. The GIS capabilities to conduct spatial analysis and visualization are expected to improve decision-making in the routing decisions from depots to assembly points and healthcare facilities. This study also covered the analysis of the initial State of Charge (SoC) level's impacts in operational efficiency, particularly in environments with limited charging infrastructure during emergencies. The findings emphasize the ability of GIS for distance minimization while maximizing electric ambulance utilization. The level of initial SoC is shown to impact the distance covered, which leads to the need for sufficient initial SoC for a promising evacuation process. Nevertheless, this study can be used as a base for decision-makers to consider the use of electric ambulances. Future directions include the need for incorporating dynamic routing that captures actual emergency situation, utilizing Artificial Intelligent (AI) for larger problem sets, and considering stochastic evacuee number. This study contributes to advancing transportation electrification applications in emergency management to improve evacuation times and allocation of vehicles.

Keywords: Emergency Evacuation, GIS-based Optimization, MDEVRPSP, Electric ambulances

Siqing Shan (Beihang University), Yangzi Yang (School of Economics and Management Beihang University, Beijing, China) and Yinong Li (Beihang University School of Economics and Management). *HOW PRODUCTS' ATTRIBUTES AFFECT ONLINE REVIEW USEFULNESS: FROM THE PERSPECTIVE OF COMPETITORS.*

Abstract. Online reviews have been demonstrated to be influential signals for consumers' purchase decisions. However, the role of spillover effects generated from online reviews of competitive products remains largely unexplored. We investigate the impact of attribute attention (AA) of competitive products on online review usefulness (ORU) from the perspective of spillover effects. Using LDA modeling, we identify topics of headphone product attributes: quality, design, battery, material, logistics, and service. Then, we construct a multiple regression model and further consider the interaction effects. Our results show that AA of competitive products has a negative role on the ORU of the focal products. Both ORP and interaction (AA, ORP) of competitive products significantly negatively affect the ORU of the focal products. Our findings could help platforms optimize online review mechanisms and provide theoretical inspiration for online review research.

Keywords: Online reviews, Spillover effect, Competition, Online review usefulness

Siqing Shan (School of Economics and Management, Beihang University), Guanxiong Wang (School of Economics and Management, Beihang University) and Jin Qian (School of Economics and Management, Beihang University). *Technology Foresight based on Technology Tree: Evidence from Aircraft Engines.*

Abstract. Aircraft engines are pivotal in modern aviation, significantly impacting performance and safety. Their innovation drives advancements in aeronautical engineering and related fields, promoting industrial and scientific progress. This study uses the PatSnap database to forecast technology in aircraft engines, involving data preprocessing, topic modeling, keyword extraction, technology tree construction, and model performance analysis. Approximately 9,900 records were preprocessed and analyzed using LDA and KeyBERT, determining five optimal topics. A technology tree was constructed through literature review and OpenNRE extraction, achieving iterative growth. The hybrid forecasting method showed high accuracy, with an average similarity of 0.8302 and precision, recall, and F1 scores around 0.85. The study integrates datasets to forecast technology, offering theoretical and practical significance by improving research efficiency and driving key breakthroughs in aircraft engines.

Keywords: Technology Foresight, Technology Tree, Patent Data, LDA, Aircraft Engine

Siqing Shan (School of Economics and Management, Beihang University), Yinong Li (School of Economics and Management, Beihang University), Yangzi Yang (School of Economics and Management, Beihang University) and Jingyu Su (School of Economics and Management, Beihang University). *COMPARATIVE STUDY ON THE INTENSITY OF GLOBAL ENERGY TRANSITION POLICIES BASED ON MULTI-DIMENSIONAL EVALUATION FRAMEWORK.*

Abstract. Energy transition is an important way to cope with climate change and achieve sustainable development. This paper proposes a multi-dimensional energy transition policy intensity evaluation framework covering policy sentiment, type, goal, tool, and field, and based on this framework, it uses text mining technology to quantitatively evaluate and internationally compare 3005 energy transition policies of 26 major economies worldwide from 2000 to 2022. The research finds that the United States, China, Australia, Germany and other countries are the leaders of global energy transition policies; the overall release of energy policies in various countries shows a gradual increasing trend, but there are significant differences in the focus and implementation intensity of energy policies in different countries, which not only reflects the actual needs of energy transition in various countries, but also reflects the close connection between energy policies and economic and social development. This paper provides new ideas and methods for comparative research on transnational energy policies, and provides decision-making reference for promoting global energy transition and climate governance.

Keywords: Energy transition, policy intensity, text mining, sentiment analysis

Anuj Kumar Goel (Indian Institute of Technology Kharagpur) and Vallayil Narayana Achutha Naikan (Indian Institute of Technology Kharagpur). *LOW-COST ACOUSTIC APPROACH FOR CONDITION MONITORING OF NOISY ROTATING INDUSTRIAL MACHINERY.*

Abstract. Rotating machinery is critical across many industries, but its operation poses safety risks necessitating effective condition monitoring (CM) for preventive maintenance. This research innovatively investigates using a low-cost electret lavalier microphone (LCELM) coupled with advanced signal processing for acoustic-based CM. The proposed methodology extracts rotational speed information - a key parameter for diagnosing common faults like unbalance, misalignment and bearing defects. The innovative approach integrates spectral kurtosis for optimal filtering to detect transient components, and Hilbert transform for demodulating the signal to extract modulating frequency components related to rotational speeds. This unique combination of techniques enables accurate speed estimation from the acoustic data acquired by the low-cost microphone in harsh industrial environments with high ambient noise levels. Rigorous experimental testing on a rotating machine test rig is used to validate the methodology across varying speeds and microphone distances. A grading rubric assessed the clarity of the rotational peaks, revealing improved detectability at higher speeds and closer microphone proximities. Insightful 3D surface plots mapped this relationship while also indicating optimum microphone distances for maximizing information extraction under different operating conditions. Stringent statistical analysis confirmed the repeatability of the experimental results. This research presents a pioneering, low-cost solution for industrial acoustic CM, overcoming the high costs of conventional systems. The innovative integration of techniques enables widespread adoption across cost-sensitive sectors for improving machinery reliability and safety.

Keywords: Rotating Machinery, Condition Monitoring, Acoustic Analysis, Low-cost Sensors

Siqing Shan (Beihang University), Jin Qian (Beihang University) and 冠雄 王 (Beihang University). *Design and Implementation of Equipment Fault Diagnosis System Based on Deep Learning and Knowledge Graphs.*

Abstract. With the rapid development of industrialization and technology, various types of equipment are increasingly used in various fields, driving productivity and economic growth. However, the increase in equipment complexity has brought about failure problems that not only affect production, but also may lead to safety accidents. Therefore, it is crucial to establish an efficient and accurate equipment fault diagnosis system. Currently, equipment fault diagnosis faces two major problems: first, the diagnostic system cannot directly utilize unstructured knowledge such as natural language. The second is how to effectively organize, manage and utilize this knowledge to support fault troubleshooting. To solve these problems, this study designs and implements a deep learning model based on BERT-GRU for automatically extracting entity information related to equipment faults, and constructs a knowledge graph for equipment fault diagnosis based on it, storing the extracted entity information in a graph database. Based on the knowledge graph, a question and answer system and a report matching system are designed to realize multi-dimensional fault diagnosis. Experimental results show that the system exhibits high accuracy in the entity extraction task, the information of the constructed knowledge graph is clear and accurate, and the related reasoning is basically effective.

Keywords: Equipment Failure, Information Systems, Deep Learning, Knowledge Graph, Diagnostic Reasoning

Xinyan Zhang (School of Professional Education and Executive Development, The Hong Kong Polytechnic University) and Pimtong Tavitiyaman (School of Professional Education and Executive Development, The Hong Kong Polytechnic University). *The effects of big data analytics on hotel supply chain resilience and employee-centered social performance.*

Abstract. The new global reality that has emerged from the COVID-19 pandemic crisis has accelerated technology adoption and called for more resilient supply chains. Big data analytics (BDA) can help businesses achieve better performance. But the benefits of BDA on social performance are not clear. The purpose of this paper is to understand how BDA technology affects hotel supply chain resilience (SCR) and employee-centered social performance in the presence of the COVID-19 pandemic. Results from a survey of 108 hotel managers in Hong Kong indicated a positive influence of BDA adoption on hotel SCR, which in turn positively influenced employee outcomes, in the context of COVID-19 disruption.

Keywords: Big data analytics, hotel supply chain, supply chain resilience, hotel employee, social performance, COVID-19

Le Minh Hien Nguyen (University of Technology Sydney), A S M Monjurul Hasan (University of Technology Sydney) and Andrea Trianni (University of Technology Sydney). *INVESTIGATION OF FAMILIARITY, BARRIERS, AND DRIVERS TO INDUSTRY 4.0 TECHNOLOGIES– AN ANALYSIS THROUGH THE LENS OF SUSTAINABILITY IN THE MANUFACTURING INDUSTRIES .*

Abstract. This research aims to investigate the familiarity of Industry 4.0 (I4.0) technologies concept for sustainability, drivers and barriers to implementing I4.0 for sustainability, and the applications of I4.0 for sustainability practices within Australian manufacturing companies. This study shows that the majority of the sampled manufacturing companies are aware of I4.0 for sustainable performance. Simultaneously, this study shows that “lack of time or other priorities”, “difficulty in implementing technical interventions”, “lack of technical knowledge”, and “access to capital” are the major barriers to I4.0 technologies for sustainability. On the contrary, a wide range of drivers have been identified, including “predictive maintenance”, “efficiency and cost reduction”, and “resource efficiency and conservation”. The study also reflects that the significant applications of I4.0 for sustainability domains are “monitoring and measuring”, “smart manufacturing”, and “predictive maintenance”. This paper can play a critical role in providing initial insight for researchers, and industrial decision makers in supporting the manufacturers adopting I4.0 in the context of sustainability. The paper concludes with future research directions.

Keywords: Industry 4.0, Sustainability, Drivers, Barriers, Australia.

Vidura De Silva (University of Moratuwa), Buddhi A. Weerasinghe (Erasmus University Rotterdam) and H. Niles Perera (University of Moratuwa). *OPTIMIZING QUAYSIDE TRUCK ALLOCATION: AN EXPERT SYSTEM APPROACH TO ENHANCE DISCHARGING OPERATIONS PLANNING IN CONTAINER TERMINALS.*

Abstract. This research investigates optimizing discharging truck allocation at container terminals, and key hubs in global maritime logistics, using a fuzzy logic approach to enhance container movements from ship to shore. Traditionally, truck allocation for discharging operations has been managed manually by ground handling staff based on real-time operational conditions. Our current model automates this process. Addressing the complexities of quayside operations, the study proposes a model that adapts to operational variables, potentially reducing bottlenecks and increasing terminal throughput. This industrial engineering effort advances both academic knowledge and practical strategies for improving operational efficiency in container terminals amid rising global trade volumes. Utilizing fuzzy logic for its adaptability and interpretability, the research provides a computational methodology suitable for the complex nature of quayside operations. Key processes include fuzzification, inference, and defuzzification, transforming raw data into actionable insights. Data were meticulously collected from two container terminal at a leading South Asian port where this study was conducted, ranked among the top 30 global ports. The study employed the Fuzzy Logic Toolbox in MATLAB and Python programming language to integrate a rule-based structure effectively. The findings underscore the critical role of discharging truck allocation as a well-established planning function within quayside operations, enhancing terminal efficiency and operational integration. Additionally, our model demonstrates the capability to integrate seamlessly with the Terminal Operating System (TOS), regardless of the initial truck allocation method used by the TOS. Future research should focus on developing more dynamic and integrated operational planning systems, which are essential for further improving efficiency and effectiveness in container terminal operations.

Keywords: Port optimization, quayside planning, discharging operations, truck allocation, fuzzy logic

Refentse Selepe (TSHWANE UNIVERSITY OF TECHNOLOGY), Thomas Munyai (TSHWANE UNIVERSITY OF TECHNOLOGY) and Olasumbo Ayodeji (UNIVERSITY OF JOHANNESBURG). *AN AHP-BASED RESOURCE ALLOCATION FRAMEWORK TO PRIORITISE FACTORS INFLUENCING POOR SUPPLY CHAIN QUALITY IN A MANUFACTURING COMPANY* .

Abstract. Due to shortage of resources (financial, physical, technological, and human), organisations come up with strategies on how to allocate resources to better benefit the organisation while remaining profitable and competitive. Supply chain processes are considered the cornerstone processes for businesses, thus efficient management of supply chains can enhance companies' competitive advantage and improve profitability by minimising cost. The Manufacturing Company considered in this study experienced an increase in operating costs due to poor supply chain quality influenced by inventory stock-out, management decisions, process deviations, longer lead times, unreliable suppliers, unreliable enterprise resource planning (ERP) system issues, inefficient communication, labour issues, environmental and political issues. Hence, the purpose of this study is to prioritise these factors in terms of importance using the Analytic Hierarchy Process (AHP) method with a view to manage and allocate resources to mitigate these supply chain challenges accordingly. The AHP results revealed that management decisions are the most important factors with a weight of 0.14, followed by inventory stock-out, process deviations, longer lead times and labour issues with a weight of 0.12 each, then supplier, political issues, inefficient communication, environmental and enterprise resource planning issues with weights of 0.11, 0.09, 0.08, 0.05 and 0.05 respectively. Based on these weights and importance of each factor, this manufacturing company can streamline their resource allocation procedures, which promote more strategic investments and increased performance in all areas of business operations.

Keywords: Resource allocation, AHP Method, Supply chain challenges, Supply chain quality.

Zhao He (Beihang University), Shenghan Zhou (Beihang University), Xu Chen (Beihang University), Jingxiao Wen (Beihang University) and Wenbing Chang (Beihang University). *The UAV risk prediction method based on CWGAN-GP and CNN.*

Abstract. The paper proposes a method based on CWGAN-GP and CNN for solving the problem of low model accuracy due to data imbalance in UAV risk prediction. Firstly, the conditional Wasserstein GAN with gradient penalty is used to generate the scarce abnormal samples in the original dataset. Secondly, the generated samples are combined with the original samples to obtain the expanded dataset. Finally, the expanded dataset is used to train the convolutional neural network model for risk prediction. The study conducts experiments on a real dataset called ALFA. The results show that the CWGAN-GP model can generate high-quality samples, which can be combined with CNN to implement a good risk prediction effect.

Keywords: CWGAN-GP, CNN, Data augmentation, Risk prediction

Abu Hashan Md Mashud (University of New South Wales,Canberra,Australia), Ripon K. Chakrabortty (School of Systems & Computing, UNSW Canberra at ADFA) and Omar K. Hussain (School of Business, UNSW Canberra at ADFA). *MITIGATING PRODUCTION DISRUPTIONS AND ENVIRONMENTAL IMPACT: STRATEGIES FOR SUSTAINABLE OPERATIONS.*

Abstract. Production disruptions significantly impact profitability and customer satisfaction in today's competitive business environment. The manufacturing system efficiency significantly hampers due to disruptions whether disruptions caused by human error or natural events. However, approaches to mitigate disruptions and reduce weakness within manufacturing supply chains remain poorly understood. This paper introduces a model that addresses multiple disruption has the production process, which not only delay orders but also has devastating social impacts, affecting economic stability. We propose linking the existing carbon tax policy with our model to demonstrate its economic and social benefits. In this model, social welfare is tied to the manufacturer's sales revenue; investing in social welfare can enhance the opportunity to receive more tax rebates and minimize the risk of penalty taxes up to a certain level. We also meticulously envisaged how optimum carbon cap investment can play an important role in profit maximization and emission minimization. In this conference paper, we aim to illustrate the interrelation of disruptions with carbon emissions, carbon tax policy, and social consequences.

Keywords: production disruption, carbon emission, imperfect production, social welfare

James C. Chen (Dept of Industrial Engineering and Engineering Mgmt, National Tsing Hua University, Hsinchu 30013, Taiwan, ROC), Tzu-Li Chen (Graduate Institute of Intelligent Mfg Tech, National Taiwan University of Science and Tech, Taipei 10608, Taiwan, ROC), Yuan-Ying Wang (Dept of Industrial Engineering and Engineering Mgmt, National Tsing Hua University, Hsinchu 30013, Taiwan, ROC), Wen-Han Chang (Department of Emergency Medicine, Mackay Memorial Hospital, Taipei 10449, Taiwan, ROC), Weide Tsai (Department of Emergency Medicine, Mackay Memorial Hospital, Taipei 10449, Taiwan, ROC), Chun-He Yun (Department of Medical Records and Medical Imaging, Mackay Memorial Hospital, Taipei 10449, Taiwan, ROC), Ji-Cheng Wang (Department of Medical Records and Medical Imaging, Mackay Memorial Hospital, Taipei 10449, Taiwan, ROC) and Fong-Chyuan Sieh (Department of Medical Records and Medical Imaging, Mackay Memorial Hospital, Taipei 10449, Taiwan, ROC). *Dynamic Appointment Scheduling for healthcare system with Patient No-Shows, Unpunctuality, and Overbooking.*

Abstract. Patient unpunctuality and no-shows are inevitable, significantly disrupting healthcare facilities operations. The uncertainties in the appointment process not only increase patients waiting time but also lower resource utilization, such as equipment and human resources. Many previous studies assumed patients were punctual if they showed up. However, for most healthcare systems, patients sometimes arrive later than the appointment time, which should be considered in the appointment scheduling. With overbooking, the healthcare system can mitigate the negative impact of patients' unpunctuality and no-shows.

This study formulates the stochastic optimization problem for appointment scheduling in a multiple-server healthcare system, incorporating patient behavior such as unpunctuality and no-shows. A Markov Decision Process (MDP) is proposed to optimize scheduling decisions that determine appointment patient numbers in each slot. The objective is to maximize the total profit the system receives each day. Given the large state space size, simulation-based Approximate Dynamic Programming (ADP) is proposed to solve the scheduling problem. Combining the techniques of post-decision state variables and aggregation, the algorithm significantly reduces the computation time and obtains near-optimal solutions.

To demonstrate the performance and effectiveness of the proposed algorithm, it is applied to three scenarios and compares the results with the optimal solutions and other baseline policies. Sensitivity analysis is conducted under different parameter settings, revealing that in most cases, the proposed algorithm provides the second-best policy after the optimal solutions. Finally, the effectiveness and insights of overbooking are proposed to hospital managers based on the scheduling outcomes.

Keywords: Dynamic Appointment Scheduling, Overbooking, No-Show, Unpunctuality

Mohammad Sarwar Morshed (Department of Mechanical and Production Engineering, Ahsanullah University of Science and Technology, Dhaka, Bangladesh), Md. Asif Mustafa (Department of Mechanical and Production Engineering, Ahsanullah University of Science and Technology, Dhaka, Bangladesh), Mongsathowai Marma (Department of Mechanical and Production Engineering, Ahsanullah University of Science and Technology, Dhaka, Bangladesh), Md. Mahfujul Haq (Department of Mechanical and Production Engineering, Ahsanullah University of Science and Technology, Dhaka, Bangladesh) and Abu Hamja (Department of Mechanical and Production Engineering, Ahsanullah University of Science and Technology, Dhaka, Bangladesh).
IMPLEMENTATION OF MACHINE LEARNING IN PRODUCT DEVELOPMENT IN LEATHER MANUFACTURING INDUSTRY TO IMPROVE PRODUCTIVITY AND EFFICIENCY .

Abstract. Improving productivity and efficiency in the fiercely competitive leather manufacturing sector requires optimizing product development procedures. Much resources and time get wasted during experimental trial-error setup in leather product development. This paper explores the application of machine learning (ML) techniques to predict the final properties of leather during the product development phase. By leveraging a comprehensive dataset based on lab experiments that includes chemical recipes, runtime of paddle drum, pH levels, and temperature conditions, this research aims to accurately predict key leather characteristics such as shrinkage temperature, tensile strength, percentage of elongation and tear strength, which are crucial optimization to follow in a successful leather manufacturing. This study utilizes various machine learning models, including regression and classification algorithms and deep neural networks, to analyze the relationships between input variables and leather properties. Integrating these predictive models into the manufacturing workflow enables a data-driven approach, reducing the need for extensive trial-and-error in experimental setups. This approach not only accelerates the development cycle but also ensures consistent quality and resource efficiency. Results from our experiment demonstrate that machine learning can significantly enhance the predictive accuracy of leather properties, providing manufacturers with valuable insights into the optimal process parameters. By implementing ML algorithms, the leather industry can streamline production, minimize waste, and better align with desired product specifications. This research underscores the potential of advanced data analytics to revolutionize traditional manufacturing practices and pave the way for more intelligent and responsive product development strategies.

Keywords: Machine Learning, Leather Manufacturing, Product Development, Predictive Modeling, Process Optimization, Data Analytics

Khaled M Toffaha (Khalifa University), Mecit Can Emre Simsekler (Khalifa University), Laurette L Bukasa (Sheikh Shakhbout Medical City) and Mohammed Omar (Khalifa University). *Predicting Cervical Cancer Risk Using Machine Learning and Bayesian Belief Networks.*

Abstract. Cervical cancer remains a significant global health concern, emphasizing the need for improved risk stratification and early detection methods. This study presents a comprehensive approach to cervical cancer prediction using advanced machine learning (ML) techniques and Bayesian Belief Networks (BBNs), showcasing the potential of digital technologies in transforming healthcare and education in the emerging digitized society.

We analyzed a dataset of 858 patients, addressing challenges such as missing data, class imbalance, and complex feature interactions - issues that are increasingly relevant in the era of big data and digital transformation. Our methodology incorporated cutting-edge data science techniques, including multiple imputation methods, feature selection techniques, and class imbalance treatments. This approach not only advances medical research but also highlights the evolving skill sets required in the workforce of the future, where data literacy and AI proficiency will be crucial.

Results demonstrated high predictive accuracy across different cervical cancer screening tests, with the combined target model achieving an accuracy of 95.6%, an AUROC of 0.958, and an F1-score of 0.945. The BBN, constructed using the optimal BART model, achieved a 91.3% positive prediction rate and 86.8% negative prediction rate. These results underscore the potential of AI and machine learning in enhancing decision-making processes across various sectors, including healthcare and education.

This study showcases the potential of combining ML with BBN for cervical cancer risk prediction, potentially improving clinical decision-making and screening strategies. It exemplifies the integration of advanced digital technologies in healthcare, reflecting broader trends in professional practice. The research highlights the growing importance of interdisciplinary collaboration and digital literacy in the medical field and beyond. Future work should focus on external validation, clinical integration, and developing educational programs to implement these advanced risk-predictive models effectively. This approach underscores the need for continuous learning and upskilling in an increasingly digitized society, emphasizing the importance of adapting educational curricula to foster critical thinking and AI literacy across various professional domains.

Keywords: Cervical cancer risk prediction, Digitized healthcare, Future of Healthcare, Bayesian Network, Machine learning

Khaled M Toffaha (Khalifa University), Mecit Can Emre Simsekler (Khalifa University) and Mohammed Omar (Khalifa University). *Review of Hospital Outpatient No-Show Explainable Prediction Using Machine Learning.*

Abstract. Patient no-shows present significant challenges and costs to healthcare systems, prompting a focused exploration of hospital outpatient no-show prediction using explainable machine learning (ML) in this review. The systematic methodology aligns with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring transparency, replicability, and thoroughness. A comprehensive search across major literature databases yielded 92 potential studies on ML models for outpatient no-show prediction. Following screening and eligibility assessments, 51 studies met inclusion criteria, emphasizing outpatient no-shows, leveraging explainable ML, featuring predictive modeling, and reporting quantitative metrics. Examining the publication distribution from 2010 to 2024 reveals a discernible upward linear trend, indicating the growing relevance of this research domain. The preference for more interpretable ML models over time, such as regression, decision trees, and ensemble methods, underscores their transparency and actionability. Despite challenges like limited model generalizability and clinician hesitation, proposed solutions, including collaborative learning and feature engineering pipelines, aim to enhance the reliability and applicability of outpatient no-show prediction models. This comprehensive strategy addresses existing challenges, facilitating the effective integration of explainable ML in healthcare settings and contributing to improved outpatient appointment attendance. In conclusion, this systematic review provides a robust foundation for understanding and implementing explainable ML approaches in predicting hospital outpatient no-shows, offering valuable insights for healthcare practitioners and researchers alike.

Keywords: Patient no-shows prediction, Digitized Healthcare, Decision tree models, Machine learning, Literature review

Jiahang Li (School of Mechanical Science & Engineering, Huazhong University of Science & Technology), Xinyu Li (School of Mechanical Science & Engineering, Huazhong University of Science & Technology), Qihao Liu (School of Mechanical Science & Engineering, Huazhong University of Science & Technology), Yiping Gao (School of Mechanical Science & Engineering, Huazhong University of Science & Technology) and Liang Gao (School of Mechanical Science & Engineering, Huazhong University of Science & Technology). *A fitness-distance selection method for workforce-constrained job shop scheduling problem considering loading/unloading time.*

Abstract. The job-shop scheduling problem (JSP) is one of the most studied problems in production scheduling. The workforce is the most common resource constraint in the workshop. However, the joint optimization of worker flexibility and JSP is currently neglected. Besides, due to the special shapes, production tasks should be loaded or unloaded on the machines. Therefore, the loading/unloading time of the production tasks should be mentioned in the workshop. In this manner, this paper investigates the JSP with worker flexibility and loading/unloading time (JSP-WLU). To this end, this paper proposes a genetic algorithm with fitness-distance selection (GA-FDS), which consists of two parts: 1) several modified crossover and mutation operators are presented to balance between exploration and exploitation, and 2) a fitness-distance selection method for the best individual is proposed to utilize the information from the solution space (distance between the individuals) and the objective space (fitness of the individuals). The proposed algorithm is verified on 20 various scales of JSP instances and compared with four state-of-the-art metaheuristics. The experiment shows that GA-FDS outperforms the comparison algorithms on statistical results. Significantly, the fitness-distance selection method is more powerful in complicated fitness landscapes.

Keywords: Job-shop scheduling problem, Metaheuristic, Selection method, Workforce constraint, Fitness landscape

Youjie Yao (Huazhong University of Science and Technology), Qihao Liu (Huazhong University of Science and Technology), Chunjiang Zhang (Huazhong University of Science and Technology) and Xinyu Li (Huazhong University of Science and Technology). *ENERGY-EFFICIENT JOB SHOP SCHEDULING PROBLEM WITH FINITE TRANSPORTATION RESOURCES AND SETUP TIME.*

Abstract. In production workshops, the transportation of jobs between machines and the setup of machines are common activities. It is essential to consider not only the processing time of jobs but also the constraints of transportation and setup times. Existing studies often overlook these two constraints, which is unrealistic. To address this limitation, this paper investigates the energy-efficient job shop scheduling problem with finite transportation and setup times and proposes an improved discrete teaching-learning-based optimization algorithm (IDTLBOA) to minimize the makespan and total energy consumption. The IDTLBOA employs a task-based three-layer encoding to enable comprehensive mapping of the solution space. Additionally, a research phase is introduced to enhance communication among teachers. A multi-teacher co-teaching strategy is then designed in the teaching phase to improve the algorithm's search capability. Finally, comparison experimental results with other effective multi-objective algorithms verify the effectiveness of the proposed algorithm.

Keywords: energy-efficient scheduling, job shop, transportation time, set-up time

Wei Xiaotong (Tianjin University), He Yingdong (Tianjin University) and He Zhen (Tianjin University). *INTEGRATION OPTIMIZATION BASED ON PRODUCTION QUALITY RISKS AND PREVENTIVE MAINTENANCE FOR SYSTEM WITH HIGH QUALITY REQUIREMENT.*

Abstract. In systems demanding high product quality standards, minimizing post-factory safety and availability issues is paramount. Upon leaving the factory, potential defects often trigger a cascade of failures, underscoring the importance of environmental stress screening (ESS) in mitigating faulty product rates. While many studies focus on equipment deterioration to gauge maintenance actions, acknowledging that production quality risk can precede such deterioration is vital in assessing system abnormalities. Thus, this paper introduces a novel joint optimization strategy integrating environmental stress screening with production quality risk considerations. Initially, it quantifies product production quality risk indices based on deviations in key quality characteristics (KQCs) and potential risks, subsequently applied to preventive maintenance (PM) activities. Following this, a dual inspection method, termed 'KQCs-ESS inspection', has been introduced to incorporate the risk associated with product production quality, and a preventive maintenance model has been formulated. Furthermore, leveraging a value iteration algorithm, the model determines optimal cycle availability (CA) and expected total cost per unit time (ETC) while considering equipment availability (EA) constraints. Finally, through concrete example and sensitivity analysis, the effectiveness of the proposed method is demonstrated, guiding corresponding management decisions.

Keywords: Production quality risk, Environmental stress screening, Early failure, Preventive maintenance, Joint optimization

Jingxiao Wen (Beihang University), Shenghan Zhou (Beihang University), Jiaqi You (China Astronautics Standards Institute), Wenbing Chang (Beihang University) and Linchao Yang (North China Electric Power University). *The UAV Risk Prediction Method Based on time Window Extraction and Flight Data Generation.*

Abstract. This paper proposes a Generative Adversarial Network (GAN) method based on data sequence features for feature extraction from temporal windows and data generation for the prediction of UAV flight risks. This approach addresses the challenge of obtaining substantial flight data within time constraint and lack of similar type of data for reference during the development process of new types of UAV. By employing a time window technique to extract features from flight and utilizing GAN for data generation, this study overcomes the scarcity of flight, particularly the data related to risky incidents. The experimental results based on a real dataset demonstrate that the data generated by the proposed method, when input into an XGBoost classifier for training, can effectively predict the type and timing of risk incidents. Compared to data obtained by traditional GANs based on single time-point data, the generated data shows a distinct advantage. In terms of risk type prediction, the method achieved a F1 score of 0.991, and for the prediction of the timing of risk incidents, it achieved a F1 score of 0.803.

Keywords: Flight Data, Risk Prediction, Generative Adversarial Networks, Temporal Windows, Feature Extraction

Sahil Sahil (Indian Institute of Technology Kharagpur) and Sarada Prasad Sarmah (Indian Institute of Technology Kharagpur, India). *VEHICLE SCRAPPAGE POLICY OPTIMIZATION CONSIDERING CONSUMER INTENTIONS.*

Abstract. Dual objectives of vehicle scrappage programs (VSP) - mitigating vehicular emissions and boosting automobile industry - motivated policymakers around the globe to implement scrappage policies to phase out End-of-Life vehicles. The aim of this study is to determine the optimal policy of participation in VSP from consumer perspective, where the voluntary participation of consumers in VSP is governed by the cost incurred by them. This study employs dynamic programming optimization to determine the optimal policy through which the cost incurred by a consumer in a given timeframe is minimized. Results indicated that the frequent drivers are more readily benefitted from participation in VSP and the monetary benefits offered by the policymakers motivates the consumers to scrap their vehicle earlier. Further, we evaluated an optimal vehicle scrapping policy considering the consumer intentions. Results indicated that considering consumer intentions in the model postpones the scrapping decision of consumer, where they intend to avail maximum utilization of their present vehicle. We recommend to introduce the heterogeneous subsidies as a decreasing function of vehicle usage, which can motivate occasional drivers to scrap their vehicle earlier

Keywords: Vehicle Scrappage, Dynamic Programming, Consumer Intensions, Policy Optimization

Eman Ouda (Khalifa University of Science and Technology), Andrei Sleptchenko (Khalifa University of Science and Technology) and Mecit Can Emre Simsekler (Khalifa University of Science and Technology). *Optimizing Emergency Department Operations: Systems Thinking for Healthcare Workers' Training and Development.*

Abstract. The overcrowding of the emergency department critically affects patient care, safety, and overall hospital efficiency. This study employs a systems thinking framework to address these challenges by integrating cross-training initiatives for healthcare workers and applying predictive demand analysis to mitigate overcrowding proactively. Systems thinking helps to develop a comprehensive analysis of the problem, enabling the design of strategies to prevent emergency department overcrowding. Cross-training improves workforce flexibility and productivity and streamlines patient care by equipping healthcare workers with diverse skill sets. The study highlights the necessity of educational reforms to incorporate digital literacy and continuous professional development, preparing healthcare workers for a digitized healthcare environment. It also examines policy and ethical considerations, highlighting the potential of combining systems thinking with cross-training to optimize emergency care. This research offers practical recommendations for healthcare institutions, educational institutions, and policy makers through innovative workforce development.

Keywords: Hospital, Emergency department, Systems thinking, Overcrowding, Cross-training, Future of work, Future of healthcare

Zhean Shao (The University of Melbourne), Wen Li (The University of Melbourne) and Ying Tan (The University of Melbourne). *SENSITIVITY ANALYSIS OF MODEL COMPLEXITY LEVEL AND TIME RESOLUTION IN ENERGY-AWARE SCHEDULING – A CASE STUDY.*

Abstract. Energy-aware scheduling (EAS) plays a crucial role in managing production and energy flows in manufacturing systems, especially those integrated with on-site renewable energy sources. Various energy models characterise the energy profiles of components in EAS problem formulations. Despite the availability of numerous models, most EAS work employs a fixed energy model. However, the selection of model complexity level and time resolution (MCLnTR) can significantly influence model fidelity, particularly regarding renewable energy sources and manufacturing activities that drive energy supply and demand. This study conducts a sensitivity analysis in EAS following the one-at-a-time principle, using an additive manufacturing job shop to show how different MCLnTR selections affect EAS performance. In this case study, 12 3D printers powered by photovoltaic (PV) systems are scheduled to complete production tasks on time. The analysis includes various PV energy supply models and manufacturing energy demand models with their corresponding time resolutions, creating a range of MCLnTRs. Multiple conditions are considered, including varying weather conditions, scheduling horizons, grid connection modes, and grid pricing strategies. Results indicate that different MCLnTR selections can significantly impact system performance and computational time, underscoring the need for sensitivity analysis in choosing appropriate MCLnTRs in EAS.

Keywords: Energy-aware scheduling, Energy models, Sensitivity analysis, Renewable Energy

Biswajit Kar (Indian Institute of Technology, Kharagpur) and Mamata Jenamani (Indian Institute of Technology, Kharagpur). *Optimized Tourist Itinerary Recommender System with Flexible Trip Options and Soft Time Windows.*

Abstract. We developed an optimized tourist itinerary recommender system (OTIRS) that generates customized and, most importantly, optimised travel schedules to maximise the travel experience. To model this, we follow a Vehicle Routing Problem with Flexible Time Windows (VRPSTW) and tourist preferences for destination selection. Unlike existing literature, this system includes features such as group or single-person trips, opening and closing times of the tourist places, vehicle and rental service selection, and tourist preferences for selecting destinations. OTIRS optimizes travel routes within major cities to make the tourists visit most sites among their preferences while considering budget constraints without compromising the time spent at a location. We compiled a widespread dataset that contains key cities and attractions in India using information from commercial websites. The problem is formulated as VRPSTW, where each day is considered a vehicle, and the daily hours denote vehicle capacity. In this model, tourist sites and their associated travel and stay durations are treated as spaces that each item occupies. We also applied Miller-Tucker-Zemlin's (MTZ) method for sub-tour elimination. Validation through comprehensive datasets and user preferences shows that the system can provide tailored and optimized itineraries. OTIRS aims to enable tourists to explore various destinations across India more effectively.

Keywords: Vehicle Routing Problem, Tourism Itinerary, Tourism Planner, Time windows

Amit Kumar Singh (Indian Institute Of Technology Kharagpur) and Mamata Jenamani (Indian Institue of Technology Kharagpur). *Analysing barriers to sustainable practices in food cold supply chain in context to emerging economy.*

Abstract. The research investigates the challenges to sustainability in the food cold chain within developing economies like India and others as most of them are agriculture-based economy. The study applies fuzzy logic to DEMATEL integrated with Interpretive Structure Modelling (ISM) to handle the uncertainty and complexity inherent in expert opinions. This approach allows for a nuanced understanding of the interrelationships and causal influences among various challenges.This work is required to balance the negative sied of cold chain for ex. harmful emmissions and to control the unaffordable technology used in food cold chain. The results reveal that inadequate government policies serve as a primary barrier, exerting significant influence on other challenges such as infrastructure deficits, lack of technological adoption, and limited financial resources. Addressing these challenges is crucial for enhancing the food cold chain's efficiency, reducing food waste, and ensuring food security. Overcoming these barriers can contribute significantly to achieving Sustainable Development Goals (SDGs) such as zero hunger, good health and well-being, and responsible consumption and production. The findings emphasize the need for comprehensive policy frameworks and investments in infrastructure to foster a sustainable food cold chain, thereby supporting broader sustainability objectives in developing economies.

Keywords: Sustainable Development, Sustainability barriers, Food cold chain, DEMATEL, ISM

Shiqi Li (Northwestern Polytechnical University), Jing Bai (Northwestern Polytechnical University), Zekai Li (Northwestern Polytechnical University), Chen Zheng (Northwestern Polytechnical University), Zhanxi Wang (Northwestern Polytechnical University), Likun Xu (Northwestern Polytechnical University), Ziyu Hu (Northwestern Polytechnical University) and Jie Wang (Northwestern Polytechnical University). *The method of module selection in product design based on intuitionistic fuzzy set.*

Abstract. With the increasing demand for rapid customization, complex products exhibit high modularity. Module selection, which uses fuzzy sets to represent the similarity of module evaluation indicators and selects similar modules by similarity calculation, is a key step in the product configuration design. However, fuzzy sets are limited to a single dimension of membership degree, which reflects the similarity of module evaluation indicators in a single way. To address these issues, this paper proposes a pre-selection method for modules based on the extensible physical-element model and an optimal selection algorithm for modules based on the intuitionistic fuzzy sets. First, this paper establishes the module evaluation indicators and selects the pre-selection modules according to their weights. Subsequently, this paper uses intuitionistic fuzzy sets to represent the module evaluation indicators and considers the possibility of extension transformation of the modules in similarity, using the degree of membership and non-membership to describe the difficulty or ease of the extension transformation of modules. Thereby, a multi-dimensional evaluation method for modules based on intuitionistic fuzzy sets is established. Third, considering the similarity calculation with extensible transformation, the most similar module is selected from the pre-selected modules. This method enables the quick and accurate selection of similar modules and aids in the implementation of extension transformation for similar modules.

Keywords: Product design, Module selection, Intuitionistic fuzzy, Extension transformation

Abdulrahman Yaghmour (American University of Sharjah), Ahmed Yousry (American University of Sharjah), Hussein Kaya (American University of Sharjah), Ibrahim Alowais (American University of Sharjah) and Zied Bahroun (American University of Sharjah). *ADVANCED MULTIPLE CRITERIA DECISION-MAKING TECHNIQUES FOR SUSTAINABLE CONSTRUCTION.*

Abstract. This paper explores the application of Multiple Criteria Decision-Making (MCDM) techniques in the context of sustainable construction. It reviews recent literature from 2019 to 2023, focusing on key themes such as site selection and infrastructure planning, sustainability assessment and performance indicators, supplier and material selection decision support systems, and sustainable materials and construction methods. The methodology includes a detailed classification of reviewed studies and an explanation of the selection and filtering process for relevant papers. Various MCDM frameworks and models, including AHP-WASPAS, MLCAQ, and fuzzy TOPSIS, are examined, highlighting their application and effectiveness in sustainable construction. The paper identifies significant research gaps and proposes future research directions, emphasizing the need for standardized sustainability metrics, dynamic decision support systems, and the integration of cultural and social factors into decision models. This review provides valuable insights and contributes to the advancement of sustainable practices in the construction industry.

Keywords: MCDM, Sustainable Construction, Material Selection, AHP, TOPSIS, Fuzzy Logic

Towfique Rahman (Griffith Business School, Griffith University, Queensland, Australia), Sanjoy Kumar Paul (UTS Business School, University of Technology Sydney, Sydney, Australia), Nagesh Shukla (Griffith Business School, Griffith University, Queensland, Australia), Tapan Sarker (School of Business, University of Southern Queensland, Queensland, Australia) and Harsha Sarvaiya (Griffith Business School, Griffith University, Queensland, Australia). *ANALYSING THE INTEGRATION OF MARKETING STRATEGIES AND SUPPLY CHAIN READINESS.*

Abstract. The integration of marketing strategies and supply chain readiness is crucial for enhancing business performance and resilience. This study examines the impact of various marketing strategies—such as promotional campaigns, customer loyalty programs, and digital marketing initiatives—on supply chain operations. By leveraging these strategies, businesses can drive customer engagement, boost sales, and foster brand loyalty while maintaining operational efficiency and agility. This research addresses the critical gap in understanding the interplay between marketing strategies and supply chain readiness, particularly for high-demand essential goods. The study explores how marketing strategies influence supply chain performance through empirical and simulation-based analyses and how advanced technologies like artificial intelligence (AI) and machine learning (ML) can enhance this integration. The findings demonstrate that robust marketing strategies significantly improve demand forecasting accuracy, inventory management efficiency, and overall supply chain agility. The results highlight the importance of a balanced approach, ensuring that increased costs associated with higher demand and enhanced service levels do not erode financial gains. The study concludes that effective synchronisation of marketing strategies with supply chain operations can significantly boost business resilience, customer satisfaction, and financial performance. This research provides valuable insights for businesses aiming to optimise their marketing and supply chain efforts, ultimately achieving greater competitiveness in the market.

Keywords: Marketing Strategies, Supply Chain Readiness, Business Performance

Li Peize (Macau University of Science and Technology), Qu Ting (Jinan University), Wu Naiqi (Macau University of Science and Technology) and Zu Yipei (Jinan University). *MULTI-SUPPLIER MULTI-PRODUCT STOCHASTIC INVENTORY OPTIMIZATION UNDER TRANSPORTATION SERVICE-SHARING MODEL.*

Abstract. In the current e-commerce domain, to better control product quality and provide fast and reliable services, self-operated e-commerce has rapidly developed and become one of the primary operating models for many e-commerce enterprises. However, as customer demands for product variety, order response speed, and service quality continue to rise, self-operated e-commerce faces the dual challenges of inventory management and logistics optimization. Therefore, determining how to effectively arrange replenishment paths and quantities is crucial for enhancing operational efficiency and customer satisfaction. This paper focuses on the replenishment process of self-operated e-commerce in a multi-supplier and multi-product environment. Firstly, to remission the competitive relationship between storage and transportation processes, a transportation service-sharing model is proposed. Secondly, a multi-period multi-supplier multi-product stochastic replenishment decision-making model is constructed, aiming to optimize replenishment quantity, time and vehicle routing for every product within each decision-making period. Finally, the model is solved using Gurobi. The research results will provide powerful theoretical support and practical guidance for e-commerce enterprises in the process of replenishment

Keywords: Inventory Control, Vehicle Routing Problem, Replenishment

Pratyush Kumar Patro (Department of Management Science and Engineering, Khalifa University, UAE), Adolf Acquaye (Department of Management Science and Engineering, Khalifa University, UAE), Raja Jayaraman (Department of Industrial Engineering,New Mexico State University, USA) and Khaled Salah (Department of Electrical Engineering and Computer Science, Khalifa University, UAE). *Circular Economy Indexing with Generative AI and PCA.*

Abstract. The circular economy represents a critical pathway toward achieving sustainable development goals through responsible resource production and consumption. Monitoring progress toward implementing a circular economy in supply chains is essential. Therefore, developing indicators to measure circular economy adoption allows organizations and countries to focus and assess their progress effectively. Current methods for creating these indicators, such as linear programming and qualitative approaches, often overlook the variability and complexity inherent in the model. This omission introduces biases that undermine the reliability of circular economy index outcomes. In this study, we propose a circular economy index using Generative Adversarial Networks (GANs) and Principal Component Analysis (PCA) to address these challenges. We utilize this method to evaluate circular economy performance across 23 EU countries, showcasing its effectiveness in identifying potential challenges and opportunities.

Keywords: Circular Economy, Generative AI, Principal Component Analysis

Maryam Shahsavari (UNSW), Omar Khadeer Hussain (UNSW), Pankaj Sharma (UNSW) and Morteza Saberi (UTS). *Using Large Language Models to Build a Bayesian Network of Causal Contributing Events Leading to Risk Events in Supply Chains.*

Abstract. Similar to disasters needing a chain of critical events to eventuate, risk events, too, do not occur in isolation and result from interconnected contributing events. Thus, for effective risk identification, identifying the contributing events leading to the risk event of interest is a crucial step. However, manually achieving this step is tedious and time-consuming for the risk manager. In this paper, we propose a semi-automated approach that builds a Bayesian Network (BN), capturing the causal links between contributing events (CEs) and risk events (REs). The proposed approach uses Large Language Models (LLMs), automated algorithms and expert knowledge to extract cause-effect pairs from news articles about the risks of interest. We evaluate the model's results against that of the experts to demonstrate its applicability in real-world scenarios.

Keywords: Supply Chain Risk Management, Bayesian Network, Large Language Model (LLM), Causal Relationship, Cause-Effect relationship

Daoheng Zhang (UNSW Canberra), Hasan Hüseyin Turan (UNSW Canberra), Ruhul Sarker (UNSW Canberra) and Daryl Essam (UNSW Canberra). *Data-driven Distributionally Robust Capital-Constrained Lot-Sizing with Inventory-based Financing.*

Abstract. We consider a single-period, multi-item, capital-constrained lot-sizing (CLS) problem, where a manufacturer can obtain additional working capital through inventory-based financing (IBF) by using inventory as security to obtain loans from a lender. We assume only partial distribution information of uncertain demands is available. That is, the confidence region of the mean and mean absolute deviation (MAD) of the random demands are only known. The estimated mean and confidence levels of these regions are determined in a data-driven manner based on bootstrapping method. The distributionally robust optimization (DRO) method is used to address the proposed CLS problem, maximizing the worst-case expected profit over the set of distributions satisfying the known information.

We establish that DRO model can be transformed into a mixed binary linear program via Lagrangian duality. Through numerical experiments, we evaluate the performance of our proposed DRO method and underscore the importance of synchronizing operational and financial strategies to enhance the manufacturer's profitability. For firms with limited initial inventory or on-hand capital, the proposed DRO model with the IBF strategy can improve profit by up to 30\% compared to a self-funding counterpart.

Keywords: Capital-constrained lot-sizing, Inventory-based Financing, Distributionally robust optimization

Karam Al-Assaf (American University of Sharjah), Wadhah Alzahmi (American University of Sharjah), Ryan Alshaikh (American University of Sharjah), Zied Bahroun (American University of Sharjah) and Vian Ahmed (American University of Sharjah). *Key Drivers for Successful ERP and Performance Management Integration in UAE Healthcare* .

Abstract. This study investigates the integration of Enterprise Resource Planning (ERP) systems with performance management practices in the UAE healthcare sector, identifying key factors for successful adoption and functionality. It addresses a critical gap by analyzing the interplay between ERP systems and performance management to enhance operational efficiencies, patient care, and administrative processes. Initially, a literature review identified 36 factors impacting ERP implementation and performance management. Expert interviews refined these, indicating 9 as weak integration factors and identifying 2 new ones. An online survey with 81 experts rated the 38 factors, allowing the calculation of the Relative Importance Index (RII). The findings highlight that top-tier factors, such as employee involvement in designing performance metrics and effective organizational performance measures, directly impact system effectiveness, employee engagement, and organizational alignment. Mid-tier factors, including effective leadership and managerial support, are crucial for maintaining integration momentum, while lower-tier factors address foundational elements like infrastructure, scalability, security, and compliance. The study recommends a holistic approach to address these factors, maximizing ERP benefits in healthcare. It provides actionable insights for healthcare administrators and policymakers, guiding future ERP implementations towards better outcomes and operational excellence. Future research should examine ERP integration challenges and solutions in both public and private healthcare setups, emphasizing the need to tailor ERP systems to distinct organizational needs and contexts.

Keywords: Enterprise Resource Planning, ERP, Performance Management, Integration, Healthcare, UAE

Anchal Patil (International Management Institute New Delhi, New Delhi, India). *Circular Economy Practices in Cyber Physical System Enabled Smart Manufacturing System* .

Abstract. The adoption of Circular Business Models (CBM) creates multiple operational complexities and requires business process changes. Previous literature favors advanced technology, such as Cyber-Physical Systems (CPS) to facilitate the CBMs. However, organizations are uncertain about the potential benefits of these technologies in achieving Sustainable Development Goals. Thus, the existing study objectives to explore and develop an understanding of CPS adoption to facilitate CBMs. The study discusses various CPS applications, stakeholders' conditions for CPS adoption, technological interventions, user requirements for CPS and antecedents in the context of manufacturing systems. The extracted antecedents of CPS were further modelled using Bayesian-best-worst method. The study's findings can help managers decide the approach to adopt CPS.

Keywords: Cyber Physical System, Circular Business Models, Smart Manufacturing, Sustainable development goals

Ziyue Geng (The University of Auckland) and Xun Xu (The University of Auckland). *AN OVERVIEW OF GENERATIVE AI FOR MANUFACTURING.*

Abstract. This paper explores the transformative potential of generative AI in the manufacturing sector, focusing on Large Language Models (LLMs) like GPT-3 and GPT-4. These models are capable of enhancing various manufacturing processes, including process optimization, predictive maintenance, quality control, supply chain management, and product design. By leveraging extensive datasets, generative AI models identify inefficiencies, predict equipment failures, automate quality inspections, optimize supply chains, and facilitate rapid product prototyping. Despite significant advancements, challenges such as data quality, system integration, and real-time data handling persist. Addressing these challenges is crucial for fully realizing the benefits of AI in manufacturing. The paper presents a comprehensive review of current applications, identifies key challenges, and discusses future research directions to advance the integration of generative AI in manufacturing, aiming to drive innovation, efficiency, and competitiveness in the industry.

Keywords: Generative AI, Large Language Models, Manufacturing, AI in Manufacturing

Nguyen Thuy Trang (School of MSME Sirindhorn International Institute of Technology, Thammasat University, Thailand), Pham Duc Tai (School of MSME Sirindhorn International Institute of Technology, Thammasat University, Thailand), Jirachai Buddhakulsomsiri (School of MSME Sirindhorn International Institute of Technology, Thammasat University, Thailand) and Parthana Parthanadee (Department of Agro-Industrial Technology, Faculty of Agro-Industry Kasetsart University, Bangkok, Thailand). *A HEURISTIC ALGORITHM FOR SOLVING LOAD-DEPENDENT VEHICLE ROUTING PROBLEM.*

Abstract. This paper explores a class of vehicle routing problems that considers the load-dependent distance objective function instead of the total distance. The problem, originating from Thailand's e-commerce delivery business, is formulated as a mixed-integer linear programming model. Since only problem instances of small scale can be solved using the mathematical model, a heuristic algorithm is developed to handle large-scale instances. The algorithm features a load-dependent distance savings algorithm for clustering, and the mathematical model is used for the re-optimization of each cluster. The effectiveness of both the exact method and heuristic is evaluated on several problem instances modified from a standard library. The results indicate that the heuristic can reach near-optimal solutions for instances with known optimal solutions. For those with only lower bounds, solutions from the heuristic show relatively small gaps compared to that of the MILP. In terms of computational time, it is observed that the heuristic algorithm takes a significantly shorter time, especially for larger problem instances, to find a solution than does the mathematical model.

Keywords: load-dependent distance, vehicle routing problem, mixed-integer linear programming, heuristic algorithm, savings algorithm, re-optimization

Doan Hoang Tuan (School of MSME, SIIT, Thammasat University, Pathum Thani, Thailand), Pham Duc Tai (School of MSME, SIIT, Thammasat University, Pathum Thani, Thailand), Jirachai Buddhakulsomsiri (School of MSME, SIIT, Thammasat University, Pathum Thani, Thailand) and Doan Thi Truc Linh (UniSA STEM, The University of South Australia Mawson Lakes, South Australia, Australia). *A MATHEMATICAL MODEL FOR STRATEGIC PLANNING OF CIRCULAR SUPPLY CHAINS.*

Abstract. In this paper, a mixed-integer linear programming model is formulated for a circular supply chain network design problem. The purpose of this model is to fully integrate the forward supply chain, where the final products are made, and the reverse supply chain, where raw materials are recycled from used products, into a single network. To achieve this, the structure of the product and its relevant manufacturing and recycling processes are included in the model. The applicability of our model is demonstrated by a case study of an oral care product. The results indicate the capability and value of the model as a managing tool for supply chain managers, who would like to evaluate the potential of transforming their supply chains into circular ones.

Keywords: Circular supply chain, Network design, BOM, Processing technology, MILP

Haicao Song (Shandong Technology and Business University), Heshan Cheng (Shandong Technology and Business University), Xuxu Liu (Shandong Technology and Business University) and Tianhua Jiang (Ludong University). *Research on multi-objective production rescheduling optimization of precast components considering equipment failure.*

Abstract. The schedule of precast production is very critical to the advancement of prefabricated building projects. However, the production shop of precast components is susceptible to different perturbing factors, such as equipment failures, order insertion, due date changes, which may impact production costs and on-time delivery. This paper formulates a production rescheduling model for PCs where the optimization objective is to minimize penalty cost and carbon emission cost, the optimization constraints include equipment failure, serial and parallel processes, the quantity of molds, and the capacity of curing room. Then, a rescheduling flow is designed to describe the impact of a equipment failure on different processes. The improved genetic algorithm is used to solve the proposed rescheduling model, and a real case study is conducted. The results show that the rescheduling model can deal well with the occurrence of equipment failure, and contribute to optimizing dynamic production scheduling and increasing its applicability in real construction projects.

Keywords: Precast components, Penalty cost, Carbon emission cost, Rescheduling, Improved genetic algorithm

Saina Akbari Kouchaksaraei (School of Systems and Computing UNSW Canberra, ACT 2610, Australia), Ruhul Sarker (School of Systems and Computing UNSW Canberra, ACT 2610, Australia) and Daryl Essam (School of Systems and Computing UNSW Canberra, ACT 2610, Australia). *DYNAMIC PRICING AND REPLENISHMENT STRATEGIES IN A PERISHABLE FOOD SUPPLY CHAIN.*

Abstract. Managing perishable foods is an important research topic in supply chains due to their short shelf life, complexity in managing, and low profit margins. The main challenge in managing perishable food is the gradual deterioration of quality, which is impacted by several factors such as humidity and temperature. It is assumed that product quality affects pricing in this case. This article examines a supply chain that spans multiple periods and tiers, featuring a dynamic price option dependent on each product's quality. A mathematical model that optimises the replenishment process has been devised to address this issue. The model is solved using appropriate techniques, and the outcomes are analysed. The research findings offer insightful information on perishable product supply chain management that can help decision-makers make the best decisions possible.

Keywords: Decision Support, Perishable food supply chain, Dynamic pricing, Genetic algorithms

Amir Hossein Ordibazar (School of Business, UNSW Canberra), Omar Hussain (School of Business, UNSW Canberra), Ripon Chakrabortty (School of Systems & Computing, UNSW Canberra), Elnaz Irannezhad (Research Centre for Integrated Transport Innovation (rCITI), School of Civil and Environmental Engineering, UNSW) and Morteza Saberi (School of Computer Science, University of Technology Sydney). *Predicting the impact of the weather conditions on transportation agility: A case study of an Australian Maritime Port.*

Abstract. Transportation of the products is the primary connection between the different parts of the supply chain network (SCN), and the agility of the movements smooths the SCN operations. Potential risks (e.g., delay, road closure, and vehicle failure) disrupt the transportation process and negatively impact SCN operations. Accurately identifying the potential risks is the first step in Supply Chain Risk management (SCRM). All the factors, especially the external events outside of the SCN boundaries that cannot be controlled, need monitoring. In this paper, we propose a data-driven model to analyse the impact of weather status, as an external event, on the agility of the transportation system. A case study of a maritime port in Australia is considered to validate the model's applicability. For categorising the transportation based on agility, first, the speed of the movements was calculated by dividing distance by time, then by comparing the transportation speed with a defined threshold, the records of the dataset were divided into "Fast" and 'Slow". For feature selection, First, seven weather-related attributes for the time of the dataset were collected, and then four criteria were calculated for each attribute. Secondly, by calculating the correlation of the features, the highly correlated ones were removed or justified, and the weather features were aggregated to the SCN dataset. Finally, after the data had been cleaned, Machine Learning (ML) models were used to train and test the aggregated dataset. The results showed 92.7% F1-score and 92.12% accuracy for the XGBoost classifier as the best one. Moreover, the weather features were recognised to be highly influential in predicting the agility of the transportation process.

Keywords: machine learning, weather, maritime, risk, transportation, case study

Rin Miyazaki (Waseda University , School of Creative Science and Engineering), Tianxiang Yang (Waseda University , School of Creative Science and Engineering) and Masayuki Goto (Waseda University , School of Creative Science and Engineering). *A deep embedding clustering method for tabular data considering the meaning of qualitative variables.*

Abstract. In recent years, deep embedding clustering methods for complex nonlinear data have attracted attention. The goal of deep embedding clustering is to learn suitable features for clustering by jointly training an unsupervised deep neural network with a clustering algorithm. These methods are adept at extracting useful low-dimensional representations from high-dimensional data and capture complex relationships among data. However, most deep embedding clustering methods are primarily based on techniques such as Deep Embedded Clustering (DEC), which assume a t-distribution suitable for clustering image data but not necessarily optimal for tabular data. To address this issue, Gaussian Cluster Embedding in Autoencoder Latent Space(G-CEALS) has been proposed, which is an unsupervised deep clustering framework for learning the parameters of multivariate Gaussian cluster distributions by iteratively updating individual cluster weights. However, G-CEALS is not necessarily effective for data that include qualitative data. In practice, real-world tabular data not only include quantitative data, but also qualitative data such as gender, occupation, job, etc. For this reason, this study proposes a new deep embedding clustering method for tabular data, which contains both qualitative and quantitative data. To be specific, by suitably embedding qualitative variables and employing deep learning tailored to these embeddings, effective deep embedding clustering can be performed on datasets that include qualitative data. Therefore, we extend the clustering method of G-CEALS based on the characteristics of qualitative data. At last, the proposed method is applied to several benchmark datasets which contain both qualitative and quantitative data for experiment to verify its effectiveness.

Keywords: deep embedding clustering, tabular data, quantitative and qualitative variables

Yuhui Su (Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University), Ming Li (Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University) and George Q Huang (Department of Industrial and Systems Engineering, The Hong Kong Polytechnic University). *A Privacy-preserving Trajectory Data Publishing Approach for Protocol Shipment Unit Tracking and Tracing in Cyber-physical Internet.*

Abstract. The operation of routers within the Cyber-physical Internet (CPI) can encounter routing loops, causing inefficiencies and delays. Analyzing the trajectory data of Protocol Shipment Units (PSUs) is crucial to address this issue. However, privacy concerns arise as third-party entities operate routers, and PSU trajectory data contains sensitive information. This study proposes a zero-knowledge proof-based approach for privacy-preserving PSU trajectory data publishing in the CPI. The approach allows PSUs to selectively publish trajectory data while ensuring anonymity through a concise statement of zero-knowledge proof. A prototype system is developed using the libsnark library, and performance analysis is conducted on three zero-knowledge proof algorithms based on the system. Additionally, potential research directions, including leveraging smart contracts and multi-party chained proofs are explored. This study significantly contributes to the field of privacy-preserving data publishing in the CPI by addressing the privacy and security concerns associated with PSU trajectory data.
Keywords: Cyber-physical Internet, Privacy-preserving Data Publishing, Zero-knowledge proof

Himanshu Gupta (Indian Institute of Technology (Indian School of Mines) Dhanbad) and Pramit Khatua (Indian Institute of Technology (Indian School of Mines) Dhanbad). *Incorporating Algorithmic Fairness, Accountability, Transparency and Ethics (FATE) in AI adoption for Micro, Small and Medium Enterprises in Sustainable Logistics Sector: An Evaluation of Key Hurdles.*

Abstract. For Micro, Small and Medium Enterprises (MSMEs), the shift to Industry 5.0, stressing resilient, human centric and sustainable practices presents certain hurdles. Human centric Artificial Intelligence (AI) (a segment of Industry 5.0) is applied in logistics sector for efficient use, flow, and storage of materials. For ethical and equitable outcomes, compliance to AI Fairness, Accountability, Transparency and Ethics (FATE) principle is critical. This study explores crucial barriers encountered during implementation of Algorithmic Fair, Accountable, Transparent and Ethical practices for sustainable logistics sector. A comprehensive literature review is conducted to identify key challenges during incorporation Algorithmic fairness, accountable, transparent, and ethical practices for MSMEs, during AI adoption for sustainable logistics organizations. Utilizing Best Worst Method (BWM), this study methodically assesses and ranks the key hurdles in incorporating Algorithmic FATE practices. By employing BWM method and Interpretative Structure Method (ISM) with MICMAC analysis, this study delves deep into the synergies between hurdles faced by Algorithmic FATE implementation in AI adoption for MSMEs in Sustainable Logistics Sector. The key barriers such as “Allocative and Representation Harms” and “Philosophical Roots” for Algorithmic Fairness, “Algorithmic Opacity” for Algorithmic Accountability, “Complexity of Algorithms” for Algorithmic Transparency, and “Data Privacy and Security” and “Personal Ethical Issues” for Algorithmic Ethics are essential in implementing Algorithmic FATE framework for AI adoption for MSMEs in sustainable logistics sector. This study culminates with invaluable insights for logistics industry leaders, Government policymakers and researchers, highlighting the need for integrated, comprehensive strategy to tackle the key hurdles. This study also discusses the social and ethical implications of adopting these practices, offering a balanced perspective on the path towards a sustainable future for micro, small and medium enterprises in the logistics sector.
Keywords: Algorithmic, Fairness, Accountability, Transparency, Ethics, AI, MSME, Sustainable Logistics

Yunlong Tang (Monash University), Keenan Granland (Monash University) and Zijue Chen (csiro). *Enhancing 3D Printing Farms with a Digital Twin Framework for Intelligent Manufacturing.*

Abstract. Additive manufacturing, commonly known as 3D printing, offers remarkable design freedom and the ability to fabricate highly complex geometric parts. It significantly reduces the lead time between design and production, making it ideal for prototyping and small batch production. As a result, 3D printing farms, comprising multiple 3D printers, are increasingly popular. However, despite the potential for full automation, 3D printing technology faces challenges in repeatability and consistency compared to traditional manufacturing processes. External variables such as material variations, machine differences, and environmental conditions can impact print quality. Additionally, the flexibility in design poses challenges in maintaining consistent quality. This research addresses these challenges by developing a digital twin system for intelligent 3D printing farms. The proposed framework operates on two levels: system and object. At the system level, services such as order fulfilment, robotic coordination, and predictive maintenance are implemented using AI algorithms and simulation-driven models. These services rely on data from the virtual twins at the object level. The object level encompasses virtual twins of 3D printers, operators, environments, and robotics, each with services that facilitate communication and collaboration. Implemented at the Monash Digital Twin Manufacture Lab, this digital twin system supports manufacturing and prototyping for undergraduate student projects and industrial customers at Monash Innovation Labs. The presentation will summarize the advantages and challenges of this innovative approach, demonstrating its potential to enhance the efficiency and reliability of 3D printing farms.

Keywords: Digital twin, 3D printing, Additive Manufacturing

Danial Rizvi (University of Technology Sydney), Gavin Paul (University of Technology Sydney), Dinh Tung Le (University of Technology Sydney), Sheila Sutjipto (University of Technology Sydney) and Munia Ahamed (University of Technology Sydney). *Multi-modal Feedback for Enhanced Hydraulic Maintenance Operations.*

Abstract. Hydraulic systems offer high-power density, making them ideal for industrial applications requiring significant force, such as the installation and removal of bushings in mining equipment. Operators often use binary control of hydraulic systems, relying on low-resolution pressure gauges, and inconsistent visual and auditory cues like estimating cylinder extension and listening for abnormal sounds to identify issues, leading to safety risks and operational difficulties. This paper investigates the role of haptics in providing additional feedback, specifically focusing on simulating pressure build-up using a novel adaptive trigger. A user study assessed participants' performance in a simulated setup with various feedback inputs: visual, sound, vibration, and an adaptive trigger. The study included a survey to evaluate the participants' perceptions and cognitive demands. Quantitative and qualitative findings were compared to determine the technology's efficacy, highlighting future research on ergonomic designs and developing a more realistic simulation. Our results found that the adaptive trigger shows no significant improvement compared to other forms of user feedback. There was a slight preference for the adaptive trigger in subjective metrics like comfort and confidence. There was also a slight aversion to the vibration feedback, which was supported by a minor drop in performance. In cases where the adaptive trigger underperformed, alternative feedback mechanisms offered potential benefits. The integration of multimodal feedback systems could revolutionize operator interaction in hazardous maintenance

environments, mitigating risk and enhancing procedural safety.

Keywords: Haptic Feedback, Adaptive Triggers, Maintenance, Operator Safety, Multimodel Feedback, Hydraulic System, Safety in Industrial Environments

Shogo Chomei (Graduate School of Creative Science and Engineering, Waseda University), Ryuta Matsuoka (Graduate School of Creative Science and Engineering, Waseda University), Naru Simizu (Graduate School of Creative Science and Engineering, Waseda University), Tianxiang Yang (Department of Management Science, Faculty of Science and Technology, Keio University) and Masayuki Goto (School of Creative Science and Engineering, Waseda University). *Twin-G NeuMF: An Enhanced Neural Matrix Factorization Model Robust to Noise.*

Abstract. In recommender systems used in e-commerce sites, implicit feedback, such as user interaction history (clicks, views, etc.), is widely used to infer user preferences. This is because it allows for the collection of large amounts of data without burdening users, unlike explicit ratings that directly reflect user preferences through review data (explicit feedback). One of the representative collaborative filtering methods using implicit feedback is Neural Matrix Factorization (NeuMF). NeuMF integrates a pre-trained linear model called Generalized Matrix Factorization (GMF), based on Matrix Factorization, with a nonlinear model called Multi-Layer Perceptron (MLP), to achieve high recommendation accuracy. However, compared to explicit feedback, implicit feedback can be easily generated through interactions such as clicks, and does not involve direct evaluation by the user. This makes it prone to containing noise interactions unrelated to the user's actual preferences, such as accidental clicks. Therefore, this study proposes Twin-G NeuMF, which further integrates another linear model, GMF, into NeuMF. The two GMFs and one MLP in Twin-G NeuMF are pre-trained on different training data due to the randomness of negative sampling (sampling a small amount of data from unobserved interactions and adding it to the data). To confirm the effectiveness of the proposed method, we conducted experiments on MovieLens with artificially added two types of noise interactions: accidental clicks and views of popular items that are not related to the user's preferences. As a result, the proposed method showed higher recommendation accuracy than NeuMF even in noise-free scenarios, and demonstrated significant improvements, especially in situations with high noise levels. Furthermore, comparison experiments with models using fixed negative sampling showed that the diversity of training data generated by the randomness of negative sampling contributes to the accuracy improvement and noise robustness of the proposed method.

Keywords: Implicit Feedback, Noise Data, Neural Collaborative Filtering, Robustness

Daiki Fujiwara (Graduate School of Creative Science and Engineering, Waseda University), Takuya Morikawa (Graduate School of Creative Science and Engineering, Waseda University), Ayako Yamagiwa (Graduate School of Creative Science and Engineering, Waseda University) and Masayuki Goto (School of Creative Science and Engineering, Waseda University). *A Method for Analyzing Customer Preferences Taking Account of Diversity of Purchasing Behavior using Knowledge Graph Attention Network.*

Abstract. In recent years, analysis of purchase history data obtained on e-commerce sites has been conducted with the aim of understanding customer preferences and purchasing trends. While research is being conducted from various perspectives to understand customer purchasing trends, "diversity of purchasing behavior" is recognized as an important concept and is being studied. In these studies, various metrics that quantify the diversity of purchasing behavior, such as the entropy and the Herfindahl-Hirschman Indexes, have been proposed. However, when analyzing purchasing behavior using an index that quantifies the diversity of purchasing behavior, the various effects of each purchasing item on the index are not taken into account, so there is a possibility that customers with the same scalar value will be treated as being with the same characteristics. When their preferences for product items are different, such combinations of customers should inherently be distinguished for customer analysis. It is, therefore, expected to be possible to analyze customer purchasing trends in more detail from the perspective of the diversity of purchasing behavior if the difference in the impact of each purchased item on the diversity of purchasing behavior can be considered. In this study, we propose a method to analyze the diversity of purchasing behavior in more detail by considering the difference in the impact of each purchase item on the diversity of purchasing behavior. Specifically, we utilize the distribution of weights assigned to each purchased item in the Knowledge Graph Attention Network, which is a type of recommendation model, to create new features that represent the diversity of customer purchase behavior. In this study, the proposed method is applied to the data of the listening history of an online music service and show the validity of the proposed method in showing the diversity of purchasing behavior and the ability to analyze the diversity of purchasing behavior in more detail than the index expressed by a scalar value.

Keywords: E-commerce Sites, Analysis of Purchase History Data, Diversity of Purchasing Behavior, Knowledge Graph Attention Network, Clustering

Kazuchika Suzuki (Waseda University), Miho Mizutani (Waseda University), Koki Yamada (Waseda University), Ayako Yamagiwa (Waseda University) and Masayuki Goto (Waseda University). *Motion Identification from Millimeter-Wave Radar Point Cloud Data Based on One Dimensional CNN and Data Augmentation.*

Abstract. Recently, the shortage of caregivers in the nursing care industry has become a significant issue in aging societies, and there is a demand for reducing their burden in elderly care facilities. Therefore, attention is focused on monitoring technologies that detect abnormalities, such as falls of residents, using sensors and promptly notify caregivers. In particular, the use of time-series point cloud data obtained by millimeter-wave radar is expected from a privacy protection perspective. The artificial intelligence technologies including deep learning may be a future solution to realize high-precision motion recognition, which can reduce the need for caregivers to constantly monitor residents, thereby significantly reducing their burden. However, the point cloud data obtained from millimeter-wave radar vary in the number of points for each acquisition, making it challenging to use them directly as input for deep learning models. Additionally, adding motion label information to the obtained point cloud data is costly. In this study, we propose a motion identification model to extract features from point cloud data using statistical measures, maintain a constant dimensionality of the data enabling the application of deep learning, and construct an appropriate structure of deep neural network for this data. Specifically, we extract useful features for motion recognition from each frame and then construct a motion recognition model using a One Dimensional CNN that performs convolution along the time series. Furthermore, we enhance the training data through data augmentation methods. Specifically, we employ three methods: horizontal shifting of the point cloud, changing the time-series frame to be clipped as an arbitrary motion, and applying mixup to the extracted features to improve motion recognition accuracy. In the analysis of real data, we applied the proposed method to actual point cloud data and confirmed the effectiveness of the proposed method in motion recognition and the improvement in accuracy through data augmentation. The results of this study contribute to reducing the burden on caregivers and improving the efficiency of the nursing care industry.

Keywords: Action Classification, Human Motion Recognition, Data Augmentation, Point Cloud Data

Kengo Miyajima (Waseda University), Yuto Nunome (Waseda University), Yuta Sakai (Waseda University) and Masayuki Goto (Waseda University). *A Hierarchical Multi-label Classification Model Adapted to Training Data with Missing Labels in Some Layers.*

Abstract. Multi-label document classification in document data is the task that predicts the multiple class labels assigned to each document. In general, there is often a semantic hierarchical structure among the assigned labels, and it may be possible to improve the accuracy of label prediction by considering the hierarchical structure.

A multi-label classification model that takes into account the semantic hierarchical structure among labels is called hierarchical multi-label classification model in the machine learning literature. Over the past few years, the Multi-label Box Model (MBM) has been proposed as hierarchical multi-label classification model utilizing geometry and probabilistic semantics of box embedding. MBM embeds the inputs in the embedding space and represents labels as boxes on the same space by using a deep neural network. It was shown that MBM is more effective than models using normal embedding representations or Poincaré embedding representations when class labels of all layers are assigned to training data. However, actual document data posted on user contributed websites are rarely assigned class labels for all layers of the hierarchy. If such data is used to train MBM, the accuracy of label prediction is deteriorated. In this study, we introduce Bidirectional Encoder Representations from Transformers (BERT) to address this issue. We propose a framework for learning MBM after complementing class labels of missing hierarchies by introducing similarity between documents calculated using BERT. The effectiveness of the proposed method is also demonstrated through evaluation experiments, which compare the accuracy of the conventional method and the proposed method when applied to data with missing labels of some hierarchies. In addition, we analyze the characteristics of class label completion due to differences in layers through comparative experiments with missing class labels from the bottom, middle, and top layers.

Keywords: Hierarchical multi-label classification, Embedding, Box embedding, BERT, Document classification

Caitlin Arnold (UNSW Canberra) and Ripon Chakrabortty (UNSW Canberra). *Predicting the Effects of Pesticides Use on Environmental Sustainability.*

Abstract. The application of agrochemicals such as pesticides in agricultural practices has been essential in increasing agricultural crop yield by managing or eliminating pests. However, given that approximately 0.1% of pesticides actually reach their target pests, as found in a study by Pimentel, 99.9% of pesticides that are applied transfer into the surrounding environment. The adverse effects of pesticides on environmental sustainability, in conjunction with the absence of Australian-based predictive modelling studies analysing the effect of pesticide application, demonstrates a requirement for an integrated approach to pesticides and sustained environmental health. Given the adaptive nature of machine learning (ML) models, in comparison to predictive analytics tools, and the significant research gap in utilising machine learning models in the agricultural sector, this research project aims to propose ML models to predict the effects of pesticide application on key environmental indicators. The initial indicators defined were water quality, air quality, soil quality and biodiversity. However, unsatisfactory data quality and an overall absence of the required data to provide accurate predictions for water quality and air quality resulted in an elimination of modelling the effect of pesticides on these features and the resultant exclusion of an assessment of aquatic biodiversity. Regression and classification Random Forest (RF) and Support Vector Machine (SVM) models were implemented, as well as Naive Bayes (NB), to predict the effects of glyphosate application rates and different crop types on metrics of assessing soil health. The spatial resolution of the application dataset limited the extent of model performance optimisation, and as such, this paper also aims to highlight the complications regarding the implementation of models analysing the overall environmental effect of pesticide application.

Keywords: Machine Learning, Pesticides, Sustainability, Agriculture

Xiaoyue Wang (Business school, Beijing Technology and Business University), Xingyue Zhao (Business school, Beijing Technology and Business University), Jingxuan Wang (Business school, Beijing Technology and Business University) and Xi Chen (Business school, Beijing Technology and Business University). *RISK ASSESSMENT FOR A SUPPLY CHAIN SYSTEM AFFECTED BY MULTI-SOURCE SHOCKS.*

Abstract. The supply chain systems are inevitably subject to the damages resulting from shocks and different suppliers of the systems may suffer the shocks from different sources due to their inherent differences. However, the prior research has not delved into the operation process of a complex supply chain system with various raw material suppliers impacted by the shocks from multiple sources. To fill these research gaps, this paper conducts the risk assessment for a supply chain system affected by multi-source shocks. A shock impact vector is defined to represent the situation in which different types of suppliers can be affected by the shocks from disparate shock sources. For each type of suppliers, their deliverability may decline due to the shocks from diverse sources with corresponding degradation mechanisms where the mixed shock models combining cumulative, run and extreme criteria are proposed. Moreover, the risk of the supply chain system is divided to the different risk levels according to the total number of raw material types in short supply resulting from the demands of the manufacturer. This study combines finite Markov chain imbedding method, phase-type distribution and universal generating function technique to derive the reliability indicators of each type of suppliers and the risk indicator of the entire supply chain system. Numerical examples are provided to prove the applicability of the proposed model.

Keywords: Supply chain system, Mixed shock model with multiple sources, Risk assessment, Finite Markov chain imbedding method, Universal generating function method

Ilango Kandasamy (The University of Auckland) and Yuqian Lu (The University of Auckland). *Instructing collaborative robots using large language models for human-robot collaboration.*

Abstract. The future of smart manufacturing hinges on robots enhancing performance and productivity, but the complex communication interface between humans and robots remains a challenge. Using natural language instructions to guide robots during collaboration will significantly improve human-robot interaction. Despite the efforts to improve the robot's ability to interpret natural language instructions, progress has been limited due to the weak generalisation and adaptability of traditional robot programming methods. Pre-trained Large Language Models (LLMs) trained on huge volumes of text data excel in Natural Language processing tasks such as semantic parsing and automatic text generation. In this study, we explored using LLMs to comprehend the basic industrial assembly instructions in natural language and convert them into low-level tasks for robots to execute additional training. We used the assembly instructions from the HA-ViD dataset to evaluate the performance of GPT-3.5 model in semantic parsing of these instructions. The GPT-3.5 demonstrated excellent generalisation in converting previously unseen industrial assembly instructions by learning from prompts. Additionally, we explored the possibility of using Vision Language Models (VLM) for object detection tasks in a novel scenario by prompting them with text input to specify target objects to be detected in the image. Finally, we proposed an end-to-end system architecture to illustrate the integration of voice and LLMs, demonstrating the performance of GPT-3.5 in converting natural language instruction into low-level robot actions for industrial assembly tasks.

Keywords: Human-robot collaboration, Large Language Model, robot, GPT-3.5, manufacturing

Sanath Kahagalage (UNSW Canberra), Hasan Hüseyin Turan (UNSW Canberra), Pankaj Sharma (UNSW Canberra) and Sondoss Elsawah (UNSW Canberra). *A study on maintenance scheduling and workforce planning under deep uncertainty.*

Abstract. Most of the real-world problems often involve multiple conflicting objectives and many decision variables. However, most of the applications concern a single objective problem and/or decision variables in isolation. Decision-making, even under the most favorable circumstances, is made difficult enough by budget constraints, conflicting stakes, and political turmoil. So, every reduction in uncertainty is more than welcome; ignoring deep uncertainty is attractive. But decisions that ignore deep uncertainty ignore reality. Substituting assumptions for deep uncertainties might simplify choices in the short term but may come at a much higher price in the longer term. In this research, using a comprehensive real-life case study-based Discrete Event Simulation model, we address high-value asset maintenance, encompassing workforce and maintenance planning problem under theccondition of deeply uncertain factors such as workforce separation and resource failures. Our objective is to identify robust solutions from a predefined set of strategies encompassing workforce and maintenance planning. Results guide decision-making by identifying robust strategies, identifying critical uncertain parameters and their ranges, and revealing vulnerable outcomes. Results highlight the significance of striking the right balance between maintenance and workforce planning. Results also reveals the importance of achieving a harmonious balance within the workforce plan. In conclusion, robust decision-making framework empowers decision-makers to navigate deep uncertainty, offering insights to support informed and robust decisions.

Keywords: Military maintenance workforce, Maintenance scheduling, Workforce planning, Deep uncertainty, Robust decision-making

Ashish Omar (Indian Institute of Management Mumbai) and Priyanka Verma (Indian Institute of Management Mumbai). *Risk-averse robust optimization of supply chain network under disruption risk with ripple effect* .

Abstract. Due to globalization, modern supply chains have become complex and prone to different risks. In recent times, global supply chains have been affected by multiple disruptions like (COVID-19, the Ukraine-Russia war, the U.S. and China trade conflict, and the blockage of the Suez Canal). The impact of disruptions of one supply chain player over the other will differ depending on their relative positions in supply chains and subsequently contribute to demand losses. The demand losses and complex structure of supply chains motivate organizations to design resilient and responsive supply chain networks under the risk of ripple effect disruptions. A risk-averse robust optimization model is developed that assumes the disruptions are random. This model uses the conditional value at risk with regret (CVaR-R) as the objective function. The ripple effect of random disruptions on the supply chain players is also captured in the model. The developed model is a mixed integer linear programming problem to observe the impact of multi-period disruption on the supply chain network and its performance. Further, different scenarios demonstrate the impact of the ripple effect on the supply chain network over demand losses.

Keywords: Risk Averse, Robust Optimization, Ripple effect, Disruption risk

Yee Yeng Liau (Pusan National University) and Kwangyeol Ryu (Pusan National University). *INTRODUCING SMART HUMAN-ROBOT COLLABORATION WITH HETEROGENEOUS COBOTS FOR ASSEMBLY OPERATIONS.*

Abstract. Human-robot collaboration systems offer a potential solution to the challenges of automating operations in low-volume, high-variety small and medium industries using traditional industrial robots. The complexity of reconfiguring traditional industrial robotic systems, which includes reprogramming and rearranging safety equipment, limits their adoption in environments that undergo rapid and frequent changes. Consequently, collaborative robots, or cobots with features such as ease of programming, force sensing and flexibility, are employed to automate hazardous tasks and enable humans to work alongside robots. The mould industry exemplifies low-volume, high-variety production, necessitating manual assembly of moulds. Heavy handling and repetitive tasks in mould assembly operations drive the need for the introduction of human-robot collaboration systems. Therefore, this study proposes a framework for implementing human-robot collaborative mould assembly using two heterogeneous cobots. The framework includes planning, monitoring and execution models to enhance the mould assembly operation. The planning model analyses and assigns hazardous tasks to cobots to reduce ergonomic risk and assembly time. The monitoring and execution models employ vision-based monitoring and position sharing to minimise errors and control subsequent task execution during the collaborative operations. This study introduces the smart concept into the proposed collaborative system by establishing the communication between the human and cobots, and integrating the developed models with knowledge management assistance. The proposed smart collaborative system enables the data analysis and connectivity in the monitoring and execution model for rapid and consistent decision making, including cobot motion corresponding to manual state and programme adjustments during collaborative assembly operations. This study contributes to the novel application of a smart human-robot collaboration system in mould assembly, offering the potential for practical semi-automation in reconfiguring frequently changing operations.

Keywords: Human-robot collaboration system, Mould assembly, Smart system

Nurul Izzah Abd Rahman (Universiti Putra Malaysia), Nor Zaratunaimah Kolan (Universiti Putra Malaysia), Muhammad Adam Umar Zaman (Universiti Putra Malaysia) and Muhammad Nazirul Iszat Ismail (Universiti Putra Malaysia). *TRENDS OF MENTAL WORKLOAD AND WORK PERFORMANCE IN REAL-TIME MANUFACTURING OF SEATING PRODUCT.*

Abstract. In 2022, Department of Occupational Safety and Health (DOSH) Malaysia reported nearly 67% of occupational accidents are contributed by manufacturing sectors. One of the identified factors is cognitive load. This study aims to determine the trends and relationship between mental workload and task performance based on task parameter variations (namely frequency, task completion time, and complexity category). Data collection was conducted in two phases during a real-time seating products manufacturing activity involving nine workstations. Phase 1 involved interview sessions and health baseline screenings, while Phase 2 involved experiments conducted under normal real-time production settings. Subjective mental workload was evaluated using NASA-TLX, while physiological parameters were measured using heart rate measuring device. Operators work performance were measured by accuracy and efficiency using a scorecard. The data was grouped into three complexity categories (regular, moderate, and advanced) and two load frequency tasks: medium and high. The NASA-TLX demonstrated that the mean performance scale score obtained was the highest while the effort score which is a combination of physical and mental components was 54% in difference, as the tasks shifted from medium to high load frequency tasks in regular complexity category. The heart rate readings demonstrate inverse patterns for medium load frequency tasks across the regular, moderate, and advanced complexity task categories. For performance score, the percentage difference increased when comparing medium and high load frequency tasks. In high load frequency tasks, significant negative correlation between physical demand and Performance Score ($r = -0.747$, $p = 0.033$) indicates that as physical demand increases, the performance score decreases accordingly. As a conclusion, MWL level is inversely proportional to the level of work performance. In future, this study offers new horizon for further exploration on the intricate relationship between cognitive load and task performance in assembly line of manufacturing sectors.

Keywords: Cognitive Ergonomics, Mental Workload, Assembly in Manufacturing, Seating Product

Mohammed Yaqot (Hamad Bin Khalifa University) and Ibrahim Al-Kulayb (The University of Sydney).
Optimizing Global Cereal Production: A Multi-Criteria Decision Analysis for Sustainable Agri4F Supply Chains.

Abstract. With global demand for cereal crops exceeding 2.8 billion metric tons annually, approximately 840 million tons (30%) of maize, wheat, and rice are wasted through their value chain. Projections for the 2032 cereal market reveal that 41% of all cereals will be consumed by humans, 37% will serve as animal feed, and 22% will be allocated to biofuels and other uses. This study aims to optimize cereal production across economic, environmental, and social dimensions by employing an integrated Multi-Criteria Decision Analysis (MCDA) framework. We utilize advanced portfolio management techniques and robust optimization models to analyze global cereal markets and propose strategic resource allocations for wheat, rice, maize, and other grains. Our model simulates optimal decision-making for supply chains using a linear programming (LP) approach. It evaluates resource allocation across feed, food, fuel, and fiber (Agri4Fs) to enhance agronomy practices and develop smarter, more sustainable, and resilient agricultural systems. The MCDA framework assesses trade-offs among economic, environmental, and social criteria by considering three alternative scenarios: high-intensity, balanced, and low-intensity farming. By incorporating regional projections and diverse criteria, our research provides actionable insights for policymakers and stakeholders to achieve balanced growth and resilience in agricultural supply chains. The findings underscore the critical need to balance sustainability with economic viability in agribusiness strategies. Furthermore, they highlight the pressing need for innovative and sustainable practices to address global challenges such as climate change and market volatility. This work offers a strategic pathway to improved global food security, economic stability, and environmental sustainability.

Keywords: Resource allocation, Supply chain, Portfolio management, MCDA, Resilient agricultural

Christoforus Yoga Haryanto (RMIT University). *LLAssist: Simple Tools for Automating Literature Review Using Large Language Models.*

Abstract. This paper introduces LLAssist, an open-source tool designed to streamline literature reviews in academic research. In an era of exponential growth in scientific publications, researchers face mounting challenges in efficiently processing vast volumes of literature. LLAssist addresses this issue by leveraging Large Language Models (LLMs) and Natural Language Processing (NLP) techniques to automate key aspects of the review process. Specifically, it extracts important information from research articles and evaluates their relevance to user-defined research questions. The goal of LLAssist is to significantly reduce the time and effort required for comprehensive literature reviews, allowing researchers to focus more on analyzing and synthesizing information rather than on initial screening tasks. By automating parts of the literature review workflow, LLAssist aims to help researchers manage the growing volume of academic publications more efficiently.

Keywords: large language models, artificial intelligence, research tools, semantic analysis, automated document processing

Alaa Salem (Faculty of Computers and Informatics, Zagazig University, Zagazig 44519, Egypt), Mona Mohamed (Higher Technological Institute, 10th of Ramadan City 44629, Egypt), Karam Sallam (Computer Science Department, University of Sharjah, Sharjah, United Arab Emirates), Ibrahim Radwan (University of Canberra, Canberra, Australia) and Mohamed Abdel-Basset (Faculty of Computers and Informatics, Zagazig University, Zagazig 44519, Egypt). *OPTIMIZING VIRTUAL SMART IRRIGATION SYSTEMS THROUGH DIGITAL TWIN APPLICATIONS: A NEUTROSOPHIC MCDM APPROACH.*

Abstract. Recently, the intervention of cutting-edge contemporary technologies in agriculture and their applications has become imperative. To address several brought on by traditional agricultural practices that threaten agriculture and verdant landscapes which therefore imperil sustainability. One of these practices is wasting water for irrigation which is in contradiction to the general welfare. The state is under pressure to cultivate more crops, which necessitates more irrigation, as a result of the population's constant growth and the resulting need for food and later economic survival. Hence, this study embraces the methods that prevent impediments to conventional irrigation practices to rationalization of irrigation. As well, as embracing technologies for Converting conventional irrigation into intelligent irrigation by employing diverse technologies to sense and monitor the farming surroundings and farmer's equipment. The simulation for the behavior of the irrigation system isn't less important than using the Internet of Things (IoT) for aggregating and processing data to determine daily irrigation. Thus, deploying a digital twin (DT) as a virtual mirror for constructing an irrigation system is crucial. Also, utilizing the appropriate application of DT is an obstacle. In turn, this study contributes to constructing innovative decision-making methodology. The paradigm's objective is to evaluate the DT applications and recommend the optimal application of DT to construct virtual smart irrigation (VSI). To achieve the study's objective, CRiteria Importance Through Intercriteria Correlation (CRITIC) of Multi-Criteria Decision Making (MCDM) techniques which is utilized for weighting criteria. The generated criteria weights are harassing in Additive Ratio ASsessment (ARAS) for ranking DT applications and recommending optimal application of DT for VSI. The utilized techniques of MCDM collaborate with uncertainty theory especially Type 2 Neutrosophic Numbers (T2NNs) for supporting decision makers (DMs) in perplexing situations and ambiguity as well as eliminating prejudice.

Keywords: digital twin (DT), virtual smart irrigation (VSI), Multi-Criteria Decision Making (MCDM), Type 2 Neutrosophic Numbers (T2NNs), sustainability

Asmaa Elsayed (Faculty of Computers and Informatics, Zagazig University, Zagazig 44519, Egypt), Mona Mohamed (Higher Technological Institute, 10th of Ramadan City 44629, Egypt), Karam Sallam (Computer Science Department, University of Sharjah, Sharjah, United Arab Emirates), Ibrahim Radwan (University of Canberra, Canberra, Australia) and Mohamed Abdel-Basset (Faculty of Computers and Informatics, Zagazig University, Zagazig 44519, Egypt). *A COMPREHENSIVE FRAMEWORK FOR EVALUATING AUTONOMOUS VEHICLES IN SMART AND SUSTAINABLE URBAN TRANSPORTATION.*

Abstract. Recently, a plethora of thoughts and terminologies have surfaced intending to protect the environment and public health as sustainability and smart cities. Wherein the relationship between these terminologies has an explicit link. The implementation of smart city regulations has the potential to enhance the standard of living for citizens by incorporating sustainable practices. Smart and green urban transportation is one of the sustainable strategies and practices. The newest innovations in Smart and ecological urban transportation are autonomous vehicles (AuVs), which can move around with minimal help from humans. Thanks to AuVs the transportation costs, pollution in cities, and dramatically the number of accidents and fatalities on the roads have lessened. Also, all social groups have better access. Opting for AuV which is optimal, and efficient is one of the toughest obstacles. This process is conducted based on a set of criteria. Hence, Multicriteria Decision Making (MCDM) techniques contribute to constructing a three-tiered decision-making paradigm (TTDMD) for appraising AuV nominates and recommending optimal AuV. Each tier is responsible for a certain mission. The first tier is aggregating data and forming it into decision matrices based on decision makers (DMs). The second tier is analyzing the correlations between criteria to ascertain the relative relevance of each through embracing Criteria Importance Through Intercriteria Correlation (CRITIC) for generating criteria weights. The third tier recommends the optimal AuV based on Multi-Attributive Border Approximation Area Comparison (MABAC). All these tiers are implemented under the authority of Type 2 Neutrosophic Numbers (T2NNs) as member of uncertainty theory. Hence, TTDMD can treat mysterious circumstances and inaccurate information.

Keywords: Autonomous vehicles (AuVs), smart cities, sustainability, MultiCriteria Decision Making (MCDM), Type 2 Neutrosophic Numbers (T2NNs)

Deniz Miller (UNSW School of Engineering & Information Technology) and Ripon Chakrabortty (UNSW School of Systems & Computing). *Resource Allocation for Australian Bushfire Response Using Agent-Based Modelling and Simulation.*

Abstract. Using simulation and other advanced artificial intelligence (AI) models to allocate and optimise resources can significantly improve the response to bushfire disasters. Resource allocation for bushfire response is the process of distributing response materials. The optimisation of this process ensures that resources are distributed in accordance with the severity of the given disaster. Ultimately, this ensures that the mismanagement of resources does not constrict the response plan implemented by the disaster response workforce. An agent-based simulation model is used in this study to conduct optimised resource allocation. The simulation includes the optimisation of Search And Rescue (SAR) teams and Fire Strike Teams (FST) to save the most lives. Its output is a disaster response plan for implementation by the workforce. The model will be based on a realistic scenario with specified constraints. Hence, it will be restricted in its real-world applications; however, this can later be expanded to include more complex scenarios. The model effectively chooses the optimal resource usage and provides a disaster response plan, including a summary of allocated resources and a vehicle routing plan.

Keywords: Bushfire, Resource Allocation, Optimisation, Simulation

Karam Al-Assaf (American University of Sharjah), Zied Bahroun (American University of Sharjah) and Vian Ahmed (American University of Sharjah). *Technological Innovations and Service Quality in Healthcare 4.0: An Analytical Review.*

Abstract. Revolutionizing healthcare through technology presents a unique set of challenges and opportunities. This review paper examines the significant impacts of Healthcare 4.0 (HC4.0) and Healthcare Service Quality (HCSQ). The paper explores the integration of advanced technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), and big data analytics within the healthcare sector. These innovations offer substantial improvements in service delivery, patient outcomes, and operational efficiencies, but they also introduce complex challenges like integrating new systems with existing infrastructures, ensuring interoperability, and addressing the digital divide that may hinder underprivileged populations from accessing these advancements. Additionally, ethical concerns regarding data privacy and automation biases require urgent attention. The analysis suggests that future research should focus on developing effective integration strategies, establishing robust compatibility standards, and advocating for policies that promote equitable access to technology. By addressing these challenges, the healthcare sector can leverage HC4.0 to achieve a balanced and inclusive approach that maximizes benefits while minimizing risks, ultimately enhancing service quality.

Keywords: Healthcare, Healthcare 4.0, Healthcare Service Quality, HCSQ, Technological Advancements

Firda Rahmadani (Khalifa University of Science and Technology), Mecit Can Emre Simsekler (Khalifa University of Science and Technology), Mohammed A. Omar (Khalifa University of Science and Technology), Ali Mohammed Al Shidi (Sheikh Shakhbout Medical City) and Siddiq Anwar (Sheikh Shakhbout Medical City).
HUMAN-CENTERED PREDICTION MODEL TO STREAMLINE DECISION-MAKING IN SEPSIS MANAGEMENT PATHWAYS.

Abstract. Sepsis presents a significant challenge in healthcare due to its rapid progression and high mortality rates. In healthcare settings, the development of a human-centered prediction model for sepsis holds the potential to enhance decision-making processes. Such a model comprehensively integrates systems-related factors, including clinician insights, workflow dynamics, and human-centered design principles. The contribution of this study includes leveraging expert knowledge during the model development. It offers valuable perspectives on the significance of specific features in learning complex relationships and generating accurate predictions. Then, expert knowledge can be combined with data analytics to develop a machine learning-based prediction model, which can aid in the early recognition and management of sepsis. The result shows that the gradient boost outperformed the other algorithms with an accuracy of 0.75, precision of 0.76, recall of 0.75, and F1 score of 0.75. The result of ML-based algorithms in sepsis prediction models will enhance the decision-making process in the healthcare setting, especially for risk assessment during triage. The current alert system is based on a Modified Early Warning Score (MEWS), which is unreliable as it often generates false positive alarms. Our study suggests that healthcare professionals can be involved in developing and implementing the proposed model to ensure it aligns with their needs and practices.

Keywords: sepsis pathway, human-centered decision-making, human factors, patient safety, machine learning, artificial intelligence

Sho Oiwa (Waseda University, Graduate School of Creative Science and Engineering), Taichi Abe (Waseda University, Graduate School of Creative Science and Engineering), Keigo Kimura (Waseda University, Graduate School of Creative Science and Engineering), Satoshi Suzuki (Waseda University, School of Creative Science and Engineering) and Masayuki Goto (Waseda University, School of Creative Science and Engineering). *Contextual Bandit Algorithm with Decision Trees and Upper Confidence Bound for Adaptive Recommendation.*

Abstract. The Contextual Bandit Algorithm, an online recommender system, makes recommendations and learns user characteristics simultaneously based on context such as user attributes. The method balances exploration and exploitation to maximize accumulated reward. Specifically, exploration involves recommending a variety of products, while exploitation involves recommending products with high expected rewards. To accurately estimate rewards from context, it is essential to adopt an appropriate model for the given situations. Additionally, it should be noted that the relationship between context and reward is often non-linear. TreeBootstrap, which uses decision trees to estimate rewards, has been proposed as a method suitable for such situations. However, the model may have a different structure even when trained on the same data because TreeBootstrap balances exploration and exploitation by bootstrapping the training data. It may not be able to fully utilize the information obtained through exploration, which may lead to insufficient cumulative reward.

In this study, we propose TreeUCB, which balances exploration and exploitation by using a confidence upper bound on the expected reward instead of bootstrapping the training data. The confidence upper bound is derived from the assumption that the number of data points with a reward of 1 in a leaf node follows a binomial distribution. We conduct experiments on artificial data to demonstrate the effectiveness of the proposed method, including other methods suitable for situations where there is a non-linear relationship between context and reward.

In addition, we discuss the balance between exploration and exploitation by comparing the reward distributions of each method and several case studies.

Keywords: Contextual Bandit, Decision Tree, Upper Confidence Bound

Masha Dilmi Jayasuriya (Center for Supply Chain, Operations and Logistics Optimization, University of Moratuwa, Katubedda 10400, Sri Lanka), Madushan Fernando (University of Moratuwa), Amila Thibbotuwawa (Center for Supply Chain, Operations and Logistics Optimization, University of Moratuwa, Katubedda 10400, Sri Lanka) and Peter Nielsen (Aalborg University). *OPTIMIZING UAV DELIVERY ROUTING FOR ISLAND DEMAND SURGES: A DATA-DRIVEN APPROACH TO MINIMIZE CARBON EMISSIONS.*

Abstract. Unmanned aerial vehicles (UAVs) offer significant advantages over traditional delivery methods, including vertical take-off and landing capabilities, lower costs, rapid and adaptable transport directly to consumers. Since its inception, the Vehicle Routing Problem (VRP) has seen substantial development, enabling route to decide that reduces costs and improves the effectiveness of operations. So, integrating the VRP with UAVs, UAV routing aims to find the best combination of routes for UAVs that minimize overall distance or time, while enhancing delivery efficiency. This research focuses on optimizing last-mile UAV delivery for rapid response to demand surges on islands, to overcome accessibility challenges. It demonstrates the comparative advantages of UAVs and provides a data-driven approach to estimate carbon emission reductions. We conducted a detailed cost-benefit analysis comparing UAV delivery with existing boat services, considering factors such as delivery time, operational costs, and carbon emissions, using a Maldives hotel chain as a case study. To be more accurate, a long-term cost-benefit analysis was also performed. The analysis indicates that while UAV implementation may not yield immediate savings in the first two years, significant cost-effectiveness and operational efficiency are achievable from the third year onwards. The research also underscores the environmental sustainability of UAVs, showcasing significant reductions in fuel consumption and carbon footprint compared to traditional boat delivery methods. On average, UAVs achieve an impressive 85% reduction in carbon emissions. Furthermore, the results show that the use of UAVs in logistics results in more effective delivery options, particularly in island markets where accessibility and rapid response are crucial to overcome the demand surges. Moreover, our model's real-world applicability is supported by assumptions that ensure its relevance to large-scale distribution networks. The implications of this research are significant for decision-makers and policymakers, aiding in the formulation of strategies to adopt and integrate UAVs in practical scenarios.

Keywords: Vehicle Routing Problem, Unmanned Aerial Vehicles, Last-mile delivery, demand surges, carbon emissions

Oliviu Matei (Technical University of Cluj Napoca, North University Centre of Baia Mare), Rudolf Erdei (Technical University of Cluj Napoca, North University Centre of Baia Mare), Daniela Delinschi (Technical University of Cluj Napoca, North University Centre of Baia Mare), Jose Barata (Technical University of Cluj Napoca, North University Centre of Baia Mare), Sanaz Nikghadam-Hojjati (Universidade NOVA de Lisboa) and Iulia Bărăian (Technical University of Cluj Napoca). *Collaborative networks in orchestration-based software architectures.*

Abstract. The article discusses the issue of smart orchestration in distributed software architectures that are loosely connected and have built-in load balancing. The technique relies on the likelihood of cooperation among software modules, represented within intelligent Markov chains, where multiple instances may be included and exhibit a fuzzy response and processing duration. In this manner, the cooperation across modules for a greater, worldwide benefit is enhanced, alongside the optimisation of execution and communication durations. This article presents an approach to using these intelligent Markov chains, which are live-updated and used as dynamic load-balancing, to improve an orchestration solution used in compositing microservices.

Keywords: Software Orchestration, Markov Chain, Distributed Systems, Load Balancing

Abhinav Katiyar (INDIAN INSTITUTE OF MANAGEMENT MUMBAI) and Vidyadhar V. Gedam (INDIAN INSTITUTE OF MANAGEMENT MUMBAI). *"HARVESTING SUSTAINABILITY: A DEEP DIVE INTO FERTILIZER INDUSTRY LIFE CYCLES".*

Abstract. The goal of this study's extensive social life cycle assessment (SLCA) of the fertilizer business is to determine the socioeconomic and social effects of fertilizer production, usage, and disposal and incorporating CE to minimize these impacts. Given the critical role fertilizers play in maintaining global food security and agricultural production, the assessment takes a comprehensive approach, taking into account a range of stakeholders, including consumers, workers, local communities, and the general public. The study's methodology adheres to the UNEP/SETAC Life Cycle Initiative's recommendations, using both quantitative and qualitative data to evaluate impacts in areas like socioeconomic development, community well-being, labor rights, and health and safety. Our findings draw attention to important issues, such as the violation of worker rights in mining operations, the dangers to one's health posed by hazardous material exposure, and the socioeconomic divide in rural regions. On the other hand, advantageous effects were also noted, including the construction of infrastructure, the creation of jobs, and the improvement of world food security. The study emphasizes the significance of focused actions, such as tighter regulatory monitoring, improved safety procedures, and community engagement programs, to reduce negative consequences. Our findings mean two things. First, they provide industry stakeholders useful information to enhance social sustainability practices in the fertilizer supply chain. Second, highlighting the necessity of an integrated strategy that balances environmental, economic, and social goals adds to the larger conversation on sustainable agriculture. Ultimately, this SLCA emphasizes how critical it is to shift to more environmentally friendly fertilizer techniques to promote justice and resilience in global food systems.

Keywords: Life Cycle Sustainability Assessment, Circular Economy, Stakeholders, Sustainability

Lankani J. Liyanathanthri (Center for Supply Chain, Operations and Logistics Optimization, University of Moratuwa, Katubedda 10400, Sri Lanka), M. Madhava Jayalath (University of Moratuwa), Amila Thibbotuwawa (Center for Supply Chain, Operations and Logistics Optimization, University of Moratuwa, Katubedda 10400, Sri Lanka) and Peter Nielsen (Aalborg University). *APPLICATION OF DIGITAL TWINS TO OPTIMIZE POST-HARVEST CIRCULAR GRAIN SUPPLY CHAIN.*

Abstract. Food loss and waste in the world has created a major distress in food security especially in developing countries. The generated loss is found to be mainly caused from the post-harvest activities along the Agri-food supply chain, the highest during the storage phase followed by distribution stage. Circular economy is a helping factor in reducing post-harvest loss, which needs implementation of technological solutions such as Industry 4.0 and Industry 5.0 applications for realization. This paper aims to provide a framework for a digital twin application for storage of grain in on farm storage stage to reduce post-harvest losses and support the circular economy concept. The proposed system comprises of several added applications such as monitoring and controlling system to monitor temperature and humidity distribution of grain inside the storage and control them under a set threshold, a shelf-life prediction scheme to measure the real time shelf life using the collected parameters – temperature and humidity in all storages connected to the digital twin platform, and a linear programming algorithm for distribution, which is operated using the calculated real time shelf life in storages to minimize the loss at all levels of storages including on-farm facilities and distribution centers. This solution will supposedly induce sustainability across the whole supply chain enabling information visibility to all levels of stakeholders from farm to retails pushing for better agricultural practices in reducing losses.

Keywords: Digital twins, Post-harvest loss, Industry 4.0, Linear programming, Circular economy, Agri-food supply chain

Siku Kim (Pusan National University) and Kwangyeol Ryu (Pusan National University). *A FRAMEWORK FOR INTEGRATING MIXED REALITY AND ARTIFITIAL INTELLIGENCE TECHNOLOGIES TO ENHANCE HUMAN-ROBOT INTERACTION.*

Abstract. With the advent of Industry 4.0, cutting-edge technologies such as artificial intelligence (AI), Internet of Things (IoT), and robotics have been integrated into the manufacturing and service industries, making great progress. Among these, human-robot collaboration (HRC) is emerging as an innovative approach for humans and robots to collaborate in a shared environment. In HRC systems, we combine human cognitive and decision-making capabilities with the precision and sustainability of robots to optimise productivity and safety in a variety of industrial environments. Mixed reality (MR) technologies are showing great potential in improving HRC. MR technology increases the efficiency and accuracy of human-robot interactions by visualizing complex data and processes in real time. This study seeks to improve efficiency and effectiveness by integrating mixed reality into human-robot collaboration systems. This study proposes the integration of head-mounted display (HMD) equipment with the application of ontology to increase the efficiency of HRC. To this end, we developed an MR-based HRC framework and worked on it. We propose main functional modules for allocation, monitoring, and control. Through this, we expect to lay the foundation for research that can lead to the development of a more natural and efficient human-robot collaboration system.

Keywords: Mixed Reality, Human-Robot Collaboration, Artificial Intelligence, Ontology, Interaction

Haed Tavakkolimoghaddam (IMT Atlantique, LS2N – CNRS, La Chantrerie, Nantes 44300), Alexandre Dolgui (IMT Atlantique, LS2N – CNRS, La Chantrerie, Nantes 44300), Simon Thevenin (IMT Atlantique, LS2N – CNRS, La Chantrerie, Nantes 44300), Oncu Hazir (Rennes School of Business, 2 Rue Robert d'Arbrissel, Rennes 35065) and Maher Agi (Rennes School of Business, 2 Rue Robert d'Arbrissel, Rennes 35065). *An MILP Model for Budget-Constrained Scheduling of Human-Robot Collaboration in Assembly Line Balancing.*

Abstract. Efficient assembly line operations are crucial in modern manufacturing systems, particularly with the rise of human-robot collaboration (HRC). This paper provides a mixed-integer linear programming (MILP) model that integrates the distinct abilities of humans and robots to achieve a new definition of assembly line balancing and scheduling. This model ensures a strategic allocation of tasks that leverages the synergistic potential of human and robot collaboration. It achieves this through a detailed formulation that includes task feasibility, station assignment, budget constraints, and resource movement. The ability of the proposed model to investigate complex operational constraints is critical to its success in optimizing resource utilization while minimizing the cycle time. Using the Gurobi Optimizer and tailoring the simulated annealing (SA) algorithm and the genetic algorithm (GA) for computational analysis, the proposed model and the algorithms show substantial improvements in reducing the cycle time in a reasonable amount of time. The insights highlight the possibility of increasing production efficiency and operational adaptability by 67.24\% and 15.15\% by changing the number of available humans and robots and considering the possibility of their collaboration.

Keywords: Assembly line balancing, Human-robot collaboration, Budget-constrained scheduling, Simulated annealing, Genetic algorithm

Xueping Li (University of Tennessee), Tom Berg (University of Tennessee), Ashley Stowe (Oak Ridge Enhanced Technology and Training Center (ORETTC)), Luke Birt (Y-12 National Security Complex), Gerald Jones (University of Tennessee), Christopher Mason (Oak Ridge Enhanced Technology and Training Center (ORETTC)), John Williams (University of Tennessee) and Scott Lawson (University of Tennessee). *A Digital Twin Framework for Predictive Maintenance Using Large Language Models and Machine Learning Methods.*

Abstract. This paper presents a comprehensive framework for developing and implementing a digital twin system for real-time monitoring and predictive maintenance in industrial environments. By leveraging cutting-edge technologies such as Unreal Engine 5, the Message Queue Telemetry Transport (MQTT) protocol, Random Forest machine learning models, and Large Language Models, we create a system that virtually replicates physical assets. This enables proactive maintenance strategies and enhances operational efficiency. The digital twin system collects sensor data from operational assets, processes it using machine learning algorithms, and provides actionable insights to mitigate potential faults and optimize asset performance. Additionally, the integration of a web portal facilitates seamless monitoring and access to historical records, training materials, and asset status updates. Initial results demonstrate the potential of digital twins to revolutionize industrial asset management and maintenance practices.

Keywords: Predictive maintenance, Digital twin, Unreal Engine 5, Machine learning, Simulation

Xueping Li (University of Tennessee), Tom Berg (University of Tennessee), Ashley Stowe (Oak Ridge Enhanced Technology and Training Center (ORETTC)), Luke Birt (Y-12 National Security Complex), Gerald Jones (University of Tennessee), Aran Arab (University of Tennessee) and Scott Lawson (University of Tennessee).
Generative Large Language Models for Predictive Maintenance Planning.

Abstract. Maintenance planning and the generation of necessary components for tasks can prove time-consuming and complex. Automating the creation of recurring or similar tasks by leveraging previous planning packages and data, while uncovering insights to automate planning package generation, presents an opportunity to conserve valuable time and resources. This research aims to harness the textual and probabilistic capabilities of large language models (LLMs) to automate the generation of planning packages. Utilizing diverse data sources ranging from raw data to handwritten text, both singular and collaborative LLMs are trained and tested. Results demonstrate their capability to generate essential planning package components, effectively replicating the statistical patterns in the data. This demonstrates the use of these tools inside a digital asset for automated planning. This work outlines a methodology for constructing datasets, a training suite, and evaluation methods for LLM-based textual and conversational planning tools utilized in an asset digital twin.

Keywords: Maintenance Planning, Large Language Models (LLMs), Collaborative LLMs, Automation

Xueping Li (University of Tennessee), Haowen Xu (Oak Ridge National Laboratory), Jose Tupayachi (University of Tennessee), Olufemi Omitaomu (Oak Ridge National Laboratory) and Xudong Wang (University of Tennessee).
Emerging AI and Cognitive Digital Twin Technologies Towards Low-Carbon Multimodal Freight Transportation System.

Abstract. Effective monitoring of multimodal freight transportation dynamics is crucial for advancing global sustainable and low-carbon economies. Traditional approaches, relying on discrete simulations for each transportation mode using single-modal data, fall short in providing the comprehensive coverage needed for optimizing the multimodal freight system. This encompasses factors such as shipping time, costs, greenhouse gas emissions, and socio-economic impacts. The evolution of Internet of Things (IoT), Artificial Intelligence (AI), and advanced computing has given rise to cognitive digital twins, facilitating smart city applications through real-time monitoring, predictive analytics, and system-wide optimization across interconnected transportation modes. This review discusses the integration of emerging geodata sources (including IoT, crowdsourcing, and connected vehicles), advanced ontology-driven simulation frameworks, and AI-driven optimization algorithms to enhance the sustainability, efficiency, and decarbonization of the multimodal transportation system at various scales. We evaluate these technologies and their application in tracking U.S. freight transport, highlighting the challenges of modeling and optimizing multimodal transportation. Drawing from our research, we propose conceptual and technical frameworks for developing a cognitive digital twin that merges these technologies into a cohesive and automated pipeline. Our discussion extends to potential solutions and research directions for achieving real-time situational awareness and optimizing the complex dynamics of multimodal transportation systems, aiming to contribute to the field's advancement towards more integrated, sustainable, and scalable freight transportation solutions.

Keywords: Artificial Intelligence, Cognitive Digital Twin, Intermodal Freight Transport System

Vikram Dhotre (University of Auckland), Xun Xu (University of Auckland), Yuqian Lu (University of Auckland) and Holger Heinzel (Heavy Engineering Research Association, New Zealand). *A CONCEPTUAL DATA CONNECTIVITY MODEL FOR CONSTRUCTION 4.0.*

Abstract. The Architecture, Engineering, Construction, and Operation (AECO) industry faces significant challenges due to its fragmented nature, resistance to digital transformation, regulatory and compliance issues, and inefficient data management, all impeding productivity and efficiency. A thorough literature review conducted to identify reason behind the challenges, key concepts and standards and develop a comprehensive model incorporating these elements. The literature review highlights existing frameworks and technologies, emphasising the industry's need for robust data management and interoperability. This paper proposes a conceptual data connectivity model that leverages Construction 4.0 technologies, digital data templates, cloud-based BIM (C-BIM), and data dictionaries. The model facilitates seamless data exchange and interoperability through standardised formats such as STEP, IfcJSON, and XML. The proposed model integrates various data sources, enhancing real-time coordination, decision-making, and project efficiency. It addresses critical issues such as cybersecurity, data sovereignty, governance, and hygiene. The paper's findings indicate that the data connectivity model can significantly improve project outcomes by fostering collaboration and technological innovation. However, challenges such as the high initial cost of implementation and the need for technical expertise must be addressed. Future research will focus on validating the model through a case study in the New Zealand AECO industry to refine the framework to meet industry needs and explore the integration of emerging technologies. In conclusion, the proposed data connectivity model represents an approach to overcoming current barriers, positioning the AECO industry for enhanced productivity and sustained technological advancement. This research underscores the importance of long-term stakeholder collaboration, integration of available digital tools, and use of interoperable data exchange formats in achieving effective data management and operational efficiency.

Keywords: Data-driven decision making, Cloud-BIM, Data dictionary, Digital data template, Data security, Industry Foundation Classes (IFC)

Mohammed Malaibari (University of New South Wales), Mustafa Siddiqui (University of New South Wales), Bahador Bahramimianrood (University of New South Wales), Sijia Xie (University of New South Wales) and Shiva Abdoli (University of New South Wales). *THE ROLE OF KNOWLEDGE GRAPHS IN IMPROVED DATA MANAGEMENT FOR DIGITAL TWIN APPLICATIONS IN THE MANUFACTURING INDUSTRY.*

Abstract. The manufacturing industry is undergoing a significant transformation driven by digitalization and the adoption of Industry 4.0 technologies and smart manufacturing. Central to this transition is digital twin technology, which provides virtual replicas of physical assets. However, the increasing volume and variety of manufacturing data stored across multiple systems in diverse formats poses significant challenges for effective data management within a digital twin environment. Data silos and data heterogeneity hinder accurate replication of real-world scenarios, comprehensive data analysis, and the derivation of actionable insights.

To address these challenges, this paper demonstrates the integration of knowledge graphs within the digital twin environment to enhance data management and decision-making in the manufacturing industry. Knowledge graphs offer a unified and comprehensive view of diverse and heterogeneous data sources, effectively mitigating the issues of data silos and heterogeneity. This integration enables seamless data interoperability, allowing digital twins to replicate real-world scenarios and support informed decision-making.

The study proposes a framework demonstrating a centralized hub for managing diverse data, optimizing manufacturing processes, and improving operational efficiency. The integration of knowledge graphs into digital twin applications offers a promising pathway for innovation and competitiveness in the manufacturing sector. Future research directions include exploring the scalability of the knowledge graph-digital twin framework and incorporating artificial intelligence to enhance its capabilities further.

Keywords: Knowledge Graph, Digital Twin, Data Management, Smart Manufacturing, Industry 4.0, Data Integration, Data Silos, Data Heterogeneity, Manufacturing Data

Ruchira Thanuja Wickramasinghe (Center for Supply Chain, Operations and Logistics Optimization, University of Moratuwa, Katubedda 10400, Sri Lanka), Amila Thibbotuwawa (Center for Supply Chain, Operations and Logistics Optimization, University of Moratuwa, Katubedda 10400, Sri Lanka), Peter Nielsen (Aalborg University) and Peshala Thibbotuwawa Gamage (Florida Institute of Technology, Melbourne, FL 32901). *SAFETY AND PRODUCTIVITY IN COLD STORAGE STOCKTAKING: UAV INTEGRATION AND ENERGY EFFICIENT ROUTING STRATEGIES.*

Abstract. Stocktake refers to the process of physically verifying the amounts and conditions of all commodities present in the warehouse. Instead of conducting this task on an annual basis, it would be more effective to perform it on a monthly basis. Workers in a cold storage warehouse face hazards throughout the stock-taking process, such as being exposed to low temperatures and working in elevated areas with ladders and heavy gear while required to have mandatory rest stops while working under extreme temperatures. Hence, conducting stocktaking operations using UAVs (Unmanned Areial Vehicles) can effectively reduce these risks and enhance the operational effectiveness of the facility. Even though battery drain is higher with extreme temperatures, modern high-density batteries are capable of performing this task in cold warehouses. Furthermore, this can help to reduce the overall time taken for the stocktaking process, improving the accuracy of the inventory. The objective of this study is to identify an effective approach for stocktaking in cold storage using UAVs and create an energy-efficient routing system for the selected UAV system. UAV with a UGV (Unmanned Ground Vehicle) was selected as the UAV system due to its benefits of safety, range, and easy navigation compared to other systems. Considering the factors affecting the energy usage of UAVs, we created an energy-aware routing system, which is 25.6% efficient compared to the traditional system in our simulated scenario. Then, we compared the time taken to perform the same task using single and two UAV systems. Two UAV systems performed the same task using 42.8% less time compared to a single UAV system, which made it beneficial in large-scale warehouse stocktaking operations.

Keywords: Cold Warehouse, UAV Stocktaking, UAV Routing, Warehouse Automation, Smart Warehousing

Menglei Kong (School of Economics and Management, Beihang University), Zhong Yao (School of Economics and Management, Beihang University) and Yunfei Dong (School of Economics and Management, Beihang University). *Pricing Strategies of Online Music Platforms in Two-sided market.*

Abstract. As the online music industry expands, sale models for digital music are becoming increasingly diverse. Online sales of music products can be regarded as typical two-sided markets, where a well-designed pricing model can help online music platforms attract more users and achieve platform growth. The research reveals the influencing mechanisms of advertising density, advertising return rate, song utility value, and user scale on platform profit and pricing strategies under a hybrid model. It also indicates that the ownership model is suitable for scenarios with high advertising density and low song utility value, while the hybrid model is ideal for conditions with a low advertising return rate and low song utility value. When the song utility value is high, the subscription model is recommended.

Keywords: Online music platform, Two-sided market, Pricing strategy, Hybrid service model

Jingzhe Lei (City University of Hong Kong) and Way Kuo (City University of Hong Kong). *Jigsaw-based load dispersion design for solar pavement systems.*

Abstract. Solar pavement, as an innovative technology, capitalizes on solar energy and effectively utilizes the road infrastructure to advance towards the goal of achieving carbon-neutralization. While solar floor tiles are engineered to accommodate the load generated by pedestrians and potentially even vehicles, the uneven load levels can impact the overall performance of the solar pavement system. The research is to explore a puzzle-based load dispersion design for solar pavement systems with the objective of enhancing their performance from a reliability engineering perspective. Given the broader applicability of irregular configurations compared to rectangular configurations, we employ a Jigsaw puzzle methodology, which is a variant of the Sudoku puzzle, to facilitate the dispersion of load risks across the entire system. Initially, load risk is assessed by considering the flow on the tiles. Subsequently, the principles of Jigsaw solving are applied to identify an optimized load distribution pattern that informs the reconfiguration design of solar pavers. Finally, an illustrative example implemented at the Hong Kong Institute for Clean Energy (HKICE) is presented to provide a comprehensive illustration of our approach.

Keywords: Solar pavement, Puzzle, Load, Reliability, Reconfiguration design

Ken Chen (Tianjin University), Zhen He (Tianjin University) and Xiaodan Wu (Hebei University of Technology). *Supplier Quality Improvement for Dual-Sourcing Procurement based on supplier process control.*

Abstract. Objective: This paper examines a dual-sourcing procurement challenge, focusing on supplier quality improvement driven by quality cost-sharing contracts under the scenario of a buyer procuring from two suppliers - one strategic and the other a spot market supplier - within an imperfect production system characterized by quality variability.

Methods: Utilizing process quality control methodologies, this study models quality costs considering out-of-control production scenarios to examine the relationship between procurement scale and process quality losses. By evaluating the equilibrium strategy of the buyer's procurement decisions and the supplier's quality decisions, this study investigates the cost-sharing contract settings that effectively promote quality improvement under various scenarios.

Results: We find that traditional inspection quality models lead to extreme procurement decisions by the buyer, increasing competitive pressures on strategic supplier and potentially driving it out of the market. Under this model, even if the buyer is willing to assume more quality responsibility, strategic suppliers may still exit the market if its competitive advantage is not apparent. In contrast, the process quality model facilitates more balanced quality cost-sharing contracts, preventing extreme shifts in quality responsibility. In certain scenarios, the buyer needs to assume as much quality responsibility as possible to better encourage supplier quality improvements. However, once the buyer shifts quality responsibility onto the supplier, it fails to provide any motivational effect.

Conclusion: The results highlight the advantages of using the process quality model to describe quality loss costs in dual-sourcing issues. Based on this model, the buyer does not resort to extreme procurement decisions to coerce suppliers into improving quality. Instead, quality cost-sharing contracts are designed for specific scenarios to appropriately allocate quality responsibilities, thereby enhancing supplier involvement in quality improvements and achieving better supply chain performance. Our contract setting strategy highlights that the buyer cannot evade quality responsibilities under any scenario. Additionally, our study provides references for supply chain procurement operations involving imperfect production systems.

Keywords: Dual-Sourcing Procurement, Heterogeneous supplier, Process Quality Control, Quality improvement, Contracting

Moustafa Abdelwanis (Khalifa University), Mecit Can Emre Simsekler (Khalifa University), Andrei Sleptchenko (Khalifa University), Adriana Gabor (Khalifa University) and Mohammed Omar (Khalifa University).
EXPLORING DRIVERS AND BARRIERS OF ADOPTING AI-DRIVEN TECHNOLOGIES IN HEALTH SYSTEMS.

Abstract. In light of recent Artificial Intelligence (AI) advancements in healthcare applications, such as medical imaging, disease prediction, precision medicine, and telehealth, there is substantial potential for enhancing and personalizing the experience while ensuring improved operations efficiency. However, the widespread integration of AI in healthcare has given rise to significant concerns, necessitating an in-depth investigation. These concerns can potentially hinder the adoption of AI-driven technologies in health systems, warranting a thorough examination. One critical concern is automation bias, where an unquestioning reliance on AI outputs may compromise pivotal decision-making processes. Other concerns, such as the "black-box" nature of AI algorithms and privacy concerns regarding sharing data between stakeholders, impact the perceived trust of AI technologies and require more robust measures when implementing AI technologies in healthcare. This study employs a systems approach to study the drivers and challenges influencing the adoption of AI-powered technologies in healthcare systems. The proposed model considers different perspectives, such as patient-related factors, physician characteristics, organizational readiness, and governance. The distinct classification of these factors highlights the necessity for a systems approach and a comprehensive strategy that considers the perspectives of all stakeholders in the adoption process. The findings of this study also recommend continuous collaboration among stakeholders and informed decision-making to ensure the safe and efficient integration of AI technologies in healthcare.

Keywords: Artificial intelligence, Technology Adoption, Healthcare, Future of Work, Technology Integration, Patient Safety

Yu Wang (Jinan University), Jiacong Wu (Jinan University) and Xu Ye (Jinan University). *Product Competitive Analysis in Online Markets Based on Consumer Preference Satisfaction Similarity.*

Abstract. This study introduces a Product Competition Analysis Model based on Consumer Preference Satisfaction Similarity (PCAM-CPSS), addressing the dynamic competitive landscape shaped by heightened consumer expectations and cost-efficiency imperatives. The methodology employs aspect-level customer sentiment analysis and the frequency of specific product attributes in UGC to quantify consumer demand satisfaction. Community detection and social network analysis are utilized to reveal the intricate competitive market landscape. The methodology includes a meticulous evaluation of product competitiveness, analyzing distinctions in PCAM-CPSS, creating a directed-weighted network for product competitiveness comparison, and applying an importance ranking algorithm. The study's findings involve a meticulous evaluation of the target product competitiveness. Supported by a directed-weighted network and an importance ranking algorithm, empirical validation through case testing confirms the superior performance of the PCAM-CPSS in both product competitor identification and overall competitiveness ranking compared to conventional methodologies. We introduce a comprehensive product competitive analysis model, which not only quantifies consumer demand satisfaction but also discerns complex competitive relationships between products, contributing to a deeper understanding of market dynamics. The study's findings, supported by advanced techniques, provide businesses with enhanced tools for strategic decision-making in a competitive market environment.

Keywords: Product competitive analysis, Consumer demand satisfaction, Product competitive relationship network, Social network analysis, User generated content

Khloud M. Mansour (Department of Mechanical Engineering, The American University in Cairo), Fatema Khedr (Industrial Engineering Program, Engineering & Applied Science (EAS) School, Nile University), Yara Elkassaby (Industrial Engineering Program, Engineering & Applied Science (EAS) School, Nile University), Ahmed Mohib (Department of Mechanical Engineering, The American University in Cairo), Mohamed F. Aly (Department of Mechanical Engineering, The American University in Cairo) and Ahmed H. Salem (Industrial Engineering Program, Engineering & Applied Science (EAS) School, Nile University). *An Integrated Roadmap for Implementing Circular Economy in Industrial Systems* .

Abstract. The transition towards circular economy is becoming a significant concern in the industrial systems, aiming to minimize resource consumption, reduce waste generation, and promote sustainable practices. This paper provides a comprehensive integrated roadmap for implementing circular economy principles within industrial systems focusing on the product, operations, and engineering as major industrial domains. The proposed roadmap provides a structured approach to guide organizations in adopting circular economy strategies and practices, encouraging sustainable development and resource optimization. This roadmap encompasses key stages, including assessment of current practices, identification of circular economy opportunities, planning, and evaluation. It emphasizes the integration of circular economy principles across the entire product lifecycle, incorporating design for circularity, designing out waste, and regenerating natural resources. Furthermore, this roadmap addresses the necessary actions in products aspects, engineering practices, and operational processes to support the circular economy's ultimate goal. Through the systematic adoption of this roadmap, industrial systems can unleash economic, environmental, and social benefits while contributing to the global sustainability paradigm. In addition, this roadmap can be utilized for developing a detailed framework and analytical model to calculate the Return on Circular Economy Investment (ROCEI) in the future.

Keywords: ROCEI, Circular Economy, Industrial Engineering, Roadmap, Framework

Abdelrahman Sultan (Industrial Engineering Program, Engineering & Applied Science (EAS) School, Nile University), Khloud M. Mansour (Department of Mechanical Engineering, The American University in Cairo), Fatema Khedr (Industrial Engineering Program, Engineering & Applied Science (EAS) School, Nile University), Mohamed F. Aly (Department of Mechanical Engineering, The American University in Cairo), Ahmed Mohib (Department of Mechanical Engineering, The American University in Cairo) and Ahmed H. Salem (Industrial Engineering Program, Engineering & Applied Science (EAS) School, Nile University). *Leveraging A Decision Support System in the Airlines Service Industry.*

Abstract. The rapid technological disruptions and fluctuating demands create significant needs for developing a well-designed Decision Support System (DSS) in various business eco-systems. Business decision-makers are facing tangible challenges in making accurate and optimal decisions. Therefore, optimizing the existing DSS approaches becomes a must. This study conducts a systemic literature review on DSS components and frameworks developed in different service industries. However, Current DSS approaches often lack optimal integration between the three key components: Database Management Systems (DBMS) for data storage, Model Base Management Systems (MBMS) for analytical models, and Dialog Generation and Management Systems (DGMS) for user interaction. This paper aims to develop an optimal DSS framework for supporting the top management strategies in the airlines industry. Furthermore, this study addresses this gap by proposing an optimal DSS framework specifically tailored for the airline service industry. This framework aims to enhance operational efficiency, mitigate disruptions, maximize profitability, and maintain customer satisfaction. The airline service industry, with its inherent dynamism and recent complexities and conflicts in the Middle East, serves as a compelling testbed to validate the proposed framework's effectiveness. A case study has been conducted to demonstrate the usability and real-world application of this novel DSS framework.

Keywords: DSS, Industrial Engineering, Airlines, Framework, ROMC

Rasyid Pratama (Research Centre for Integrated Transport Innovations (rCITI), University of New South Wales) and Elnaz Irannezhad (Research Centre for Integrated Transport Innovations (rCITI), University of New South Wales). *IMPROVING PERFORMANCE OF CONTAINER TERMINAL OPERATIONS: AN AGENT-BASED SIMULATION MODEL.*

Abstract. Cooperation among freight actors in the container transport chain, such as shipping lines and trucking companies, has been shown to reduce logistics costs and adverse environmental impacts, among others. This research investigates the impact of two cooperation mechanisms—utilisation of multi-trailer trucks and backloading operations—on overall container terminal performance. Using real-world data, we developed an agent-based simulation model to assess the impact of increasing percentages of multi-trailer and backloaded trucks on terminal operations. We also tested a truck prioritisation strategy, where trucks are prioritised to be serviced by straddle carriers over quay cranes, as a strategy to reduce truck turnaround times. The simulation results suggest that higher proportions of multi-trailer trucks and backloading operations lead to worsened metrics such as truck turnaround time, truck queue time at gates, crane rate, and hourly container volume processed by straddle carriers. This is mainly due to an increased container volume and throughput as a result of higher productivity trucks. However, the metric of container turnaround time improves, indicating enhanced efficiency per unit of containers. Additionally, implementing a truck prioritisation strategy mitigates the impacts of increased container throughput and the decline in container terminal performance due to the presence of a large number of multi-trailer and backloaded trucks.

Keywords: agent-based simulation model, job sequence strategy, container terminal, simulation optimization, operational performance

Ziyu Zhang (State Key Lab of Intelligent Manufacturing Equipment and Technology, Huazhong University of Science and Technology), Xinyu Li (State Key Lab of Intelligent Manufacturing Equipment and Technology, Huazhong University of Science and Technology), Liang Gao (State Key Lab of Intelligent Manufacturing Equipment and Technology, Huazhong University of Science and Technology) and Qihao Liu (State Key Lab of Intelligent Manufacturing Equipment and Technology, Huazhong University of Science and Technology). *A hybrid biogeography-based optimization algorithm for solving dual resource flexible job shop scheduling problem with transfer time.*

Abstract. This paper addresses the dual resource flexible job shop scheduling problem with transfer time (DRFJSP-TT), a complex combinatorial optimization problem found widely in manufacturing. To tackle this NP-hard problem, a mathematical model of the DRFJSP-TT is established, and a novel hybrid biogeography-based optimization (HBBO) with particle swarm optimization (PSO) search mechanism is proposed in this paper. Firstly, the example learning approach is proposed to mitigate the disruption of elite solutions by inferior ones. Secondly, the migration operator incorporating the PSO search mechanism is designed to enhance global exploration and accelerate the search for high quality solutions. Finally, the random mutation operator is introduced to facilitate local exploitation around promising solutions, further refining the solution quality. Experimental results, validated against a set of 10 benchmark instances, demonstrate that the proposed hybrid BBO algorithm outperforms traditional methods in terms of solution quality and stability. The algorithm not only reduces makespan but also balances the utilization of both machine and human resources, leading to more sustainable and efficient production environments.

Keywords: Dual resource, Flexible job shop scheduling, Transfer time, Biogeography-based optimization, Particle swarm optimization

Munia Ahamed (University of Technology Sydney), Nathalie Sick (University of Technology Sydney) and Matthias Guertler (University of Technology Sydney). *BRIDGING THE GAP: BARRIERS TO AND REQUIREMENTS FOR HUMAN-ROBOT KNOWLEDGE TRANSFER.*

Abstract. This article focuses on the need for efficient information exchange between humans and collaborative robots (cobots) in advanced manufacturing by investigating the barriers to and requirements for effective knowledge transfer. Industry 4.0-based manufacturing systems heavily rely on the collaboration between humans and robots to improve safety, productivity, and adaptability. On the other hand, insufficient communication within the existing HRC systems results in a lack of trust and decreased effectiveness. The study combines a literature search, qualitative analysis of interviews and a design research methodology (DRM) to synthesize findings. The study integrates human expertise with cobot capabilities and examines the primary obstacles to knowledge transfer within Industry 4.0 frameworks. The literature gap is thoroughly examined by incorporating real industry settings and expert opinions while considering HRC's technical and interpersonal aspects. Focusing on the list of barriers like technological incompatibility, proper communication, and lack of human-centred design and requirements seeks to improve the smooth exchange of knowledge and skills between individuals and cobots, ensuring efficient collaboration. Therefore, it is essential to integrate a socio-technical system theory and resource-based view to handle the complex interaction between humans and robots in a collaborative environment. The study's findings highlight the significance of considering both technological and human-centered factors to promote seamless interactions and knowledge sharing, which require ongoing monitoring and feedback to improve teamwork. In conclusion, the study highlights the significance of efficient knowledge transfer in improving the manufacturing industry's efficiency, competitiveness, and innovation. This study builds the foundation for developing targeted interventions to overcome collaborative barriers in Industry 4.0 settings, thus advancing both a methodical approach and practical implementation to address the difficulties of knowledge transfer between humans and robots in industrial settings.

Keywords: Human-Robot collaboration, Knowledge Transfer, Industry 4.0, Manufacturing Industry, Requirements, Barriers, Human-robot interactions

Shohei Kanda (Graduate School of Advanced Science and Engineering, Hiroshima University), Keisuke Nagasawa (Graduate School of Advanced Science and Engineering, Hiroshima University), Katsumi Morikawa (Graduate School of Advanced Science and Engineering, Hiroshima University) and Katsuhiko Takahashi (Graduate School of Advanced Science and Engineering, Hiroshima University). *Controlling the frequency of dynamic switching between make-to-stock and make-to-order production.*

Abstract. Since companies have been required to satisfy a wide variety of customers' needs in recent years, not only traditional production strategies, such as make-to-stock (MTS) and make-to-order (MTO), but also a dynamic hybrid MTS/MTO production system — one of the flexible production strategies — are widely adopted in various industries. The dynamic hybrid system consists of MTS-dedicated machines and hybrid machines that can manufacture both MTS and MTO products. Depending on the situation, it can maintain high utilization with a small number of machines while switching to hybrid machines. In the dynamic hybrid system, a switching policy is one of the critical factors for effective operation. A multistep switching policy, in which each hybrid machine is switched one by one stepwise, can improve the system performance compared to a group switching policy, in which all hybrid machines are switched together, according to previous research. Under the multistep switching policy, however, it becomes necessary to avoid frequent switching, which might occur with oscillatory fluctuation of MTS inventory. Therefore, in this study, we propose a control policy to partially restrict the switchover for the dynamic hybrid system under a multistep switching policy to suppress the switching load. The system is analyzed utilizing a Markov analysis, and the impact of our proposed policy is investigated in the numerical experiments while comparing it with the simple multistep switching policy without any restriction of switchover. As a result, it has been shown that frequent switching can be suppressed by our proposed policy while improving operating costs.

Keywords: make-to-stock, make-to-order, hybrid production system, switching policy, Markov chain

Iwan Vanany (ITS), Muhammad Cholili (Institut Teknologi Sepuluh Nopember), Niken Anggraini Savitri (Institut Teknologi Sepuluh Nopember) and Dody Hartanto (Institut Teknologi Sepuluh Nopember). *REDUCING DETENTIONS COST IN CONTAINER YARD USING DISCRETE EVENT SIMULATION: INDONESIAN PORT CASE.*

Abstract. Container yard (CY) facilities are essential for storing raw materials/components to be produced or finished products to be shipped to consumers. In the automotive industry, container yard facilities are also used to store various components imported from abroad. The existing problems, especially in the Indonesian case as the problem formulation of this research, are relatively complex processes and activities carried out in logistics management, the optimal facility requirements are not yet known, and there is uncertainty in the arrival and demand of production so that the detention cost is relatively high and the efficiency in some logistics processes is also not optimal in the case study encountered. Therefore, this research aims to create a simulation model to reduce detention costs and improve the efficiency of logistics processes such as detention costs, number of containers, waiting time containers, and others. This research determined which scenario is the best compared to the existing options and provided practical implications and recommendations for improvement, ensuring that the company management can directly benefit from our findings.

Keywords: Container yard, discrete events simulation, detention cost

Assal Aminian (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran), Reza Tavakkoli-Moghaddam (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran), Behdin Vahedi-Nouri (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran), Keivan Tafakkori (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran) and Mohammad Rahmani (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran). *An Optimization Model of a Bread Supply Chain with the Circular Economy* .

Abstract. This paper considers a bread supply chain within the framework of a circular economy. The proposed model collects surplus bread generated at the retailer interface which is then grounded into bread flour or used as feedstock for sustainable biorefineries. The model has two objectives; minimizing the total cost of the supply chain and minimizing the negative environmental impact. Optimizing these objectives often involves a trade-off. The model incorporates supply chain and circular economy (CE) constraints and is solved using goal programming and Python. The results indicate that establishing biorefineries is not feasible; however, setting up grounding centers is recommended. Furthermore, the model illustrates high sensitivity to transportation costs and market demand. Even with reduced set-up costs or increased incentives, biorefineries are not considered viable.

Keywords: Bread supply chain, Bi-objective optimization, Circular economy

Mehrnaz Najafi (Department of Industrial Engineering, Faculty of Engineering, Kharazmi University, Tehran, Iran), Ali Ghodratnama (Department of Industrial Engineering, Faculty of Engineering, Kharazmi University, Tehran, Iran), Zdeněk Hanzálek (Industrial Informatics Department, Czech Technical University in Prague, Prague, Czech Republic), Reza Tavakkoli-Moghaddam (School of Industrial Engineering, College of Engineering, University of Tehran, Tehran, Iran) and Mohammad Rohaninejad (Industrial Informatics Department, Czech Technical University in Prague, Prague, Czech Republic). *An Economic Production Quantity Model with Quantity Discounts, Rework, and Process Interruptions for Several Items on a Single-Machine Environment.*

Abstract. This research uses an economic production quantity (EPQ) inventory model that includes manufacturer quantity discounts, process pauses, scrap, and rework. The model is for a range of products produced by a distinct machine. Only one consumer made bulk purchases from the business. The fixed costs and most of the parameters in this model are considered stochastic. Determining the cycle length, quantity of products produced by the producing plant, production uptime for product and incomplete products, and storage area for all products is hoped to reduce both the expected and the variance of the manufacturer's and the buyer's overall cost. A single-objective stochastic programming strategy is initially used to calculate the total cost. Following that, it is modeled as a bi-objective deterministic nonlinear programming problem. To solve complex problems, the non-dominated sorting genetic algorithms (NSGA-II) and non-dominated ranking genetic algorithms (NRGA) use meta-heuristics. A numerical example is given at the end of the chapter to show how the model can be applied.

Keywords: Economic production quantity, Multiple products, Rework and crap, Interruption, Quantity discounts, Multi-objective meta-heuristics

Zhongxue Yang (The Key Laboratory of Advanced High Temperature Structural Materials AECC Beijing Institute of Aeronautical Materials), Tianren Zhang (School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an, China), Yulong Wu (School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an, China), Qiang Zhang (The Key Laboratory of Advanced High Temperature Structural Materials AECC Beijing Institute of Aeronautical Materials) and Yuanbin Wang (School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an, China). *DIGITAL TWIN-DRIVEN ADAPTIVE FIXTURING FOR MACHINING OF COMPLEX THIN-WALLED PARTS.*

Abstract. Complex thin-walled parts tend to deform during forming stage, e.g. rolling and investment casting. These deviations cause variations of the fixturing position and orientation during the machining procedures afterwards, and further leading to low final geometrical accuracy. This paper proposes a digital twin-driven adaptive fixturing method to alleviate the geometric deviations and ensure the final product quality. By integrating 3D scanning for measurement, initial registration, fixture pose prediction, and optimization algorithms, the proposed model aims to enhance the precision of the thin-walled blanks. Measurements are taken on real blades and digital fixture models are developed based on their geometric shapes. Simulation experiment on fixturing and adaptive adjustment demonstrate the effectiveness of the method, achieving significant reductions in geometric errors and improving the relative positional accuracy of the blade body. The results highlight the potential of digital twin technology in optimizing machining processes for high-temperature alloy castings.

Keywords: Digital twin, Complex parts, Fixturing, Adaptive adjustment, Machining accuracy

Siqing Shan (School of Economics and Management, Beihang University), Yanan Li (School of Economics and Management, Beihang University) and Yinong Li (School of Economics and Management, Beihang University). *THE IMPACT OF DIGITAL TRANSFORMATION ON FIRMS' CAPITAL ALLOCATION EFFICIENCY - EMPIRICAL EVIDENCE FROM LISTED MANUFACTURING COMPANIES.*

Abstract. This study investigates the impact of digital transformation on the capital allocation efficiency of Chinese manufacturing enterprises listed from 2011 to 2021. By quantifying the degree of digital transformation using Python crawler technology and machine learning methods, we empirically examine the relationship between digital transformation and capital allocation efficiency. The results demonstrate that digital transformation significantly optimizes the capital allocation efficiency of enterprises. Mechanism tests reveal that this effect is mediated through three pathways: improving the level of specialized division of labor, enhancing corporate information transparency, and improving the quality of internal control. Furthermore, heterogeneity analyses indicate that the effect of digital transformation on capital allocation efficiency varies based on the competitiveness of the industry in which the enterprise operates, the technological attributes of the enterprise, and the size of the enterprise. These findings provide valuable insights into the role of digital transformation in shaping the efficiency of capital allocation among Chinese manufacturing enterprises.

Keywords: Digital transformation, capital allocation efficiency, specialised division of labour, information empowerment, quality of internal controls

Zhongbao Zhou ((+86) 15040390531). *RESEARCH ON THE IMPACT OF ONLINE GENERATED CONTENT ON CUSTOMER LIFETIME VALUE.*

Abstract. China's online shopping market, with 884 million users, is the largest globally and continues to grow with the proliferation of digital devices and technologies. The market is transitioning from extensive development to deep cultivation, integrating e-commerce with social media. This integration leverages user and enterprise-generated content to support the long-term development of e-commerce platforms. From a relationship marketing perspective, this study aims to enhance customer value and satisfaction by focusing on customer lifetime value, a crucial metric in relationship marketing that measures a customer's long-term contribution to a business. The study defines variables in user and enterprise-generated content, analyzing customer lifetime value through these two routes. Using real online shopping data and the BG/NBD model, it predicts customer lifetime value and examines the impact of factors such as the number of customer comments, comment scores, emotional polarity of comments, average brand price, number of product categories, and enterprise promotions on customer lifetime value.

The research improves the understanding of customer lifetime value within the context of social and customer relationship management, innovating the research environment and simplifying the research path for customer lifetime value. Results indicate that both user and certain enterprise-generated content positively impact customer lifetime value. Additionally, the study creates a customer profile based on purchase recency, frequency, and monetary value, aiding businesses in analyzing and monitoring their customer groups. The study concludes with practical implications for the sustainable development of related industries from both customer and enterprise perspectives.

Keywords: Machine Learning, Customer lifetime value, Online-generated content

Rishav Deval (Indian Institute of Technology Bombay) and Jayendran Venkateswaran (Indian Institute of Technology Bombay). *Emission-constrained Production and Inventory Control System (EC-PICS): A cost-based analysis under dynamic emission regulations.*

Abstract. This paper proposes an emission-constrained production and inventory control system (EC-PICS) framework that dynamically incorporates emission regulations into the operational strategies of manufacturing firms. By leveraging system dynamics modeling, the EC-PICS framework captures the complex interactions between operational decisions and environmental constraints, attempting to provide a more realistic and robust analysis of system behavior under varying regulatory conditions. The study introduces three critical modifications to the traditional PICS: emission-constrained ordering, emission-constrained sales, and emission-sensitive forecasting. These modifications create feedback loops that adjust production and inventory levels based on emission feedback, ensuring compliance with environmental standards while striving to meet customer demand. The results demonstrate that a lack of communication and coordination among individual sub-units shows policy resistance, instability, and dysfunction for environmental feedback. Thus, an integrated approach helps achieve emission compliance and offers valuable insights into cost dynamics and system stability. The findings lay a solid foundation for future studies to enhance industrial operations' sustainability through innovative frameworks and dynamic regulatory integration.

Keywords: Sustainability, EC-PICS, APIOBPCS, Emission-constrained Ordering, Emission-constrained Sales, Emission-sensitive Forecasting

Muhammad Ridwan Reza Nugraha (Khalifa University), Young-Ji Byon (Northwestern College), Adriana F. Gabor (Khalifa University) and Mouna Kchaou-Boujelben (United Arab Emirates University). *Scoring Based Heuristic for a Platoon Formation Planning Problem with Charging Capacity.*

Abstract. This study focuses on scheduling electric connected and autonomous vehicles (CAVs) in platoons on highways, using a tree-like network that includes charging stations with limited capacity. The aim is to reduce overall energy consumption and travel time while meeting vehicle deadlines and charging capacities. The problem can be formulated by an MILP, however, this is only feasible for small instances. To reduce the size of the MILP, we propose to select possible platoon members and leaders based on a heuristic that takes into account the specific characteristics of the vehicles. Our numerical experiments indicate that this heuristic is 36 times faster than the original MILP.

Keywords: platooning, coordinated vehicles, scheduling, charging capacity, heuristic, scoring

Manna Huang (Jinan University), Ting Qu (Jinan University), Ming Wan (Jinan University) and George Q. Huang (The Hong Kong Polytechnic University). *THE MULTI-COMPARTMENT VEHICLE ROUTING PROBLEM IN WASTE MANAGEMENT BASED ON DUAL INCENTIVE MECHANISM.*

Abstract. With the advent of smart cities and the increasing prevalence of intelligent waste collection terminals, it has become feasible to monitor the fill levels of waste bins. However, due to the high uncertainty of the time when residents throw domestic waste, enterprises have to spend additional expenses to respond in time, making it difficult to form an economic effect of waste transportation. Therefore, this paper aims to mitigate dynamic demand by incentivizing residents to throw domestic waste at certain times, potentially resulting in cost savings. Firstly, this paper qualitatively designs dual incentive mechanisms to encourage residents to throw their domestic waste at certain time and quantitatively develops a linear function to define the relationship between the volume of domestic waste and reward points. Subsequently, this problem is formulated as a multi-compartment vehicle routing problem model based on the dual incentive mechanisms. Finally, a case study of a community in South China is employed to empirically illustrate the validity and feasibility of our model.

Keywords: Domestic waste, Dual incentive mechanisms, Multi-compartment vehicle routing problem

Marjia Haque (University of New South Wales, Canberra, Australia), Sanjoy Kumar Paul (UTS Business School, University of Technology Sydney, Sydney, Australia), Ruhul Sarker (University of New South Wales, Canberra, Australia) and Daryl Essam (University of New South Wales, Canberra, Australia). *A Simulation-Optimization Approach for Supply Chain under Uncertainties.*

Abstract. This paper studies a multi-stage decentralized supply chain (SC) with multiple entities in each stage (e.g., multiple manufacturers, multiple distributors, multiple retailers, etc.), while considering both demand and supply uncertainties in each entity. A two-phase multi-period planning approach is considered, in which the model enables an overall total SC-wide synchronization to satisfy the end-customer demand as well as allows individual SC entities to optimize their own objectives by sharing restricted necessary information among them. In addition, a planning strategy has been proposed to revise the operational plan, if any changes are required, when the actual demand situation is revealed. A simulation-based stochastic optimization approach is developed to solve the proposed models, and a solution heuristic is proposed. To validate the model, a large number of scenarios are generated to capture real-world uncertain environments, and extensive numerical experimentations are conducted using a range of hypothetical data sets. The conducted results analyses highlight the practical implications of the study.

Keywords: Decentralized supply chain, uncertainty, stochastic model, simulation-optimization

Chen Li (Dalian University of Technology), Xiyan Zhao (Dalian University of Technology), Qing Zhang (Dalian University of Technology), Lin Lin (Dalian University of Technology), Wenqiang Zhang (Henan University of Technology) and Mitsuo Gen (Tokyo University of Science). *An Evolutionary Knowledge Training-Based Proximal Policy Optimization Algorithm for Job Shop Scheduling in Flexible Intelligent Manufacturing.*

Abstract. Flexible intelligent manufacturing introduces complex scheduling problems, often modeled as the flexible job shop scheduling problem (FJSP). In FJSP, operations can be processed on multiple machines, creating complex relationships. While deep reinforcement learning (DRL) has improved solution quality for FJSP by learning priority dispatching rules (PDRs), it struggles with the flexibility of operation-machine relationships. This study proposes an end-to-end DRL framework using proximal policy optimization (PPO) with evolutionary knowledge training to address these challenges. It integrates a disjunctive and heterogeneous graph-based representation for state features and employs a feature fusion graph neural network to capture complex relationships. To mitigate sample bias in PPO and enhance accuracy, a genetic algorithm (GA) replaces the state value function for calculating temporal difference targets in the critic network. A new GA encoding strategy and fitness evaluation function are introduced to improve search efficiency and training stability. Experimental results show that this approach significantly enhances DRL performance, demonstrating superior effectiveness and generalization over existing DRL methods and traditional PDRs across various problem scales.

Keywords: FJSP, DRL, PPO, GA

Wei Wang (School of Management, Xi'an Jiaotong University), Chunjiao He (School of Management, Xi'an Jiaotong University), Chao Fang (School of Management, Xi'an Jiaotong University) and Zonglei Han (School of Management, Xi'an Jiaotong University). *Deployment and Trajectory Optimization of UAVs for Emergency Communication in Post-Disaster Areas.*

Abstract. Advancements in unmanned aerial vehicle (UAV) technology have enabled UAV-assisted base stations (UAV-BSs) to support emergency communication in post-disaster areas. Due to the limited duration of the UAV and the restricted communication coverage of the base station, it is hard to cover all the ground terminals (GTs) in a large-scale area with a certain number of UAV-BSs. This paper addresses the joint optimization problem of deployment and trajectory of UAV-BSs for emergency communication in the post-disaster area. We formulate the UAV-BS deployment as a disk cover problem and develop a minimum enclosing circle algorithm to determine the optimal coverage radius, thereby minimizing the required transmit power. To minimize the total energy consumption, we utilize a large neighborhood search (LNS) algorithm to find the best deployment and coverage radii of UAV-BSs, as well as the optimal UAVs' trajectories. Experimental results from realworld cases demonstrate that our proposed method and algorithm effectively adapt to instances with diverse distributions of GTs.

Keywords: UAV communication coverage, energy-efficient communication, UAV-BS location, UAV trajectory optimization

Nikolai West (Institute of Production Systems), Andrea Trianni (Centre for Advanced Manufacturing) and Jochen Deuse (Centre for Advanced Manufacturing). *Detection of surface-based anomalies for self-tapping screws in plastic housings using supervised machine learning.*

Abstract. This paper presents a comprehensive study on anomaly detection in screw connections using supervised machine learning techniques. We introduce a novel, open-source dataset comprising 12,500 time series observations from screw tightening processes, including both normal operations and seven distinct error types related to surface properties. The dataset encompasses multiple tightening cycles, allowing for the analysis of progressive wear effects. To establish a benchmark, four supervised classifiers (Naive Bayes, Multilayer Perceptron, k-Nearest Neighbours, and Random Forest) are evaluated across six different scenarios. These scenarios consider various screw cycles and labelling strategy granularities. Results demonstrate that classification performance improves as the number of classes decreases, with binary classification yielding the highest accuracies. The Random Forest model consistently outperforms other algorithms. However, all models exhibit a marked decrease in performance when analysing data from multiple tightening cycles, highlighting challenges posed by wear effects and subtle temporal changes.

Our findings provide insights into the varying detectability of different error types and the challenges of automated quality assurance in manufacturing processes. This study contributes to the field of anomaly detection in manufacturing, offering a benchmark for further research and demonstrating the potential of machine learning in identifying complex error patterns in screw connections.

Keywords: anomaly detection, screw driving, threaded fasteners, machine learning, supervised models, time series analysis, open-source data, open science

Kritika Karwasra (PhD Scholar, Department of IEOR, IIT Bombay) and Narayan Rangaraj (Professor, Department of IEOR, IIT Bombay). *Optimizing Shipper Transportation: Analyzing Allocation Policies for In-House and Outsourced Rail Rakes using Simulation Modeling.*

Abstract. Rail is an effective mode of transport, especially for bulk commodities like cement and steel, over medium and long distances. However, rail services are subject to delayed deliveries, especially due to the unavailability of wagons (set of wagons, also known as rakes). To address these issues, companies (shippers) invest in railway wagons. The shipper maintains this fleet, but the movement is by the railway company with a rebate on transportation costs. Procuring such a fleet requires a significant financial investment. Instead of relying solely on a `make or buy' approach, companies adopt a `make and buy' strategy, procuring some in-house rakes while also utilizing outsourced resources. With this mixed fleet composition and considering the benefits of in-house rakes over outsourced rakes, an operational question arises: How should we allocate in-house and outsourced rakes to various demands? In this paper we investigate this question using real case study of steel manufacturing company in India. We examine several allocation policies considering 1) distance, 2) cost benefit through an in-house fleet, and 3) overall transportation cost. A simulation modeling tool is used to assess these different policies under various scenarios, considering demand patterns, turnaround time, locomotive waiting time, and outsourced rakes' availability. The study also explores how the randomness associated with these parameters can affect these policies. This paper address the broader question of how to optimally use limited internal capacity along with outsourced resources is a cost-effectively manner.

Keywords: Allocation policy for mix fleet, Bulk supply chain, Freight transportation, Simulation model

Shivam Sharma (Department of Management Sciences, Indian Institute of Technology Kanpur, India & La Trobe University, Australia), Sobhan Sean Arisian (La Trobe Business School, La Trobe University, Australia), Vipin B (Department of Management Sciences, Indian Institute of Technology Kanpur, India), Raghu Nandan Sengupta (Department of Management Sciences, Indian Institute of Technology Kanpur, India) and Aron O'Cass (La Trobe Business School, La Trobe University, Australia). *COORDINATING FOREIGN TRADE AND DOMESTIC PRODUCTION SUPPORT POLICIES TO OPTIMIZE THE GLOBAL AGRICULTURAL SUPPLY CHAIN.*

Abstract. Host governments face significant challenges in optimizing agricultural domestic support schemes and foreign trade policies to meet rising consumer demand. This research examines how aligning production support and trade policies can minimize market distortions and stabilize supply chains. We propose a framework to address geopolitical uncertainties and policy ambiguities, fostering a resilient and equitable global agricultural market. In India, demand for pulses is rapidly increasing due to population growth (projected to rise by around 300 million between 2030 and 2050), a growing preference for plant-based diets, a significant vegetarian population (about 38%), and the affordability of pulses as a protein source. Despite being the world's largest producer and consumer of lentils, domestic production is insufficient, leading to substantial imports, primarily from Australia and Canada, which supplied approximately 97% of India's lentils in 2022-23. Thus, it is crucial for the host government to balance domestic support and trade policies to ensure a stable supply and meet this rising demand.

Inspired by real-world practices and empirical evidence from Indian agricultural policymaking, this study develops a game-theoretical optimization model to determine optimal tariff rates for governments under various trade policy scenarios. Strategic interactions among importers are modeled using a non-cooperative game-theoretical framework, considering the influence of domestic support policies, tariff mechanisms, and domestic production levels on importers' decisions.

The research analyzes production and import volumes across different policy scenarios, integrating domestic and foreign trade policies to find optimal policy combinations that enhance farmer welfare, minimize market distortions, and stabilize supply chains. The model assists policymakers in crafting stable policies that optimize social welfare and enhance stakeholder profitability while reducing trade uncertainty. The findings contribute to Sustainable Development Goals 2 (Zero Hunger) and 12 (Responsible Consumption and Production) by promoting sustainable agriculture and enhancing food security.

Keywords: Global Agricultural Supply Chain, International Trade, Tariff, Tariff Rate Quotas

Santosh Palaskar (Indian Institute of Technology Bombay), Nandyala Hemachandra (Indian Institute of Technology Bombay) and Narayan Rangaraj (Indian Institute of Technology Bombay). *Hierarchical Aggregation-wise Multivariate Time Series Forecasting for Supply Chain.*

Abstract. Hierarchical forecasting involves structuring time series data into various aggregation levels to ensure coherent forecasts across different hierarchical levels. To address challenges in achieving alignment between lower-level and aggregate forecasts, hierarchical reconciliation has emerged as a standard practice across industries like supply chain management, electricity generation, macroeconomics, and tourism management. However, existing methods in hierarchical forecasting often involve a two-step process: generating independent base forecasts for individual time series and then reconciling them to maintain coherence. Unfortunately, this approach overlooks the correlation and dependence between time series. While some efforts have explored multivariate time series forecasting (MTSF), applying it to all bottom-level series can introduce excessive noise. To overcome these limitations, we proposed a method to incorporate the constraints of the base forecast and the challenges of applying MTSF to numerous bottom-level series. This novel approach, the hierarchical aggregation-wise multivariate time series forecasting method, focuses on MTSF for bottom-level nodes that share the same parent nodes. For validation, we demonstrated improvements in forecasting accuracy across three datasets, achieving up to a 12% reduction in RMSE and a 9.7% reduction in MAE compared to state-of-the-art methods. In summary, this innovative approach addresses the limitations of conventional hierarchical forecasting methods by focusing on MTSF while considering aggregation constraints, thereby enabling more accurate and coherent forecasts across different hierarchical levels in various industry applications.

Keywords: hierarchical forecast, supply chain, time series, coherence, TSMixer, multivariate forecasting

Maria Anityasari (Department of Industrial and Systems Engineering Institut Teknologi Sepuluh Nopember Surabaya), Dyah Santhi Dewi (Department of Industrial and Systems Engineering Institut Teknologi Sepuluh Nopember Surabaya), Rhamandita Dyadna Prabaswara (Department of Industrial and Systems Engineering Institut Teknologi Sepuluh Nopember Surabaya) and Reza Aulia Akbar (Department of Industrial and Systems Engineering Institut Teknologi Sepuluh Nopember Surabaya). *WORKLOAD ANALYSIS OF SURABAYA CITY PUBLIC STREET LIGHTING MAINTENANCE FIELD OFFICERS.*

Abstract. Surabaya City has more than 93,000 PJU points spread throughout the city, and this number will continue to grow in the future. The number of PJU points certainly requires a good maintenance. However, eight field officers in each of the seven existing rayons are deemed unable to do their maintenance job optimally, due to several reasons including their workload. Therefore, a workload analysis is carried out using the Stopwatch Time Study (STS) and Work Sampling and the NASA-TLX method, as a reference in calculating workload and human resource requirements. The workload analysis was carried out by conducting field observations to seven existing rayons, distributing questionnaires to 57 field officers related to mental workload based on the NASA-TLX method, and also interviews and discussions with rayon heads to determine the performance rating, the level of influence of field obstacles on field work time, and validation of field observations. The results obtained are that all PJU rayons in Surabaya City require additional field officers to be able to handle the average work each month. Then, regarding mental workload, the overall average mental workload of the field officers was 88.58 which is classified as "very high". Then, based on the regression test and correlation test, field obstacles have a not-so-significant influence on field work time. Several recommendations have been written to improve the work system in the PJU Unit of Surabaya City as well as to support the recommendation for reallocation of PJU field officers of Surabaya City.

Keywords: FTE, NASA–TLX, Public Street Lighting (PJU), Stopwatch Time Study, Work System

Jianming Lei (Major in Industrial Data Science & Engineering Department of Industrial Engineering Pusan National University) and Kwangyeol Ryu (Department of Industrial Engineering Pusan National University). *FRAMEWORK OF IMPLEMENTING SENSOR FUSION FOR ENABLING HUMAN COGNITIVE ABILITIES IN COLLABORATIVE ROBOT.*

Abstract. Human-Robot Collaboration (HRC) including direct human-robot interactions aims to combine human capabilities with robots to accomplish common goals. It plays an important role in smart manufacturing due to its advantages for cost minimization, operational effectiveness, and sustainability. Nonetheless, robots often operate in dynamic environments and encounter challenges in complex and rapidly changing work settings where tasks require high flexibility and adaptability. To address these challenges, this study proposes a conceptual framework to integrate human cognitive abilities into the HRC system through sensor fusion. The framework begins by detecting environmental changes using multi-sensor, such as light, sound, and touch, to establish a holistic view of the environment. By conducting multimodal data analysis, reasonable decisions and commands are made and an intelligent operation workstation can be established. This framework contributes to the overall performance and adaptability of the HRC system by allowing multiple humans and robots to collaboratively perform manufacturing tasks while considering each other's operational needs, resource requirements, and complementary capabilities. The creation of a more intelligent and natural industrial production environment will further develop automation and provide valuable insights to researchers and industry practitioners investigating resilient human-robot collaboration.

Keywords: Human-Robot Collaboration, Human cognitive abilities, Sensor fusion, Hybrid visual servoing system

Aparna Venkataraman (Indian Institute of Technology Delhi, The University of Queensland), Varun Ramamohan (Indian Institute of Technology Delhi) and Sisira Edirippulige (The University of Queensland). *Integrated Patient Appointment Scheduling Model for In-Person and Telemedicine Outpatient Consultations.*

Abstract. Telemedicine enhances patient access to physicians and improves health outcomes by augmenting in-person appointments. However, the full potential of telemedicine can only be realized when it is seamlessly integrated with in-person appointment systems. Efficiently managing the concurrent scheduling and delivery of in-person and telemedicine consultations poses significant operational challenges in healthcare settings. This study utilizes a discrete-event simulation analysis to optimize a rolling-horizon schedule for patient appointments, including new and follow-up telemedicine and in-person consultations for both walk-in and scheduled patients. This study addresses the following critical operational questions: (a) What should be the optimal duration of appointment slots for different types of consultations? (b) How should these consultation slot durations be communicated to patients to manage expectations and reduce waiting times? (c) What should be the proportion of consultation slots for scheduled appointments versus walk-ins? These questions are answered taking into account variables such as uncertainties in consultation durations, patient no-show rates, infrastructure disruptions in telemedicine consultations, and emergency walk-ins to reflect real-world variability in service delivery within a multispecialty healthcare setting. The outcomes from this study assess key performance indicators such as patient waiting time, server overtime, patient length of stay, and server utilization to provide recommendations for optimizing telemedicine and in-person consultation scheduling. Thus, the findings from this study provide evidence-based recommendations for optimizing scheduling processes to navigate the complexities of patient attendance and infrastructure reliability, ensuring efficient patient flow and enhanced provider productivity.

Keywords: appointment scheduling, telemedicine, healthcare delivery, discrete-event simulation

Shoma Kubono (Kanagawa Institute of Technology) and Jun Usuki (Kanagawa Institute of Technology).
DECISION MAKING IRREGULAR ORDER ACCEPTANCE THROUGH THE COOPERATION OF AUTONOMOUS INDIVIDUALS USING BLOCK OCCUPANCY AND LOGISTIC-DM.

Abstract. In the production and logistics sector, numerous robots, such as AGVs, have traditionally been developed and utilized to respond flexibly to changes in customer demand and to improve work efficiency, moreover, research has also been conducted into autonomous adaptation to changes in the environment. In recent years, improvements in AGV technology have led to the emergence of autonomous mobile robots (AMRs) that run trackless, which has led to further studies on the autonomy of AGVs (hereafter referred to as handling robots). In this context, this study focuses on a "more flexible response" to changes in customer demand. It examines a method whereby a handling robot autonomously decides whether or not to respond to an unexpected order (hereafter referred to as an irregular order) in a production plant. In a factory, unless the production is completely made-to-order when receiving an irregular order, it may be necessary to change the plan in advance due to interruptions in work, additionally, simulations based on these changes may be required. Furthermore, even when orders are received, there are limits to how they can be accepted. To enable decisions to be made between handling robots in response to such an irregular order, this research first proposes a logistics version of the Dynamic Map (Logistic-DM), which is an autonomous individual that hierarchical dealing with changing maps and various types of information and can also exchange such information, so that multiple handling robots can dynamically exchange information with each other. Therefore, a method is proposed to calculate the possibility of handling irregular orders without disturbing the planned handling operation, in cooperation with this Logistic-DM and multiple handling robots. Finally, the simulation results of these proposed methods show acceptance for the future.

Keywords: Autonomous Cooperation, Handling Vehicle, Dynamic Map, Route Planning

Risa Usuki (Waseda University) and Jun Usuki (Kanagawa Institute of Technology). *A KUSHO WORDS RECOGNITION METHOD FOR CONTACTLESS INFORMATION MANAGEMENT IN RESTAURANT KITCHENS.*

Abstract. Advances in IT technology have led to research into KUSHO recognition, which enables the non-contact operation of devices without the use of devices such as keyboards or controllers. This is a technology that transmits information about the characters written in space towards the camera (hereafter this action is referred to as KUSHO) to the devices. KUSHO has advantages, such as the ability to transfer information without training. In restaurant kitchens, workers transmit various types of information using devices with input functions, however, hygiene considerations are essential when operating equipment in kitchens. In addition, in noisy kitchens, it is also difficult to use voice input, and there are limits to paper-based information transmission. Under these circumstances, in this research, the introduction of KUSHO input technology for non-contact information transfer in restaurant kitchens is being investigated. Therefore, the content handled by kitchen workers for information management is first analyzed and shown to be representable in three input formats. Subsequently, an additional hand signal to be used while doing KUSHO and an improved algorithm for determining them are proposed. Finally, an algorithm for KUSHO recognition of character strings using standard input time is proposed. Experiments on the implementation of these proposals have shown the effectiveness of the new decision algorithm for the addition of a hand signal, with a 100% correct rate. For strings of two or more uppercase alphabetic characters, the recognition rate was 92.5% for all eight types of "KUSHO operation" and the recognition rate was 70.0% for ten randomly selected from 100 different "product names." For "quantity," it was difficult to recognize multiple digits, however 100% recognition rate was achieved by dividing the digits into each single digit 0~9 using an improved hand signal algorithm. Thus, algorithm some problems remain, the effectiveness of all the proposed methods has been found.

Keywords: Aerial handwriting recognition, Character strings separation, Contactless device operation, Information transmission, Information management

Xiao-Hui Qiu (Jinan University), Ting Qu (Jinan University), Hai-Nan Huang (Jinan University), Lin Ma (The Hong Kong Polytechnic University) and Du-Xian Nie (South China Agricultural University). *OPTIMIZATION METHOD OF THE INDUSTRIAL VALUE CHAIN CONFIGURATION HEADQUARTER-CENTERED GROUP-TYPE MANUFACTURING ENTERPRISES CONSIDERING SYNERGY RELATIONSHIPS.*

Abstract. With the development of Industry 4.0, the distributed manufacturing model has become the mainstream trend. In the new economic environment, the industrial chain as an economic unit pays more attention to macro-level resource coordination and value co-creation. However, current research pays less attention to the multi-dimensional value co-creation and Synergy relationships. Therefore, this paper studies the industrial value chain configuration problem of an assembly product headquarter-centered group-type manufacturing enterprise and proposes a two-stage configuration method. At the same time, it defines multi-dimensional value objectives and coordination coefficients and proposes an industrial value chain optimization configuration method based on the ALC method.

Keywords: Industrial Value Chain Configuration, QoS, Synergy Relationships, Headquarter-Centered

Dyah Santhi Dewi (Departement of Industrial and Systems Engineering, Institute of Technology Sepuluh Nopember) and Annisaul Fadhillah Idi (Departement of Industrial and Systems Engineering, Institute of Technology Sepuluh Nopember). *THE EFFECT OF SOCIAL MEDIA USAGE ON STUDENT LEARNING BEHAVIOR WITH SOCIAL MEDIA FATIGUE AS A MEDIATING VARIABLE.*

Abstract. The development of information technology in the 21st century has supported the use of social media in various sectors. Education is one of the sectors with a high dominance of social media usage, especially at the university level. Based on the pre-survey results, social media has become a source of information as well as a learning tool for students. The use of excessive and compulsive social media can trigger the emergence of social media fatigue (SMF). This study aims to determine the effect of social media usage, especially YouTube, on student learning behavior with social media fatigue as an intervening variable. The method used in this research is Structural Equation Modeling Partial Least Square (SEM-PLS). The assessment in the questionnaire adapts the measurement instruments of the Youtube as Learning Resources questionnaire, Social Media Fatigue Scale (SMFS), and learning behavior in college. The exogenous latent variable or independent variable used in this study is the use of social media (YouTube) and the endogenous latent variable or dependent variable is learning behavior and social media fatigue (YouTube) as an intervening variable. The results showed that the relationship between social media usage has a significant effect on learning behavior with a p-value of 0.000. Meanwhile, the relationship between social media fatigue on learning behavior has a p-value of 0.018 which indicates that the relationship between the two has a significant effect and the relationship between social media usage and social media fatigue has a p-value of 0.473 indicating an insignificant relationship. Finally, social media fatigue failed to mediate the relationship between social media use and learning behavior with a p-value of 0.536. Social media fatigue is less precise to mediate the relationship between the two because in fact students can organize and limit their YouTube usage time wisely to avoid fatigue.

Keywords: Higher education, Learning behavior, SEM-PLS, Social Media Fatigue

Putu Karningsih (Institut Teknologi Sepuluh Nopember), Princesia Rahmatindar (Institut Teknologi Sepuluh Nopember), Moses Singgih (Institut Teknologi Sepuluh Nopember) and Samsul Arifin (Widatra Bhakti Co). *ASSESSING THE READINESS TO TOYOTA PRODUCTION SYSTEM 4.0.*

Abstract. Since the 1990s, the Toyota Production System approach has been widely used to eliminate non-value-adding activities through continuous improvement. Approximately 20 years later, the Fourth Industrial Revolution began. It offers many benefits for manufacturing companies, including efficiency and productivity improvements achieved using several technologies, such as the Internet of Things. However, adopting Industry 4.0 technology for inefficient processes could lead to exacerbating waste. Therefore, it is suggested that waste should be reduced with the Lean or Toyota Production System approach before Industry 4.0 adoption. This integration is known as the Toyota Production System 4.0. When a company has implemented the Toyota Production System and plans to transform to Industry 4.0, a tool that can measure its leanness and readiness for Industry 4.0 is required as a first and essential step. However, this tool is not yet available in an integrated manner. Thus, this paper proposes a tool for assessing the level of lean implementation and readiness to move toward digital transformation after implementing the Toyota Production System approach. An Industry 4.0 Readiness Index is used as a reference model and integrated with lean assessment tools to encompass indicators for both leanness and Industry 4.0 readiness. Validation of this tool using a real case company showed that the assessment results could assist the company in understanding its readiness for Toyota Production System 4.0 implementation and provide recommendations for improvement.

Keywords: Industry 4.0, Waste, Toyota Production System 4.0, Readiness Assessment

Kriti Karmakar (Indian Institute of Technology Kharagpur) and Prof. Pradip Kumar Ray (Indian Institute of Technology Kharagpur). *MANAGEMENT OF BLOOD BANK OPERATIONS THROUGH DATA-DRIVEN STATISTICAL ANALYSIS.*

Abstract. Blood transfusion stands as one of the most critical and life-saving therapeutic interventions in modern medical science. Blood banks play a pivotal role in efficient functioning of the healthcare industry by facilitating crucial activities such as collection of blood from voluntary donors, testing for infectious diseases to ensure its safety, typing into various blood groups, production of specific blood components, storage under optimal conditions, and timely distribution to meet patient needs. In this context, statistical analysis emerges as an effective technique to analyze the data pertaining to blood supply, demand for specific blood components, blood group distributions, and transfusion causes for informed decision-making of blood banking operations. This study adopts a systematic approach to gather and analyze medical data from a reputable stand-alone blood bank in Kolkata, India, spanning January to December 2019. Utilizing numerical and graphical descriptive statistical methods, the data is segmented based on blood bank activities and summarized to extract meaningful insights. Findings emphasize the importance of accurate demand forecasting, maintaining optimal inventory levels with adequate safety stocks, and implementing suitable issuing policies for efficient blood bank operations. Moreover, the study highlights the significance of broader strategies such as raising public awareness about blood donation, understanding local epidemiological trends, and fostering robust communication channels between healthcare providers and blood banks. These holistic approaches will not only enhance the efficacy of blood bank management but also contribute significantly to the overall resilience and effectiveness of the healthcare system.

Keywords: Blood Bank, Healthcare, Statistical Analysis, Data Analysis

Krunal Padwekar (Department of Management Sciences, Indian Institute of Technology Kanpur), Kanchan Awasthi (Department of Management Sciences, Indian Institute of Technology Kanpur), Khalid Shamim (Department of Management Sciences, Indian Institute of Technology Kanpur) and Subhas Chandra Misra (Department of Management Sciences, Indian Institute of Technology Kanpur). *PRIORITISING BARRIERS TO IMPLEMENTATION OF METAVERSE IN AFSC WITH NEW SPHERICAL FUZZY SETS BEST WORST METHOD.*

Abstract. Metaverse has emerged as an integration of technologies and ideas, changing how individuals interact and learn in the digital environment. Its interconnected nature and virtual setting have the capacity to address changing market demand, which may provide organizations with a competitive edge and new sources of income. In agri-food supply chain, Metaverse has the potential to increase traceability and reduce food waste and food losses, thus promoting sustainable production and consumption among concerned stakeholders. However, research on its adoption and acceptance in this context is limited. To foster Metaverse acceptance in agri-food supply chain, it is necessary to recognise barriers to Metaverse implementation so that preliminary steps can be taken to counter these barriers. The current study aims at this objective by recognising and prioritising the barriers to Metaverse implementation in agri-food supply chain. The study identifies barriers through an extensive literature review, and then seeks expert opinions. The study employed Spherical Fuzzy Sets based Best-Worst method for analysis to determine the best and worst barriers Spherical Fuzzy Sets improve decision-making accuracy by using membership, non-membership, and hesitancy functions to handle ambiguous information in multi criteria decision making. This hybrid method improves the decision-making process and gives robust results. The finding shows that Unavailability of Required Support Services, Resource Constraints such as Lack of Capital, Investment or Credit, Lack of Government Support, Lack of Regulation and Standardisation are the most prominent barriers.

Keywords: Metaverse, Agri-food supply chain, Spherical Fuzzy Sets, Best-Worst Method, Barriers

Kanchan Awasthi (Department of Management Sciences, Indian Institute of Technology Kanpur), Krunal Padwekar (Department of Management Sciences, Indian Institute of Technology Kanpur), Khalid Shamim (Department of Management Sciences, Indian Institute of Technology Kanpur) and Subhas Chandra Misra (Department of Management Sciences, Indian Institute of Technology Kanpur). *A HYBRID SPHERICAL FUZZY WINGS APPROACH FOR IDENTIFYING DRIVERS TO INDUSTRY 5.0 IMPLEMENTATION IN TEXTILE SECTOR.*

Abstract. Industry 5.0 is a complementary approach to Industry 4.0 which focuses on bringing human roles back into production systems. Industry 5.0 approach is centered mainly on three dimensions, namely sustainability, resilience, and human centricity. Its purpose is to enhance the quality of products, foster development, and generate opportunities by combining the advantages of automation with the creativity and cognition of humans. Industry 5.0 implementation is a crucial step in building human-centric production systems. Therefore, it is necessary to identify the key drivers to accelerate the implementation process. This study aims to identify and evaluate the hierarchical and causal structure of drivers for Industry 5.0 implementation. To meet this objective, the current study proposed a hybrid Spherical Fuzzy Weighted Influence Non-linear Gauge System (SF-WINGS) and Interpretive Structural Modeling. The applicability of the proposed method is evaluated, considering textile sector as a case example. It was found that Top Management's Environmental Values, Enhancing Business Reputation and Promotion, Internal Innovation Process are the main drivers of Industry 5.0 implementation. Specifically, top management's consideration of environmental values and beliefs can guide implementation of Industry 5.0. Industry 5.0 implementation is achievable by focusing on reducing waste, innovating internal processes, and engaging top management in sustainability efforts.

Keywords: Industry 5.0, Drivers, WINGS, ISM, Spherical Fuzzy Sets, Textile sector

Tamer Yared (German Jordanian University), Abdullah Qasem (German Jordanian University), Rashed Mansour (German Jordanian University) and Soud Alsaleh (German Jordanian University). *USING THE SYSTEM USABILITY SCALE (SUS) TO EVALUATE VARIOUS SMARTPHONE MEASUREMENT APPLICATIONS FOR ASSESSING WORKPLACE ENVIRONMENTAL FACTORS.*

Abstract. Ergonomics is essential in the workplace as it aims to create an environment that promotes employee health and productivity by considering various environmental factors. These factors include lighting, temperature, air quality, and noise management, all of which are crucial for enhancing employee well-being, ensuring regulatory compliance, and supporting overall sustainability and success. To assess these elements, a range of measurement tools is employed, such as light meters, heart rate monitors, and sound level meters. However, the size of these instruments can pose portability issues for those collecting data. Recently, smartphones have emerged as a practical solution for data collection, equipped with sensors that can measure these environmental factors. Dedicated smartphone applications facilitate easy display of measurements. While several studies have confirmed the accuracy and usability of these smartphone applications, none have focused on their interface usability. The main aim of this study is to evaluate the usability of various smartphone applications using the System Usability Scale (SUS). Field measurements were carried out with these applications across different smartphone brands and users to gather data on workplace environments related to human factors engineering. The results indicated that some applications provided a good interface and usability, while others were deemed acceptable. Applications with high usability ratings can enhance the effectiveness and efficiency of assessing workplace environmental conditions. Conversely, some applications received low usability scores, rendering them unsuitable for practical use. We recommend that designers and developers of smartphone application interfaces invest more effort into improving the user-friendliness of applications used for environmental measurements.

Keywords: Ergonomics, Workplace, Smartphone applications, Environmental factors, System Usability Scale

Haruki Ichimura (Department of Information and Computer Sciences Kanagawa Institute of Technology) and Jun Usuki (Department of Information Network and Communication Kanagawa Institute of Technology). *AERIAL CHARACTER STRINGS SEPARATION FOR RESTAURANT ORDERS USING DNN.*

Abstract. In recent years, self-ordering devices have been introduced in restaurants. Depending on these devices, the order processing efficiency in restaurants has improved, although device maintenance tasks were added. Under these circumstances, an ordering system based on aerial handwriting character recognition using only a camera has been discussed. Aerial handwriting character recognition is a technology that enables non-contact input of information, expected to reduce the risk of device breakdown and theft. However, character string recognition, such as restaurant orders written in a single stroke, is difficult because the boundaries between each character are difficult to identify. In previous research, Machine learning models that estimate the coordinates that serve as boundaries (character delimitations) for each character and recognition algorithms for aerial handwritten character strings based on these models have been proposed, although the recognition rate for character strings with a large number of characters is low. In this study, an improved character delimiter estimation model was investigated for the implementation of an aerial handwritten ordering system. The point at which the writing direction changes significantly was used as the primary character delimitation candidate, and the layers that make up the model were further reviewed, resulting in a higher F1 score compared to the previous model. Furthermore, a new aerial handwritten character recognition algorithm that uses the distribution of writing directions per frame to recognize character strings using the output of the character delimiter model was investigated. The correct response rate for aerial handwriting characters string recognition by this model was 75%. As a certain level of effectiveness was obtained for each of the proposals, a blank text string recognition system using them is currently being considered.

Keywords: Aerial handwriting character recognition, character strings separation, RNN, CNN

Shailesh Chandra (Department of Civil Engineering and Construction Management, California State University Long Beach). *TRANSITIONING FROM A CONVENTIONAL TO AN AUTOMATED TERMINAL: PORT VEHICLE EFFICIENCY-BASED ANALYSIS.*

Abstract. Vehicles in port operations bridge quay and yard cranes, crucial for efficient container transport. Recent technological advancements have led to automation in container terminals, necessitating a deep understanding of this transition. Metrics like port vehicle travel times in transportation of containers and their dwell times at quay cranes serve as efficiency measure of port performance. With port terminal automation rising, robust evaluation methods are vital to enhance efficiency and ship turnaround times. Optimizing port vehicle routing and planning in terminals reduces waiting times for equipment and container dwell times. Our research employs continuous approximation models to analyze the efficiency of conventional and automated terminals, and to determine the optimal number of port vehicles and quay crane deployments needed for a seamless shift from conventional to automated operations, with a focus on container transportation by port vehicles.

Keywords: port, cranes, circular navigation, grid network, vehicle, continuous approximation

Amy Lee (Chung Hua University) and He-Yau Kang (National Chin-Yi University of Technology). *A PRELIMINARY STUDY OF THE SUSTAINABLE VEHICLE ROUTING PROBLEM.*

Abstract. Global climate change has become a severe problem. People's awareness of environmental protection is increasing, and environmental protection regulations are becoming increasingly strict. Manufacturing accounts for most global greenhouse gas (GHG) emissions, and many companies have begun implementing plans to require themselves and their suppliers to meet environmental protection targets. If a company fails to meet relevant requirements in the future, it will lose its competitive advantage. In addition, actions to reduce GHG emissions and waste can help improve the company's internal operations and supply chain. The vehicle routing problem (VRP) is a core issue in logistics and one of the main areas of supply chain management. To meet today's complex business environment, the VRP needs to consider many objectives and constraints to serve customers, such as total system cost, customer satisfaction, timeliness, limited vehicle capacity, limited vehicle travel time, multi-commodity, time windows, etc. Introducing sustainability as a critical dimension adds challenges and uncertainties, driven by GHG emission reduction regulations and corporate social responsibility initiatives. Since the fuel consumption of different types of vehicles and the distance and speed travelled by the vehicles affect overall GHG emissions, the sustainability in the VRP becomes an important issue. Consequently, the conventional single-objective approach in VRP may prove inadequate, necessitating the adoption of a multi-objective VRP to better align with real-world decision-making needs. In this study, a multi-objective programming model is established for the sustainable vehicle routing problem to consider multiple objectives, including minimizing the total cost and maximizing customer satisfaction. The total cost includes the total traveling cost, total dispatching cost, total crash cost, total GHG emission cost, and total penalty cost in the system. In addition, a genetic algorithm model is developed to solve large-scale problems in a short computational time, thereby enhancing the practical applicability of the research.

Keywords: Vehicle routing problem, Time window, Genetic algorithm

Victoria Estrella (Mapua University), Josephine German (Mapua University), Ardvin Kester Ong (Mapua University) and Anak Agung Ngurah Perwira Redi (Sampoerna University). *ANALYZING FACTORS AFFECTING WORKPLACE BEHAVIOR OF GENERATION Z IN A DEVELOPING COUNTRY: APPLYING STRUCTURAL EQUATION MODELING WITH HIGHER-ORDER CONSTRUCT ANALYSIS.*

Abstract. The entry of a new generation known as Generation Z or Gen-Z into the labor force created substantial implications for corporate operations, communication, and problem resolution within organizations. These Gen-Zs were raised in a digital age where social media, smartphones, live streaming, and the internet were all quite commonplace. Through working with their teams, their unique skills, values, and perspectives emerge. This study evaluated the significant variables influencing the work behaviors of Filipino Gen-Z employees in the Philippines. A total of 400 responses from currently employed Filipino Gen-Zs in the manufacturing and service industry sectors were collected using the purposive sampling technique. Data were analyzed using the partial least squares structural equation modeling (PLS-SEM) with higher-order construct analysis. The findings showed how crucial it is to understand the variables influencing Gen-Z behavior and to get the Philippine labor market ready for the influx of young, skilled workers. The results demonstrate that the workplace behavior of Gen-Zs is greatly influenced by diversity, teamwork, individualism, work-life balance, leadership, organizational culture, career growth, and training. Similarly, good behavior at work has a favorable impact on general job satisfaction, employees' productivity, and the company's financial performance. The study can help managers and human resource specialists design the hiring and retention procedures of the business to promote positive workplace behaviors, particularly among the younger workforce.

Keywords: Workplace behavior, Gen-Z, Partial least squares structural equation modeling (PLS-SEM), Higher-order construct analysis

Vineet Arora (IIT Kanpur), Amit Shukla (IIT Kanpur) and Jasvir Nachatar Singh (La Trobe University, Australia). *MEASUREMENT OF REMOTE PSYCHOLOGICAL CAPITAL OF INFORMATION AND COMMUNICATION TECHNOLOGY WORKERS: A MIXED-METHODS APPROACH FOR CONSTRUCT DEVELOPMENT.*

Abstract. The COVID-19 pandemic and technological advancements have made remote work increasingly prevalent in organizations. Although measures such as information technology self-efficacy and virtual work self-efficacy exist, there is a lack of comprehensive tools to assess the psychological resources of remote workers and understand how their performance can be enhanced. This study aims to develop a measure of remote psychological capital specifically for the information and communication technology (ICT) industry. Using a mixed-methods approach, we generated items by interviewing remote workers and conducting a thorough review of the existing literature on remote work and positive organizational behavior. Following rigorous and established scale development procedures, we developed a six-factor scale of remote psychological capital through exploratory and confirmatory factor analyses. The new scale demonstrates good construct reliability and convergent validity, and it provides insights into how to better support remote workers in overcoming the challenges posed by remote work. This study is the first to create a valid and reliable scale for assessing the psychological strengths of remote workers in the Indian context. The theoretical and practical implications, along with directions for future research, are discussed.

Keywords: Remote Work, Psychological Capital, Scale Development, Mixed Methods, ICT Workers

Sahil Sahil (Indian Institute of Technology Kharagpur, India) and Sarada Prasad Sarmah (Indian Institute of Technology Kharagpur, India). *DRIVING CHANGE: EVALUATING THE IMPACT OF ODD-EVEN POLICIES ON ELECTRIC VEHICLE ADOPTION AND END-OF-LIFE VEHICLE SCRAPPAGE.*

Abstract. Global policymakers have voiced significant concerns regarding the heightened levels of vehicular emissions linked to the proliferation of aging vehicle fleets. Consequently, various measures have been instituted to mitigate tailpipe emissions, including vehicle scrappage programs, the designation of low-economic zones in highly polluted cities, and the implementation of odd-even policies. This study aims to assess the impact of the odd-even policy on incentivizing the scrapping of End-of-Life vehicles and bolstering electric vehicle sales in the Delhi-NCR region of India. Furthermore, the study seeks to establish a causal relationship between the odd-even policy and the observed increases in electric vehicle purchases and vehicle scrappage. Findings indicate that the implementation of the odd-even policy has proven effective in stimulating electric vehicle sales and encouraging the scrapping of End-of-Life vehicles, underscoring its efficacy as a policy intervention by policymakers.

Keywords: Vehicle Scrappage, Odd-Even Policy, Policy Implementation

Muhammad Rizal Falaqi (Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia), Agus Tricahyo (Institut Agama Islam Negeri Ponorogo, Indonesia) and Uril Bahruddin (Universitas Islam Negeri Maulana Malik Ibrahim Malang, Indonesia). *TOWARDS THE FUTURE OF EDUCATION: UTILIZING AI TO TRANSFORM THE LEARNING CURRICULUM IN DYNAMIC SCHOOLS.*

Abstract. This research aims to explain the concept and implementation of Artificial Intelligence (AI) in learning curriculum management in schools. Currently, the education curriculum continues to change and evolve to form strong human resources that are strong and ready to face developments over time. School curriculum management must be designed and developed dynamically following the times and student developments. So, it is important to apply AI in school curriculum management. AI is an artificial intelligence technology that is believed to be able to help humans in their lives. Hence, it needs to be implemented in education as a provision for students to know and utilize technology in their lives. Using the narrative literature review method, this article describes the concept of AI-based school curriculum management by studying relevant literature. In the learning process, AI technology can act as a learning application, tutor system, intelligent tutor, and guide for creating curriculum and education policies. The results of this research illustrate the concept of an AI-based school curriculum so that it can be used as reference material in school curriculum management activities.

Keywords: Artificial intelligence, Curriculum Management, School, Learning application

Petri Helo (University of Vaasa) and Bening Mayanti (University of Vaasa). *Dynamics of energy costs and emissions in operations: analysing energy operational adjustments.*

Abstract. The amount of energy use in operations and the source of that energy influence the greenhouse gas footprint. This paper analyses the dynamics of energy use in manufacturing where energy price and carbon emission from the grid are hourly fluctuating and vary at different times of the days. Three scenarios are analysed (1) pre-/postponement of operations, (2) storage effect and value, (3) system effect of simultaneous operations. Based on the analyses, we show how different strategies may impact the cost of energy consumed and energy-related emissions. These objectives may be conflicting with each other. A simulator software is presented to analyse the scenarios.

Keywords: operations, sustainability, energy

Chethana Chandrasiri (Department of Manufacturing & Industrial Engineering, Faculty of Engineering, University of Peradeniya), Asela Kulatunga (Department of Engineering, Faculty of Environment, Science and Economics, University of Exeter) and Subodha Dharmapriya (Department of Manufacturing & Industrial Engineering, Faculty of Engineering, University of Peradeniya). *SIMULATION BASED SUPPLY CHAIN RECONFIGURATION TOWARDS SUSTAINABILITY* .

Abstract. Many of the supply chains that evolved over the years have inherent unsustainable practices. To reconfigure them in a sustainable manner, it requires substantial analyses before reconfiguring them. However, if there is a possibility to reconfigure the existing supply chains, it is possible to investigate multiple alternatives available with respect to overall efficiency, cost, emissions, environmental sustainability, etc., which could be easily evaluated and corrective actions taken. Conversely, simulation techniques have developed in recent years to model many complex engineering problems, which include supply chain designs and configurations. Therefore, this research uses simulation techniques to model and reconfigure the conventional vegetable supply chain in Sri Lanka, which currently has inherent unsustainable practices and postharvest losses. Initially, the existing vegetable supply chain was mapped from farm gates to retail outlets, considering all the intermediatory activities. Subsequently, to minimize road-based transportation, segments between the transhipment centres known as economic centres were replaced by converting that segment to rail mode as a model shift. A sample of farmers, economic centres, and retailers was derived using multistage sampling combined with the Pareto principle at each stage. The transportation cost, food miles, lead time, and overall emissions of the supply chain were quantified and compared in each case. Results of the analysis demonstrated that multimodal transportation strategies reduce food-miles by 20%, CO2eq emission by 12.5% and total transportation cost by 20.4%. However, transit time has been increased 14 % due to modal change. Furthermore, reconfiguration model could be used to further enhance the sustainability by adaptation of different business strategies to distribute vegetable at different railway stations instead of the movement restricted between transhipment centres.

Keywords: Supply chain Reconfiguration, Sustainability, Multimodal transportation, Simulation, Emissions Reductions

D. P. P. Meddage (University of New South Wales), Damith Mohotti (University of New South Wales), Kasun Wijesooriya (University of New South Wales) and Chi King Lee (University of New South Wales). *MODELLING OF THE TRANSIENT WIND PRESSURE ON A TALL BUILDING USING MACHINE LEARNING* .

Abstract. Machine learning (ML) has received significant interest in wind engineering applications over the recent decade. Conventional ML-based approaches for predicting wind loads on tall buildings have primarily focused on static pressure, often neglecting transient wind pressure analysis. In this study, a machine learning approach is employed to predict transient wind pressure on a tall building, considering three wind directions. Transient pressure data on the building surfaces were obtained through computational fluid dynamics (CFD) simulations and validated using wind tunnel experimental data. A long short-term memory (LSTM) network was used to predict the transient wind pressure on the tall building. The LSTM model demonstrated excellent prediction accuracy in both the training and testing phases, accurately capturing wind flow characteristics on the building surfaces to a greater extent than the numerical simulations. This research highlights the potential of machine learning to provide fast and reliable wind pressure predictions for the design of tall buildings. Therefore, the authors suggest this approach as an alternative tool for design engineers to predict wind pressure on tall buildings.

Keywords: wind load, tall building, machine learning

Chamodi Widanage (University of New South Wales, Canberra), Damith Mohotti (University of New South Wales, Canberra), Chi King Lee (University of New South Wales, Canberra) and Kasun Wijesooriya (University of New South Wales, Canberra). *PREDICTIVE MODELLING OF BLAST-INDUCED INCIDENT PRESSURE TIME HISTORIES USING A DEEP LEARNING-BASED FRAMEWORK.*

Abstract. Recent research has increasingly focused on assessing the applicability of deep learning for the predictive modelling of blast dynamics due to its high level of accuracy and computational efficiency. A critical component in understanding the structural response to explosions is the time history of blast-induced incident pressure. Despite its importance, there is limited research in the published literature that explores deep learning methods to predict blast-induced incident pressure time histories. To address this gap, the authors introduce a novel deep learning-based framework to predict blast-induced incident pressure time histories. This novel framework comprises multiple artificial neural networks (ANN) that operate collaboratively to predict the incident pressure time histories. This approach effectively breaks down the prediction process into stages, significantly reducing both the ANN training time and overall prediction time. The ANN models in the framework were trained using datasets of blast events, populated with results from validated numerical models. Comparative analysis between the predictions generated by the numerical model and the ANN-based framework revealed that the ANN framework's results closely resemble those of the numerical models, achieving a similarity of 99%. Moreover, the computational time required by the ANN-based framework to predict the incident pressure time history for a blast event is approximately 1% of the time required by an equivalent numerical model. Hence, the findings of this research suggest that an ANN-based framework can serve as an effective and efficient method for predicting blast dynamics.

Keywords: Blast, Incident pressure time history, Artificial neural network

Harrison Pastega (UNSW) and Ripon Chakrabortty (UNSW). *Bolstering Australian Defence Force Recruitment and Retention.*

Abstract. Personnel challenges are one of the central issues facing the modern Australian Defence Force (ADF), with significant criticisms for consistently failing to achieve workforce targets. With a diminishing workforce and slow recruitment pipeline, the ADF must compete for the high-quality, skilled employees it requires. This study examines the ADF's recruitment and retention policies compared to private sector strategies by implementing the Analytical Hierarchy Process (AHP) to prioritise ADF's current recruitment and retention strategies. This research encompasses a comprehensive review, identifying consistent practices observed in successful organisations, such as employer branding, diversity and inclusion, flexible work arrangements and positive organisational culture as key to increasing recruitment and retention. Concurrently, the research considers the retention struggles of the ADF, where compounding factors such as job satisfaction, family-work imbalance, and promotion of unsuitable personnel are causing significant difficulties in retaining personnel. Due to the individual nuances of strategies and policies for recruitment and retention, two separate AHPs were conducted. In the case of recruitment, workplace experience is the key factor in employees considering employment in the ADF. For retention, ways of working become the key factor. The prioritisation of these factors has implications for current ADF resourcing and communication strategies, and the realignment of ADF strategic policy and direction to align with this study and other contemporary academic literature findings is endorsed. Through a comparative analysis of ADF and private sector recruitment and retention policies, this study offers actionable insights into achieving effective recruitment and retention strategies, emphasising the critical need for human resources initiatives.

Keywords: Australian Defence Force, Recruitment Strategies, Retention Strategies, Human Resource Management, Analytical Hierarchy Process, Employee Value Proposition

Hannah E. Komatsu Quinn (School of Systems & Computing, UNSW Canberra, Australia) and Ripon K. Chakrabortty (Senior Lecturer, School of Systems & Computing, UNSW Canberra, Australia). *Smart Healthcare Scheduling Focusing on Outpatient No-Show Appointments.*

Abstract. In recent years, the Australian population has experienced an overall increase in waiting times within the domain of healthcare. This has been experienced whilst waiting for a general practitioner (GP) appointment, urgent care from a GP, and during visits to the emergency department (ED). The management and scheduling of healthcare resources (such as equipment and staffing), as well as the appointments, are primary factors in the patient's overall experience. A notable factor that has been observed to cause problems within healthcare scheduling is the presence of no-show patients who miss their appointments and subsequently waste medical resources and other individuals' time. Though previous research was conducted with the usage of machine learning (ML) models, it has been noted that the presence of no-show patients is not an inherently random occurrence and has not been predicted to date. This project aimed to investigate further the prediction of no-show patients, specifically within an Australian context within an outpatient appointment setting. However, due to time constraints, the data used in this investigation was based on a Brazilian context. To build upon this research, these predictions are to be implemented with a rescheduling policy with regard to rescheduling appointments in order to observe how no show patients can increase the overall waiting time of other patients.

Keywords: Healthcare Scheduling, Machine Learning, No-Show Appointments, Emergency Department

Katsumi Morikawa (Hiroshima University), Keisuke Nagasawa (Hiroshima University) and Katsuhiko Takahashi (Hiroshima University). *Job shop scheduling with automated processing during breaks.*

Abstract. The present study focuses on scheduling a job shop under the condition that each operation consists of a manual work unit, at most one automated work unit, and a manual work unit. The manual work unit must be processed on a specified machine with a worker's support, while the automated work unit does not require a worker. The objective of the scheduling is to minimize the makespan under the given break times during the planning horizon. When the processing of a manual work unit overlaps with a break, the processing is interrupted at the beginning of the break and resumed after the break. The processing of an automated work unit is not affected by break times. Under these conditions, an operation's processing time becomes start-time-dependent. A mixed-integer programming model is developed by implicitly considering the start time and duration of breaks. Only the processing time of the automated work unit is adjusted when it overlaps with a break. A heuristic scheduling method is also developed, assuming a solver is available for the classical job shop scheduling problem. The formulated mathematical model solved a 10-job, 10-machine problem instance. The same instance was also used to investigate the behavior of the proposed heuristic method. Potential extensions of the proposed method are discussed.

Keywords: job shop, scheduling, break times, time-dependent, mixed-integer programming model

Syed Irtija Hasan (University Of Wollongong, Wollongong, Australia), Sonia Farhana Nimmy (University of New South Wales, Canberra, Australia) and Md Sarwar Kamal (University of Technology Sydney, Sydney, Australia). *Predictive Maintenance for Industrial Drones in the Industrial Internet of Things Using Federated Learning and Explainable AI.*

Abstract. Predictive maintenance is crucial for optimizing industrial operations by reducing downtime and maintenance costs. We propose a novel approach integrating Federated Learning (FL) and Explainable AI (XAI) to enhance predictive maintenance in Industrial Internet of Things (IIoT) environments. Our methodology leverages decentralized sensor data from various IoT devices, including drones, across industrial plants to enable collaborative model training while ensuring data privacy. We utilize a Stochastic Gradient Descent (SGD) federated algorithm for FL, which allows for the training of a global predictive maintenance model with local updates from each device, thereby improving model accuracy and adhering to strict data privacy regulations. Recognizing the opaque nature of many AI approaches, and the critical need for transparency in maintenance decision-making, we employ XAI techniques. Specifically, we utilize Counterfactual Explanations and Feature Importance Analysis with SHapley Additive exPlanations (SHAP), which provide interpretable explanations for maintenance predictions. These explanations empower industrial engineers and managers to understand how factors such as temperature, vibration, rotor speed, and environmental conditions like fog, dust, and smoke influence machinery performance. Our approach has been validated on operational datasets from manufacturing and process industries, demonstrating significant improvements in predicting equipment failures and optimizing maintenance actions. This contributes to advanced predictive maintenance strategies and efficient asset management in IIoT, showcasing a scalable framework that combines privacy, accuracy, and explainability.

Keywords: Federated Learning, Predictive Maintenance, Industrial IoT, Explainable AI, IoT Data Analytics

Farhad Habibi (School of Systems & Computing, UNSW Canberra, ACT 2610, Australia), Alireza Abbasi (School of Systems & Computing, UNSW Canberra, ACT 2610, Australia), William Ho (Department of Management and Marketing, University of Melbourne, Australia) and Ripon K. Chakrabortty (School of Systems & Computing, UNSW Canberra, ACT 2610, Australia). *Navigating the Disruption Maze: Strategies to Enhance Supply Chain Resilience.*

Abstract. Complexities inherent in today's supply chains necessitate robust networks to mitigate disruption ripples. This study aims to enhance SCN resilience by exploring effective strategies to mitigate disruptions affecting SCN components (e.g., nodes, links) and tiers (e.g., suppliers, production facilities, warehouses). We address key gaps in the literature by examining the heterogeneous structure of supply chain networks (SCNs), focusing on how facilities in different tiers with varying roles impact resilience. Our research examines disruption sources at both node and link levels, evaluating the effectiveness of mitigation strategies like proactive and reactive interventions. An SCN creator algorithm generated a dataset with SCNs ranging from two to seven tiers. A disruption/recovery simulation assessed the resilience of these networks, measuring average functionality and recovery time across diverse scenarios. Our findings reveal that disruptions originating from earlier tiers have a more significant impact and require extended recovery periods. This underscores the criticality of effective disruption management, particularly at the initial stages of the SCN. Additionally, prioritizing proactive support for these initial tiers significantly bolsters resilience, highlighting the importance of fortifying these foundational elements for safeguarding the entire network. Regional government support plays a crucial role in facilitating rapid recovery, emphasizing the need for stakeholder collaboration and coordination to streamline recovery efforts and minimize disruption's impact on SCN operations. Our findings highlight that disruptions from initial tiers have the most severe impact and longest recovery times. They show that prioritizing proactive support for these critical tiers and increasing regional government aid significantly improves SCN resilience and recovery speed. These insights provide actionable guidance for decision-makers and outline important areas for further academic research.

Keywords: Disruption impact analysis, Risk management, Multi-tier network, Supply chain resilience, Ripple effect

Vinit Ghosh (T A Pai Management Institute, Manipal Academy of Higher Education, India), Rohan Mukherjee (International Management Institute Kolkata, India) and Andrea Appolloni (University of Rome Tor Vergata, Italy). *Digital-Powered Transformation of Circular Supply Chains for Sustainable Future -A Structural Topic Modelling Approach.*

Abstract. The concept of the circular economy (CE) is attracting considerable interest from scholars and policymakers (Barreiro-Gen & Lozano, 2020). As emphasis on waste reduction throughout the product lifecycle has increased, a noticeable shift in the supply-chain management has been observed (Barreiro-Gen & Lozano, 2020; Farooque et al., 2019). Nowadays, IoT, big data, AI, or artificial intelligence as well as blockchain are viewed majorly as enablers towards a more sustainable or circular economy. Technology integration with CE principles for sustainability and zero-waste output has been emphasized lately (Rusch et al., 2023; M. Yang et al., 2021). This integration leads to the shifting of traditional supply chains into circular supply chain (Mastos et al., 2021; Asad et al., 2024). CSCM integrates the philosophy of "circular economy" into all functions and processes involved in managing the supply chain (Zhou et al., 2024). The integration of digital technologies (DTs) into circular supply chain management (CSCM) offers a promising approach to improving sustainability. This integrated approach has immense potential to advance the Sustainable Development Goals (SDGs). As a result, there is an increase in the number of papers focusing on the integration of DTs, CSCM, and sustainability. The present study explores how Industry 4.0 technologies can enable collaboration mechanisms. While the number of articles reviewed is not disclosed in the article, the perusal of cited studies indicates that the number is less than 100. Though the current literature in this field is appreciable, it offers limited insights into how DTs contribute to the realization of CSCM. A lack of coherence in literature has implications for both researchers and policy makers. The rapid advancements in DTs coupled with their application in CSCM necessitates an up-to-date quantitative review to identify emerging themes and trends on DTs, sustainability and CSCM. We aim to give a comprehensive overview of the existing literature, identifying major themes in the research. One of the unique contributions of the paper is the mapping of research themes with SDGs. This ensures that efforts towards leveraging digital solutions and circular economy principles for enhancing supply chain's sustainability with recognized global objectives. Moreover, by comprehending this intersectional research area helps organizations optimize resources, manage risks, and unlock opportunities for green growth. This contributes to a comprehensive approach towards dealing with complex issues associated with environmental and social systems stability. The mapping with SDGs is essential to align these innovative practices with global sustainability agendas. Through this exploration, the paper identifies gaps in the current body of research, advancing our understanding of the linkages between digital technologies, sustainability, and CSCM. It also outlines future research directions.

The paper has employed a combination of structural topic modelling (STM) and content analysis to address the above RQs. This approach was chosen because traditional literature review methods may not effectively capture the dynamic and ever-changing nature of this research field. By employing STM, we were able to identify emerging trends and themes, allowing us to gain timely insights into the latest developments and research frontiers. This study utilizes a text mining approach that maps the literature on the linkages between DTs, sustainability, and CSCM. Additionally, the study also maps the identified themes with relevant SDGs. The study analyzes a comprehensive dataset of 430 articles published in journals indexed in the Scopus database to uncover prevailing themes, emerging trends, and research gaps in this multidisciplinary field. Eleven studies from the sample of 430 were evaluated using the appropriate assessment tool. The methodological quality of the included articles was systematically appraised by two independent researchers. The Critical Appraisal Skills Programme (CASP) checklist was utilized for qualitative and quantitative studies, while the Joanna Briggs Institute (JBI) for Systematic Review (JBI, 2020) critical appraisal tool was employed for review articles.

Despite the progress, our review highlights critical gaps in the empirical evidence, particularly in the context of developing economies. Our research clearly indicates a gaining momentum among scholars and practitioners to embrace research and practices pertaining to CE. CSCM aims to integrate sustainability into supply chains, promoting sustainable production and consumption. Advanced technologies such as IoT, big data, AI, and blockchain are key enablers of this transition, driving traditional supply chains towards circular models. CSCM aligns with the Sustainable Development Goals (SDGs), particularly SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action), also indirectly contributing to SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure). The current research article has provided a coherent picture examining the available literature on technology trends in CSCM. Right policies and human actions aligning to the adoption of emerging technologies in CSCM can optimize resources, manage risks, and drive green growth. The study reveals a geographical imbalance in the existing studies. The existing studies have more focus on developed economies. This gap underscores the need for research in the context of developing and emerging economies. Developing and emerging economies may face different challenges and opportunities. These different challenges and opportunities may influence the effectiveness of these technologies. Future studies should focus on conducting case studies in different geographical locations. In particular, the case studies should focus on developing countries. The studies can provide a clearer roadmap. The roadmap serves to achieve sustainability goals.

Keywords: Digital technologies, Literature review, SDG, Circular supply chain, Structural topic modelling

Mohammed Yaqot (Hamad Bin Khalifa University (HBKU)). *Unveiling Bullwhip Effect Main Topics: An Integrated Latent Dirichlet Allocation and Generative AI Approach.*

Abstract. The bullwhip effect (BWE) describes how minor fluctuations in downstream processes can cause increasingly significant amplified variations upstream in the supply chain. It presents a significant challenge within supply chain management (SCM), leading to inefficiencies and increased costs. This study aims to build a comprehensive understanding of the BWE main topics that influence the dynamic propagation of fluctuations, variabilities, and uncertainties by leveraging Latent Dirichlet Allocation (LDA), a statistical method employed for topic modeling. This work focuses on analyzing 982 publications over the past twenty-seven years using a two-phase method. The first phase utilizes LDA to identify the optimal number of topics, and the second phase involves the application of Generative AI (GenAI) to generate meaningful and concise names for these topics. This work contributes to a deeper understanding of the traditional scoping, narrative, systematic, and bibliometric BWE reviews, offering an integrated methodological approach to analyzing complex supply chain phenomena. Through this framework, the intricate mechanisms and interdependencies that exacerbate the BWE are revealed. The findings provide seven main topics and underscore the complexity of the BWE and demonstrate the utility of topic modeling in providing insights for developing more resilient and efficient supply chain strategies.

Keywords: Bullwhip effect, Supply chain, Topic modeling, LDA, Generative AI

Suraj Gupta (Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur), Jhareswar Maiti (Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur) and Akhilesh Kumar (Department of Industrial and Systems Engineering, Indian Institute of Technology Kharagpur). *EXPLAINABLE AI-DRIVEN DEEP LEARNING APPROACH FOR PREDICTING REMAINING USEFUL LIFE OF TURBOFAN ENGINE.*

Abstract. Predictive maintenance has gained considerable importance in various industries, especially those that rely heavily on heavy duty machinery to ensure uninterrupted operation. Continuous health monitoring and early forecasting of the machine failure can help the management to proactively plan the maintenance activities to avoid any unwanted production breakdown. Thus based on the same idea, this study presents an interpretable approach for forecasting the Remaining Useful Life (RUL) of a turbofan engine. The proposed methodology employs an Explainable Artificial Intelligence (AI) powered Long Short-Term Memory (LSTM) and 2D-CNN+PCA model that can effectively captures the temporal dependencies and patterns inherent in the dataset and precisely predicts the engine's time to failure. The Explainable AI in the model increases the interpretability of the model and offer transparency for more informed decision making. The study also provide an experimental analysis of the hyperparameter tuning and dimensional reduction to enhance the performance of the machine learning model. The proposed methodology is evaluated using a benchmark dataset that has been publicly released by NASA via its repository. The results of the study shows that the hybridization of the model with explainable AI not only increase the interpretability of the prediction but also provide the casual factors relating to the degradation of the engine. The results of the analysis shows that 2D-CNN + PCA with Adam optimizer outperforms LSTM with significant margins.

Keywords: Remaining Useful Life, Failure Prognostics, Explainable AI, Deep Learning, Condition Monitoring

Sourav Bagchi (Indian Institute of Technology Kharagpur), Mamata Jenamani (Indian Institute of Technology Kharagpur) and Aurobinda Routray (Indian Institute of Technology Kharagpur). *A Noise-Resilient Missing Data Imputation during IoT enabled Reefer Container monitoring.*

Abstract. Handling missing data in reefer container monitoring systems using IoT becomes particularly challenging due to the presence of noise injected from other instruments, which affects data quality and imputation accuracy, ultimately impacting the distribution planning for perishable produce. To address this issue, we propose an innovative algorithm that imputes missing data in the presence of noisy training set using a modified Variational Autoencoder (VAE). Our method employs an unsupervised approach with an adaptive loss function, effectively handling the scarcity of initial complete datasets. Furthermore, the algorithm considers both missing data patterns and observed data to extract abstract features that can significantly impact the imputation. We demonstrate the efficacy of our proposed algorithm using a dataset collected from a real-time cold chain monitoring experiment. Comparative analysis with existing approaches shows that our algorithm outperforms other state-of-the-art methods in terms of accuracy. These findings highlight the potential of our approach to enhance data quality in IoT-based monitoring systems, ensuring more reliable data quality and improved operational efficiency in the cold chain industry.

Keywords: Internet of Things (IoT), Missing data imputation, Reefer container monitoring, Variational Autoencoder (VAE), Adaptive learning

Md Sarwar Kamal (University of Technology Sydney), Sonia Farhana Nimmy (UNSW, Canberra), Wafa Alharbi (Shaqra University), Ahnaf Tajwar (BRAC University) and Nazia Hasan (East West University Bangladesh). *Real-time Anomaly Detection in Cyber-Physical Systems Using Fourier Transform Features and Explainable AI.*

Abstract. In critical Cyber-Physical Systems (CPS), such as healthcare and transportation, the need for robust and interpretable anomaly detection is paramount to prevent failures and ensure system reliability. In this paper, we present a novel anomaly detection method that uses the Fourier transform (FT) for feature extraction and incorporates a novel explainable artificial intelligence (XAI) approach based on cooperative game theory, specifically employing the core model. The FT is used to transform time series data from CPS into the frequency domain to isolate crucial features that indicate normal and abnormal behavior. These features include username regularity, credential changes, email verification and more. The transformation process highlights the frequency components associated with irregular patterns, facilitating accurate anomaly detection. The XAI approach interprets the interactions between the different model components as a strategic game, where the influence of each feature is akin to a player's contribution to a coalition. By using the kernel, we ensure that the distribution of explanatory weight between features (players) is such that no subset of features would be better off forming an alternative explanatory coalition. This method provides a mathematically rigorous, quantifiable explanation of each feature's role in the model's predictions, promoting deeper confidence and understanding of AI-driven decisions. The integrated approach not only improves detection accuracy, but also ensures the interpretability and reliability of decisions, which is crucial for maintaining the integrity of CPS in sensitive industries.

Keywords: Cyber-Physical Systems, Fourier Transform, Explainable AI, Anomaly Detection, Security

Jia Guo (The University of New South Wales) and Jonathan Bard (The University of Texas at Austin). *Weekly Scheduling for Freight Rail Engineers & Trainmen.*

Abstract. Standard practice in the freight rail industry has been used to provide only short-term crew schedules for a day or two at a time. This essentially means that the engineers and other trainmen function on a ‘‘just-in-time’’ basis with as little as two hours notice to report to work. This approach offers the greatest flexibility for management but plays havoc with the work-life balance of the crew. The purpose of this paper is to show that it is possible to construct robust weekly schedules that satisfy the full range of legal regulations and company policies without greatly enlarging the size of the workforce. This is done with a 3-phase algorithm that relies on the logic of column generation and local improvement procedures. Additional features include the option to generate cyclic schedules and a parametric approach to account for random trip times. To demonstrate the effectiveness of the methodology, computational experiments and statistical analysis are conducted using data sets from a Class I railroad. The robustness of the derived schedules is confirmed through simulation with varied parameter settings by comparing each of the baseline schedules produced by the 3-phase algorithm with 100 random instances.

Keywords: Freight rail crew scheduling, Column generation, Random travel times, Robust schedules, Parametric analysis

Akshay Bhosale (Indian Institute of Technology Kharagpur) and Sayak Roychowdhury (Indian Institute of Technology Kharagpur). *Bayesian-BWM Integrated CoCoSo method with Single Valued Neutrosophic Fuzzy Sets to Prioritize Threat-agent Types in Connected and Autonomous Vehicles.*

Abstract. Connected and autonomous vehicles (CAVs) are one of the critical elements in intelligent transportation systems (ITS). CAVs communicate with each other and the environment using wireless communication technologies that increase the cyber threats in the ITS. Different types of threat-agents implement a variety of cyber-attacks on CAVs. Each threat-agent consists of different resources, capabilities, motivations, and access that must be considered while defending CAVs against different cyber-attacks. This study aims to prioritize the threat-agent types as part of the cyber risk management techniques using a novel Hybrid Multi-Criteria Decision Making (MCDM) framework. Hence, in this study, five different categories of threat-agents, which are nation-state, cyber-criminal, hacktivist, terrorist, and insider, with five criteria, namely injury or death to personnel, damage to vehicle or public property, degradation of system availability or performance, loss of critical information, loss of cargo using fuzzy multi-criteria decision making (MCDM) are prioritized. We propose a novel multi-criteria decision-making (MCDM) approach that integrates the Combined Compromise Solution (CoCoSo) methodology and the Bayesian Best-Worst Method (B-BWM) within the framework of Single-Valued Neutrosophic Fuzzy Sets (SVNFS). B-BWM helps to calculate the aggregated final criteria weights for a group of decision-makers with fewer pairwise comparisons. The CoCoSo method calculates three appraisal score strategies that generate optimal rank indexes for different alternatives. The results show that injury or death to personnel is an important criterion for threat-agent ranking. The results obtained from the CoCoSo method show that cyber-criminals are the highest and terrorists are the lowest risk causing types of threat-agents. The proposed technique will provide helpful insights to cybersecurity decision-makers on optimizing mitigation techniques against different categories of threat agents.

Keywords: Cybersecurity, Fuzzy MCDM, Connected and autonomous vehicles, Threat-agent prioritization, Bayesian Best-Worst Method, Combined Compromise Solution (CoCoSo)

Qinwen Wang (Shanghai Jiao Tong University), Juanru Zhao (Shanghai Jiao Tong University) and Ning Li (Shanghai Jiao Tong University). *Open-Set Domain Adaptation in Machinery Fault Diagnosis by Adversarial Network and Extreme Value Theory.*

Abstract. In recent years, there has been significant advancement in applying transfer learning to fault diagnosis. This approach leverages existing data to address fault identification challenges across varied operational conditions. Given the complexity of machinery and the dynamic nature of industrial production settings, the conditions of equipment can vary, potentially introducing new fault categories within collected signals. Consequently, enhancing the capability of transfer learning methods to recognize new, unseen categories in open-set conditions has become a critical area of research. Existing models of transfer learning may suffer from severe negative transfer when tackling open-set issues, which can result in overlapping sample distributions in the feature space and challenges in isolating unknown categories. To address these challenges, this paper introduces a hybrid approach that integrates adversarial networks with distribution fitting techniques to establish a comprehensive open-set domain adaptation strategy. First, we introduced a weighting mechanism which decreases the influence of samples that differ from the known classes in the source domain. Moreover, a statistical-model-based strategy is introduced to detect unknown samples. Our experiments on a real machinery dataset validate the proposed method. The results show that the method is promising for open-set domain adaptation problems, which improves the applicability of deep learning-based methods for practical fault diagnosis tasks.

Keywords: fault diagnosis, open-set domain adaptation, deep learning

Serdar Semih Coşkun (Asst. Prof. Dr.). *Improving the Customer Services Management Processes through Deep Learning and Natural Language Processing in the Downstream Oil and Gas Supply Chain.*

Abstract. Supply chain management is an up-to-date research area with operational and organizational perspectives. At the operational level, supply chains consist of various activities executed throughout the processes and sub-processes to create value for customers. Customer service management is one of the eight macro processes comprised of activities in which the firm faces its customers in the supply chain. In this procedure, call centers' task is to process information such as complaints, requests, and reports shared by customer companies and respond quickly to these companies' needs. However, the bounded rationality of decision-makers makes these operations prone to errors and causes direct and indirect costs in the supply chain. When the uncertainty and complexity escalate, human being's insufficient cognitive capacity causes more severe consequences such as customer dissatisfaction, contract terminals, service level drops, and trust loss. This study proposes using machine learning (ML) and natural language processing (NLP) approaches in customer service management activities to compensate for human decision-makers' lack of adequate information processing capacity. Specifically, this study aims to find the most appropriate Turkish NLP tools and ML algorithms and the optimum hyper-parameter values of those algorithms to automatically classify the content categories shared by customer companies and direct them to the relevant business units in the supply chain. The selected algorithms' predictive validity will be tested with indicators such as k-fold cross-validation, precision, recall, and F1-score. To judge the algorithms' success, the test results obtained over these indicators will be compared with the predetermined relative and absolute evaluation criteria. For these purposes, the necessary analysis will be conducted using open-source Python libraries. A proposed normative framework sets out the subsequent stages and steps to be followed to achieve these goals. This framework will be applied in the customer service processes of the gas supply chain of a real-world oil company. Currently, customer companies share content with the focus firm via web portals attached to the Enterprise Resource Planning (ERP) infrastructure. These contents are categorized manually by call center employees and forwarded to the relevant business units. The proposed approach will provide decision support in the short run and automate the mentioned activities in the long term. Thus, the supply chain's responsiveness performance will increase, and a more agile supply chain will be possible.

Keywords: Supply Chain Customer Services Management Process, Machine Learning, Natural Language Processing

Olasumbo Makinde (University of Johannesburg). *PRIORITIZATION OF PROJECT RISKS ENCOUNTERED AT A SOUTH AFRICAN POWER STATION DURING PANDEMIC PERIOD.*

Abstract. Various projects carried out in an organisation are subject to risks and uncertainties owing to rapid changes in the external environment of these organisations. Hence, it is vital for project teams and managers in an organisation to be able identify risks and accurately predict their occurrence as well as establish suitable strategies that could be used to control these risks. In light of this, this study unveiled and prioritized the risks that affected projects executed at a South African Power Station during COVID-19 pandemic period. The project risk register logbook of a South African Power Station sourced from the Project Manager of this organisation was deployed to identify and prioritize the risks that negatively impacted the smooth execution of projects in this organisation during COVID-19 pandemic period. The result of the Pareto Analysis exercise conducted on the identified risks revealed that Domestic and Global Supply Chain Disruption and Delay, Sub-Contractor Delay, Force Majeure, Government Restrictions and regulations, Quarantine and Self-Isolation are the critical risks that negatively impacted project execution at a South African Power Station during COVID-19 pandemic period.

Keywords: Project, Risk, Pareto Analysis, Prioritization, COVID-19

Olasumbo Makinde (University of Johannesburg). *PROBABILISTIC RISK ASSESSMENT OF A ROAD CONSTRUCTION PROJECT.*

Abstract. A road construction project is characterized by myriads of risks which result into project delay. Therefore, appropriate contingencies should be put in place to mitigate the project risks. Hence, this study unveiled a risk assessment exercise premised on the use of conditional probabilistic computational approach tailored to unveil the road construction project risk assessment score. The risk assessment exercise was carried out on a road construction project that comprises of nine project work packages. The project risk analysis was activated using historical data of risk occurrence on four similar road construction projects carried out at various locations in South Africa. From the study, it was revealed that the probability that a road construction project will finish on time given that it is subjected to myriads of risks such as labour shortage, project schedule delay, issues with subcontractors, contractual obligations, unavailability of raw material, late delivery of raw material, limited finance and community strike; during project execution is 2.34%. On the other hand, it was inferred that the probability that the non-critical work packages in the road construction project will finish on time, if the myriads of the aforementioned risks occurred during project execution is 96.875%. Thus, we conclude that the road construction project will not finish on time if any or combination of the aforementioned risks occur during project execution.

Keywords: Road Construction, Project, Probability, Risk

Mesut Kumru (Professor at Doğuş University in Istanbul). *FUNCTIONAL OBJECTIVES COMBINATION (FOC): A COMPOSITE MEASURING APPROACH TO CORPORATE PERFORMANCE.*

Abstract. Performance studies in the literature do not aim to create an aggregate performance measure for the entire organization, rather, they partially involve composite measuring and are not comprehensive enough. This paper proposes a novel approach for assessing corporate performance by aggregating multiple performance indicators into a single measure. It is based on the functional objectives of a company. Influence analysis/pairwise comparison and linear weighted functioning are used while developing the aggregate score. Using FOC, it is possible to identify and measure the overall performance of a company and to calculate its performance improvements as well. It has unique contributions to the area of performance management (PM). From the theoretical point of view, it brings to PM a new composite approach and a substantial contribution to multi-criteria performance evaluation.

Keywords: Performance measurement, Composite measuring, Objective, Function

Mahdi Jemmali (Computer Science Department, College of Computing and Informatics, University of Sharjah, Sharjah, United Arab Emirates), Karam Sallam (Computer Science Department, College of Computing and Informatics, University of Sharjah, Sharjah, United Arab Emirates), Ayad Turky (Computer Science Department, University of Sharjah, Sharjah, United Arab Emirates) and Ripon Chakrabortty (School of Systems & Computing, UNSW Canberra at ADFA, ACT 2610, Australia). *Parallel Machine problem under Dejong's Learning Curves Constraints to Minimize the Makespan: Impact of Curves.*

Abstract. This paper addresses the parallel machine scheduling problem incorporating DeJong's learning effect, to minimize the makespan. This problem is a well-known NP-hard problem. This problem presents various real-life scenarios in manufacturing and computer science. While several algorithms have been developed to solve this problem within reasonable computing times, no exact methods have succeeded in achieving optimal solutions even for small instances. To address this need, the paper presents a genetic algorithm for solving this problem. This study shows the impact of the choice of curves on the performance of the developed algorithms. Two versions of genetic algorithms are developed in this paper. A comparison study between 9 curves is detailed. In addition, a comparison between the developed algorithms is measured and performed. The results show that the choice of curve impacts the performance of the developed algorithms

Keywords: Heuristics, Metaheuristics, Makespan, Parallel Machines, Genetic Algorithm, Dispatching Rule, Learning Effect

Xun Xiao (University of Otago). *Learning Local Cascading Failure Patterns from Massive Network Failure Data.*

Abstract. Systems of infrastructure assets, such as power grids, pipelines, and transportation networks, are of vital importance to the functioning of contemporary society. Like networks distributed in large spaces, these long-lived fixed structures connect us to reliable energy, clean water, and timely transport services. Without careful maintenance, multiple assets can fail like a chain reaction, leading to catastrophic cascade of failures and undue repair costs. Massive data are collected from such complex networks. We try to learn information from data and then use it to make better maintenance decisions to prevent assets from malfunction. In this talk, we will discuss a novel multivariate point process regression model for a large-scale physically distributed network infrastructure with two failure modes, i.e., primary failures caused by the long-term usage and degradation of the asset, and cascading failures triggered by primary failures in a short period. Large-scale field data on pipe failures from a UK-based water utility are exploited to support the rationale of considering the two failure modes. The two failure modes are not self-revealed in the field data. To make the inference of the large-scale problem possible, a time window for cascading failures is introduced, based on which the likelihood of the pipe failure process can be decomposed into two parts, one for the primary failures and the other for the cascading failure processes modulated by the primary failure processes. The window length for cascading failures is treated as a tuning parameter and it is determined through maximizing the likelihood based on all failure data. To illustrate the effectiveness of the proposed model, two case studies are presented based on real data from the UK-based water utility. Interesting features of the cascading failures are identified from massive field pipe failure data. The results provide insights on more advanced modelling and practical decision-making for both researchers and practitioners.

Keywords: Network reliability, Point process regression, Recurrent failure, Infrastructure resilience

Apsarini Pradipta (Institut Teknologi Sepuluh Nopember) and Iwan Vanany (Institut Teknologi Sepuluh Nopember). *Simulation Model for a Robotic Mobile Fulfillment System (RMFS) In Spareparts Warehouse.*

Abstract. This study contributes to the robotic mobile fulfillment system (RMFS) as material handling in warehouses due to the lack of evaluation and decision improvement scenarios to improve performance that the prior studies should have addressed. This study developed a simulation model to evaluate and decide the improvement scenario that improved the warehouse's utility and reduced the duration of delays. This study presents a discrete events simulation model to evaluate and decide on a better improvement scenario to increase utility and reduce delay duration. RFMS implementation in an automotive warehouse is an objective case in this study. The results show that adding two levels of shelves and eight pods is the best improvement scenario to be selected. This study can guide warehouse managers in improving their warehouse performance, especially for utility and duration of delay indicators.

Keywords: Robotic Mobile Fulfillment System (RMFS), Automated Guide Vehicle (AGV), Discrete Event Simulation, Pods Inventory

Kurnia Novita Sari (Bandung Institute of Technology), Udjianna Sekteria Pasaribu (Bandung Institute of Technology), Utriweni Mukhaiyar (Bandung Institute of Technology), Adilan Widyawan Mahdiyasa (Bandung Institute of Technology), Devi Nandita Choesin (Bandung Institute of Technology) and Fauzi Al'Muzakki (Bandung Institute of Technology). *PREDICTION OF GROUNDWATER LEVELS TO MITIGATE THE RISK OF INCREASED CARBON EMISSIONS DUE TO PEATLAND FIRES THROUGH ANISOTROPIC SEMIVARIOGRAM MODELING WITH OUTLIER MODIFICATION.*

Abstract. Indonesia has the largest tropical peatland in the world, about 13,43 million hectares, and 33,5% of it spread over the island of Kalimantan. The peatlands are rich of organic material and play an important role in the global carbon emissions cycle. The carbon tax regulation in Indonesia was enacted to achieve the carbon emission targets outlined in the Paris Agreement regarding the global response to the threat of climate change. The stakeholders must strive toward a green economy in an effort to reduce the carbon emissions. One of the palm oil plantation industries needs to align its activities to reduce carbon emissions by controlling the groundwater level (GWL) variables. A decrease in GWL can increase the risk of drought, which may lead to forest and land fires. This study aims to model GWL using anisotropic semivariogram geostatistical modelling to control GWL. Anisotropic semivariogram modelling considers the the distance and direction between observation locations, allowing the estimation of the impact of groundwater level (GWL) reduction from one palm oil plantation location to another. Often, the GWL data contains outliers, so outlier detection is performed using Moran's I statistical test, followed by a Yeo-Johnson transformation. After that, the estimation of the semivariogram model parameters is carried out using Ordinary Least Squares-Trust Region (OLS-TR). Based on the selected semivariogram model, the GWL values at unobserved locations can be predicted through Ordinary Kriging (OK) interpolation methods. The results indicate that the Yeo-Johnson transformation can reduce the variability of the experimental semivariogram and produce an anisotropic Gaussian semivariogram model. The prediction map of GWL distribution shows the presence of spatial anisotropic effects in the Northeast-Southwest direction.

Keywords: Anisotropic, Ground water level, Outlier, Semivariogram, Transformation Yeo-Johnson

Sina Ehsani (University of Arizona) and Jian Liu (University of Arizona). *From the Depths to the Surface: Navigating Spatial Temporal Data with DeepShallow Network.*

Abstract. Addressing spatial-temporal event series modeling for prediction poses significant challenges due to the intricate dynamics and varying temporal relevance of data points. Traditional time series methods and conventional neural networks often struggle to capture the nuanced interplay between spatial proximity and temporal relevance, particularly in balancing the influence of historical trends with recent events. This limitation has led to suboptimal forecasting in dynamic systems where both long-term patterns and short-term fluctuations are crucial. To address this, we propose the DeepShallow Neural Networks, a novel convolutional neural network architecture designed to process spatial-temporal data with variable depths of analysis based on timestamp.Our approach allows for comprehensive historical understanding while maintaining immediate responsiveness to new information. The DeepShallow Network distinguishes itself through its depth modulation based on temporal context, efficient weight-sharing mechanism, and preservation of spatial information, offering a more nuanced and computationally efficient solution to spatial-temporal forecasting.

Empirical results demonstrate significant improvements in forecasting accuracy compared to the best baseline models, with a 7.27% reduction in Mean Squared Error for urban traffic prediction, a 9.48% improvement in rain precipitation forecasting, and 2.46% for flight-level passenger traffic forecasting, establishing new benchmarks in spatial-temporal event series modeling and highlighting the model's potential impact across various applications requiring reliable long-term and short-term predictions.

Keywords: Artificial Intelligence, Multimodal Neural Networks, Spatial-Temporal Analysis, Model-based Prediction

Simon Dunstall (CSIRO), Canchen Jiang (Monash University), Hao Wang (Monash University), David Smith (CSIRO) and Edward Lam (Monash University). *A scalable approach for delivering grid stability services by way of coordinated electric vehicle charging and discharging.*

Abstract. We propose computational elements of future systems where stationary electric vehicles (EVs) are harnessed for electrical network stability support. An aggregator of EV battery capacity engages EV owners (prosumers) and interacts of their behalf in the market for electricity system ancillary services. The aggregator provides prosumers with financial returns based on prosumers' individual period-by-period decisions on electricity contingency market participation. We directly consider prediction uncertainty and chance events, the need for rapid combinatorial decision-making over large networks of independent prosumer agents, and the protection of prosumers' privacy and confidentiality. In our proposed approach, stochastic control policies are developed ahead-of-time using dynamic programming for each prosumer individually, and are tailored to their relevant electrical system capacities and behavioural patterns. The price-dependent market participation decisions are then extracted from each prosumer's control policies and communicated to the aggregator. The aggregator uses this information to form aggregate bids into the ancillary services market. In the case that a network contingency occurs and the market operator calls upon the aggregator's offer, the aggregator then obliges the prosumers to act in accordance with their control policies, and either import or export energy principally via EV battery charge or discharge. We show that this approach provides for a computationally scalable, equitable and privacy-aware approach for coordinating EV battery operations across electricity networks.

Keywords: electrical network stability, electric vehicles, optimization, privacy-preservation

Jaganath Mohanty (National Institute of Technology Rourkela India) and Ram Mohanty (DK Int Pty Ltd). *SMARAN: Integrating In-Memory Techniques for Secure and Efficient Genomic Data Processing in Constrained Devices.*

Abstract. In this paper, the open research challenge of developing a secure, scalable, economical, and compact system for DNA alignment is addressed. We present SMARAN, a novel methodology that utilizes limited memory devices in a distributed computing environment to perform genome analysis. SMARAN employs an innovative security protocol specifically tailored for genetic data, integrating end-to-end encryption and secure multi-party computation to ensure data integrity and privacy. Our approach optimizes memory usage through the parallel processing of paired-end read datasets, achieving substantial improvements in computational efficiency. Extensive evaluations on a standard benchmark dataset demonstrate that SMARAN achieves 44% energy efficiency over a 32-core Xeon system, while maintaining comparable accuracy and achieving a five-fold increase in cost efficiency.

Keywords: genetic computation, genetic security, embedded system, ARM, energy efficient system

U. S. Pasaribu (Institut Teknologi Bandung), N. A. Sari (Institut Teknologi Bandung), N. F. Sa'Idah (Institut Teknologi Bandung) and S. B. Harmadi (Institut Teknologi Sepuluh November). *OPTIMIZING CORRESPONDENCE ANALYSIS WITH SINGULAR VALUE DECOMPOSITION: A STUNTING DATA CASE STUDY.*

Abstract. Correspondence Analysis (CA) is a statistical technique used to map relationships between qualitative variables. It visualizes data in a low-dimensional space, enabling the interpretation of complex relationships. This study addresses the challenge of visualizing contingency tables with more than three categories using Singular Value Decomposition (SVD) for dimensionality reduction. We apply this approach to stunting data collected by the Indonesian Population Coalition in 2023, focusing on variables such as the district of residence, fever management methods, educational level of caregivers, and sources of information on stunting. The analysis reveals significant associations among these variables, providing insights that could inform public health strategies. This work underscores the utility of CA and SVD in handling high-dimensional qualitative data, particularly in health-related studies.

Keywords: Correspondence Analysis, Singular Value Decomposition, Stunting, Dimensionality Reduction, Public Health

Haruka Ohba (Juntendo University), Shingo Sadakuni (Kanagawa Institute of Technology), Takashi Matsuda (Shizuoka Institute of Science and Technology) and Shinya Mizuno (Juntendo University). *Constructing Ergodic Networks using Discrete Markov Chains.*

Abstract. In a region's tourism strategy, connecting famous locations to surrounding areas can stimulate activity throughout the region. Connections between locations can be established by identifying the central locations in the area and creating routes from them to other locations. This study proposes an algorithm to obtain ergodicity in discrete Markov chains by utilizing network centrality measures. The number of calculations to obtain ergodicity was compared using several definitions of network centrality, enabling the selection of an appropriate network centrality measure for the target network. The proposed method identifies the central locations within the network and determines the necessary adjustments to transition probabilities between locations to achieve ergodicity. If the location network holds ergodicity, a stationary distribution of the Markov chain exists and optimization applications are expected. Numerical calculations were used to demonstrate the method's applicability to various networks. Furthermore, using a Wi-Fi log, we observed that the proposed method can reconstruct a network with ergodicity for networks that use access points as locations, indicating the social applicability of the proposed method. The proposed method can be used to analyze various networks in modern society, such as facility operations and tourism stimulation. In facility operations, this method can be applied to manage human traffic and analyze stay duration. To promote tourism, by considering tourist sites as network locations, the method clarifies which routes should be prioritized to construct an uninterrupted tourist network, making the construction and operation of an extensive tourist network possible.

Keywords: Discrete Markov chains, ergodicity, equivalence class, network centrality

Ming-Shun Tsai (National Tsing Hua University, Hsinchu, Taiwan), Che-Wei Chou (Feng Chia University, Taiwan) and Chen-Fu Chien (National Tsing Hua University, Hsinchu, Taiwan). *AI-BASED OPEN PLATFORM FOR SMART MANUFACTURING: EMPOWERING SMES IN MACHINE TOOL INDUSTRY.*

Abstract. This research addresses the urgent requirement for digital transformation within small and medium-sized enterprises (SMEs) in the Taiwanese machine tool and machining industry. Recognizing the barriers to AI adoption, including high implementation costs and a lack of specialized expertise, this study proposes an AI-based open platform for smart manufacturing. This platform leverages adaptable foundation models with fine-tuning using limited data samples, generated through deep learning, to enable rapid production line changes and provide SMEs with accessible AI solutions. The platform integrates data-driven insights, deep learning algorithms, and other AI technologies to tackle critical challenges in the industry. These include high testing costs, tool-related workpiece damage, challenges in maintaining manufacturing precision, and difficulties in adapting to diverse product demands. This research offers practical AI solutions for SMEs in flexible manufacturing and guides tool machine developers in AI integration, it contributes to the digital transformation of SMEs and bridges gaps in academic literature and industry applications. The study establishes a novel AI-based Open Platform architecture tailored for SMEs, advancing smart manufacturing accessibility and actionable in machine tool industry.

Keywords: AI-Based Open Platform, Smart Manufacturing, Machine Tool industry, Machining Quality, Tool Wear Diagnostic System

Amir Yousefli (School of Global Urban and Social Studies, RMIT University, Melbourne, Australia) and Afshin Jafari (School of Global Urban and Social Studies, RMIT University, Melbourne, Australia). *DATA-DRIVEN INSIGHTS FOR DEVELOPING 20-MINUTE NEIGHBOURHOODS IN MELBOURNE.*

Abstract. Urban growth and liveable neighbourhood initiatives have popularized the 20-minute neighbourhood concept, where residents can meet their daily needs within a short walk or bike ride. Melbourne's 2050 development plan aims to create inclusive, vibrant, and healthy neighbourhoods. There is a challenge to properly identify commonly co-visited destinations and design accessible service complexes within a 20-minute range. This paper analyses trip data from 2012 to 2020 to pinpoint the most frequently visited destinations and the services that must be provided to meet 90% of residents' daily needs. The analysis categorizes destinations into 15 classes and shows that sport facilities, shopping centre, restaurant or café, local shop, retail services, primary school, local park, community services, secondary school, and health services are the most visited. Using association rule mining and graph hierarchy clustering, the most interconnected destinations are identified, and based on these insights, some strategies are suggested to transform existing neighbourhoods into 20-minute neighbourhoods.

Keywords: 20-minute neighbourhood, data analysis, co-visited destinations

Utriweni Mukhaiyar (Institut Teknologi Bandung), Panji Adhipura (Institut Teknologi Bandung), Sri Winarni (Institut Teknologi Bandung), Muhammad Luthfi Wijaya (Institut Teknologi Bandung), Kurnia Novita Sari (Institut Teknologi Bandung), Udjianna Sekteria Pasaribu (Institut Teknologi Bandung), Sapto Wahyu Indratno (Institut Teknologi Bandung) and Lucky Cahya Wanditra (Institut Teknologi Bandung). *FORECASTING OF THE HEAVY EQUIPMENT MARKET DEMAND THROUGH TRANSFER FUNCTION MODEL WITH MULTI INPUT VARIABLES OF COMMODITY PRICES.*

Abstract. The trend of 20T Class heavy Equipment in Indonesia was fluctuates. Nowadays, the demand has increased sharply since 2003 and reached the highest level in 2011. Then, the market demand declined up to the lowest level in 2015 and continuing in 2019. The fluctuation on the total market demand was not only depend on time, but also triggered by commodity prices especially coal price, world crude oil prices (WTI), CPO price and Indonesia's Inflation Level which has stronger correlation to 20T Class heavy equipment demand. Indonesian market has faced challenging situation since the market change was dynamic. This research propose to forecast 20T Class heavy equipment market demand with ARIMA using transfer function model. This model will be compared with ARIMA. The difference between the two methods is that the transfer function model method considers other input variables besides time, while ARIMA only considers time in forecasting. The results obtained are the ARIMA(1,2,1) model using a multi-input transfer function model with a MAPE value of 15.05%, ARIMA model (1,2,1) using a multi-input transfer function model with standardized data with a MAPE value of 19.41%, and the ARIMA(1, 2, 1) model with a MAPE of 34.3%. The conclusion drawn is that the multi input transfer function model provides more accurate forecasting than the ARIMA(1, 2, 1) model .

Keywords: heavy equipment market, transfer function, ARIMA model, multi input variables, forecasting

Avila Patil (Dr Vishwanath Karad World Peace University (MITWPU), Pune) and Vandana Jagtap (Dr Vishwanath Karad World Peace University (MITWPU), Pune). *Enhancing Urban Road Safety:Pothole Detection Using YOLOv8.*

Abstract. Potholes are a major safety concern on roads as they often lead to accidents. Identifying them promptly is vital in preventing accidents. This research focuses on potholes that are very evident during the rainy season because These road defects pose great difficulties for drivers. This study presents the creation of an automatic pothole segmentation model for real time road damage assessment. Potholes have severe safety implications and infrastructure problems, which indicate a need for effective monitoring and maintenance strategies. A YOLOv8based segmentation model was trained using computer vision and machine learning techniques with a curated dataset of road images. Then, we fine-tuned this model through transfer learning while evaluating its performance using various metrics to detect and segment potholes accurately. After that, we integrated the model into a real time video processing pipeline which is combined with road monitoring systems so as to continuously assess the state of roads. Finally, we discuss deployment architecture, real time performance evaluation, use cases as well as future research directions towards automated pothole segmentation's potential in enhancing road safety and infrastructure management.

Keywords: deep learning, potholes, road safety, yolo algorithm, object detection, convolutional neural networks, real-time detection, yolov8

Alaa Selim (University of New South Wales), Huadong Mo (University of New South Wales), Hemanshu Pota (University of New South Wales), Chaojie Li (University of New South Wales), Jingxuan Zhou (Chuzhou university), Daoyi Dong (Australian National University) and Xiaoyu Liu (Guanghua School of Management). *State of Health Estimation of Lithium Batteries through Vision Transformer Analysis of Electrochemical Impedance Spectroscopy.*

Abstract. The rapid advancement and widespread deployment of energy storage systems, particularly lithium-ion batteries, underscore the necessity for precise and reliable state of health (SOH) estimation techniques. This paper develops a novel approach to battery SOH estimation by leveraging Vision Transformers (ViTs), a class of transformer models excelling in handling visual data, in analyzing Electrochemical Impedance Spectroscopy (EIS) data. Unlike traditional methods that rely heavily on handcrafted features or classical impedance models, our methodology treats EIS Nyquist plots as images and utilizes ViTs for direct SOH classification. We use a comprehensive real dataset comprising thousands of Nyquist plots, labeled with their corresponding SOH and augmented through various colormap transformations to enhance ViT robustness. Our experiments demonstrate that ViTs can capture subtle, yet critical, impedance characteristics indicative of battery health, achieving superior classification accuracy compared to conventional machine learning techniques.

Keywords: Vision Transformers, State of Health Estimation, Lithium Batteries, Electrochemical Impedance Spectroscopy, Image-based Data Analysis, Battery Diagnostics

Micael Gonçalves (ALGORITMI Centre, Department of Production and Systems, School of Engineering, University of Minho, Guimarães, Portugal), Paulo Martins (ALGORITMI Centre, Department of Production and Systems, School of Engineering, University of Minho, Guimarães, Portugal) and Guilherme Pereira (ALGORITMI Centre, Department of Production and Systems, School of Engineering, University of Minho, Guimarães, Portugal). *ELEMENT TYPES AND PROPERTIES TO REPRESENT TRANSPORT AND MATERIAL HANDLING SYSTEMS IN MANUFACTURING SYSTEMS.*

Abstract. Industry 4.0 aims for a stage of full integration and synchronization between all entities in manufacturing systems. Everything is being digitalized at an incredible speed and Transport and Material Handling Systems (TMHS) take a critical role in implementing more efficient processes because they can interact with several entities of a manufacturing system. The representation of TMHS is challenging because they can have different element types, characteristics and behaviors. This paper presents a representation language to be applied by users of each organization to represent each element of the TMHS – in a simple, easy and quick way. Three main element types are identified in the model – namely, the objects transported, the workstations in a manufacturing system and transport and handling equipment (devices) in a TMHS. Each element type includes a set of properties to be easily identified by users of each organization to represent the TMHS. The representation language also includes a graphic representation for each element of the TMHS to create a clear and objective language, and standardize the communication between different users of the model – reducing the effort required to learn and apply the model.

The main findings of the representation language proposed in this paper, when compared with traditional approaches in the literature, are: it can be effectively applied to represent the TMHS of several organizations and industry types; and the capability to provide more and better information that represents physical or behavioral properties of the TMHS. This is particularly important to satisfy the requirements of Industry 4.0 and Smart Factories and to develop, in the future, a set of processes capable of controlling and integrating transport and handling activities in manufacturing systems.

Keywords: Industry 4.0, manufacturing, logistics, transport and material handling systems

Seraj Y. Abed (King Abdul Aziz University) and Maher M. Othman (King Abdul Aziz University). *SERVICE SECTOR PRODUCTIVITY CHALLENGES AND MEASUREMENTS.*

Abstract. In today's economies, the service sector is essential because it includes many businesses, government and social firms that serve wide spectrum of customers both individuals and organizations. Because, services are intangible and involve complicated relationships, increasing their productivity can be very challenging. This paper emphasizes the importance of productivity in the service sector for the welfare of customers, labor, businesses, societies and the whole economy. Labor efficiency, innovation and technology impact, global competitiveness, and the importance of policies are key factors that support sustainable development and productivity. A definition of service productivity based on capacity utilization, service quality, and resource transformation is presented. The study investigates some factors including market competition, organizational culture, technology, human capital, and regulations as it is necessary to comprehend these components to develop productivity-boosting strategies. This paper highlights the methodical difficulties regarding the assessment of service productivity, such as data reliability, variability, quality adjustment, output and input measurement. It compares several measuring techniques, including benchmarking, data envelope analysis (DEA), and total factor productivity (TFP) that are commonly used to measure service sector productivity. The purpose of this paper is to support the development of strategies for increased productivity and sustainable economic growth by providing a thorough exploration of the complexities, theoretical foundations, and measurement techniques of the service sector. This paper makes a valuable contribution to the ongoing discourse on productivity in the service sector.

Keywords: Service Sector, Productivity, Operational Excellence, customer-satisfaction, Growth

Jeffrey Kelly (Industrial Algorithms) and Brenno Menezes (Hamad Bin Khalifa University). *SURROGATE SELECTION REGRESSION IN THE DOW DATA CHALLENGE PROBLEM FOR SOFT SENSOR DEVELOPMENT.*

Abstract. Surrogate (or subset) selection regression (SSR) for soft sensor development of dependent variables (DVs) to be tracked (inferred, monitored, predicted, etc.) is an effective multi-input-single-output (MISO) sparse regression technique that employs a brute-force variable subset selection (BFVSS) search in the independent variable (IV) space. The proposed SSR requires data sets of the IVs, Xs, or inputs and of the DV, ys, or output split in training data (X1, y1) and the testing data (X2, y2). In the SSR method, the number of selections is determined via a discrete binary randomization technique, whereby the inputs are (a) a random number that lies between 0 and 1, rounded to 0 or 1 to determine the subset selection, and (b) the total number of IVs or Xs to be included into the subset or surrogate model. SSR first computes the model's parameters or coefficients based on a randomized combination of the coefficient setups of Xs from the training data and solves the normal equations via Cholesky factorization. Then second, predicts the output error for the testing data and chooses the best prediction over the number of selections which exhibits the smallest Q2 or the R2 but for the testing data with the coefficients derived from the training data. R2 is a measure of model fit to the original data, and Q2 provides an internal measure of consistency between the original and cross-validation predicted data. The proposed SSR method is applied to the Dow Data Challenge Problem (DDCP) which is a soft sensor regression application predicting the impurity of a product stream against some unknown subset of forty-plus process input variables which are highly mutually correlated. SSR finds the best Q2 as 0.740 with eight process inputs solving in-parallel taking ~5-minutes which is better than the best-known in literature Q2 value of 0.698.

Keywords: Surrogate modeling, Subset selection, Randomized brute-force, Grid search

Adilan Widyawan Mahdiyasa (Bandung Institute of Technology), Udjianna Sekteria Pasaribu (Bandung Institute of Technology) and Kurnia Novita Sari (Bandung Institute of Technology). *ANALYSIS OF RECOVERY TIME HAZARD RATE FOR FEVER PATIENTS IN SOCIAL SECURITY AGENCY ON HEALTH (BPJS KESEHATAN) USING COX MODEL.*

Abstract. This study aims to analyze the hazard rate of recovery time for Social Security Agency on Health (BPJS Kesehatan) patients suffering from fever using the Cox model with various baseline hazards: exponential, gamma, Weibull, and lognormal. The data used includes health information of BPJS patients diagnosed with fever. The covariates examined in this study are age, gender, and province of residence. The semiparametric Cox model is applied to evaluate the influence of these variables on the recovery time of patients. This research is expected to provide a deeper understanding of the factors affecting the recovery of fever patients. Additionally, the analysis provided in this study offer valuable insights for the development of more effective and efficient health strategies within the BPJS program.

Keywords: Hazard rate, Cox model, Health strategies, Unspecified fever

Vikram Gupta (Indian Institute of Technology Kharagpur west bengal). *MULTI OBJECTIVE OPTIMIZATION OF L-PBF GEAR ADDITIVE MANUFACTURING PROCESS PARAMETERS BASED ON PLACKETT- BURMAN DESIGN AND NSGA-II.*

Abstract. Optimizing process parameters to improve quality and efficiency continues to be a problem in the recent progress of metal additive manufacturing. This study presents a new method for simulating the thermal-mechanical behavior of a nickel-based alloy (IN718) spur gear in laser powder bed fusion (L-PBF). This study examines eight process parameters as input variables to optimize residual stress, temperature, and deformation. The initial Plackett-Burman design of the experiment was utilized to screen the significant variables that impact the residual stress and deformation parameters of L-PBF gear. The chosen variables had response rates of 99.50%, 97.56%, and 96.06% for Y1, Y2, and Y3, respectively. The investigation indicates that the gear quality was enhanced by factors such as laser power, layer thickness, scan speed, and orientation angle. Next The optimization process parameters were obtained using the NSGA-II (non-dominated sorting genetic algorithm-II) optimization techniques. The Pareto front demonstrated an optimal balance by achieving a reduction of up to 50.12% in residual stress, as well as over 50% in deformations and temperature. This emphasizes the significance of optimizing and selecting the appropriate parameters in the L-PBF gear manufacturing process. The results illustrate the efficacy of combining DOE with optimization algorithms for optimizing process parameters in L-PBF, with potential implications for enhancing manufacturing processes.

Keywords: Additive Manufacturing, Laser Powder Bed Fusion, Finite Element Simulation, NSGAII, Spur Gear

Lin Lin (School of Civil Engineering, University of Sydney), Orlando Rivera Letelier (Alicanto Labs), Xinyu Wang (School of Civil Engineering, University of Sydney), Robin Sandell (Sandell Consulting) and Andrés Fielbaum (School of Civil Engineering, University of Sydney). *Timetabling an electric ferry public transport system through an ILP.*

Abstract. Electrifying public transportation will be a future goal under the requirement of sustainable development. This study models how to determine timetables, vessel itineraries, and wharf utilisation for a public transport ferry system for electrification, using the real Sydney system as a case study. Operational barriers to using battery electric vessels are greater than electric buses because of the energy intensity of ferries. The need for frequent charging affects vessel and wharf capacity and creates difficult challenges for timetable scheduling. The primary research question is how to optimise timetables while maintaining current passenger habits (such as existing routes and clockface departure times) and optimising vessel tasks and berth utilisation as much as possible. The model's external data include the network details, route information, and vessel details. Based on those, this study develops an Integer Linear Programming (ILP) model focusing on operational constraints. The core objective is determining the timetable of every line, and the daily itinerary of every vessel within the predefined constraints. The optimisation goal is to minimise fleet size and reduce unnecessary vessel movements to lower operational costs.

The research is divided into two phases. The first phase focuses on the basic model, which includes current ferry tasks, to confirm the feasibility of applying the ILP method to timetabling. The second phase focuses on the advanced model, which adds charging and crew break tasks and their related constraints to the basic model. This phase aims to find the optimal solution for the electrified vessel system and provide insights into public transport operations, such as vessel allocation or quantity adjustments, schedule changes, and the feasibility of charging stations.

The study shows that the model is feasible, with optimised ferry timetables, vessel itineraries, and wharf utilisation. The ILP method can effectively capture this complex problem through mathematical expressions for the constraints. The current results are for the basic model and are limited to a 6-hour model. Since computational times can become too long, some complementary heuristics are needed to extend towards the full day and the advanced model. This case study suggests that using ILP for public ferry systems might be a competitive way to optimise timetabling when electrification requires additional charging tasks. However, the model's complexity and the long runtime might pose significant challenges to the ILP method.

Keywords: Public transport, Integer Linear Programming, Ferries, Electrification, Timetabling, Scheduling

Zhongyuan Li (Texas A&M University, College Station, Texas, USA) and Hamid Parsaei (Texas A&M University, College Station, Texas, USA). *TPT-LAKE: A Business-Driven Data Infrastructure for Digital Transformation In Industry 4.0.*

Abstract. Industry 4.0 integrates physical and data technologies such as the Internet of Things, Artificial Intelligence, and big data analytics, transforming manufacturing and service industries. At the heart of Industry 4.0 lies digital transformation, which integrates data technologies across businesses, enabling insights into manufacturing processes, identifying areas for improvement, and optimizing operations and services. A significant challenge in digital transformation is determining leadership for the transformation and managing digital assets effectively. Organizations may acquire SaaS (Software as a Service) digital or data products or develop their solutions. However, maintaining control over digital assets during transformation can be daunting. Digital products, resembling black boxes, are user-friendly but complex to control and understand. This opacity in production development and unfamiliarity with data technologies often causes organizations to hesitate in making digital transformation decisions. This paper proposes a solution that divides digital/data product development into distinct engineering and business logic components. This approach allows business operators with domain knowledge and specific requirements to participate in the development alongside engineers actively. Doing so gives them a comprehensive understanding and control over their digital assets. This solution encompasses three distinct application levels - Logic Tagging, Logic Parsing, and Logic Translating - forming a robust, business-driven data infrastructure known as TPT-Lake. With this framework, business operators assume full control over business logic and requirements, while engineers focus exclusively on developing easily extendable, upgradable, or replaceable products. This approach empowers business operators to spearhead digital transformation initiatives by minimizing dependencies on data technology and engineering efforts. A qualitative performance evaluation compares the proposed solution with existing mainstream methods. The evaluation demonstrates that our solution excels in time, cost, and scope. Moreover, it proves adaptable to various use cases within the realm of building data infrastructure during digital transformation processes.

Keywords: Industry 4.0, Digital Transformation, Data Engineering, Big Data

Xingren Pan (Edith Cowan University), Ferry Jie (Edith Cowan Univerisity), Leisa Armstrong (Edith Cowan Univerisity) and David Cook (Edith Cowan Univerisity). *SEKansformer: Effective Tomato Classification with Kansformer Backbone and SENet Channel Attention Mechanism.*

Abstract. Tomatoes are one of the most widely cultivated and consumed vegetables globally and ranked No.3 in terms of production value of vegetables in Australia in financial year 2023. AI-driven systems can analyse large volumes of tomatoes quickly and consistently, evaluating parameters like colour, size, shape, and surface defects with greater accuracy and objectivity than human inspectors. This study presents SEKansformer, an innovative architecture that integrates SENet (Squeeze-and-Excitation Networks), KAN (Kolmogorov Arnold Network), and ViT (Vision Transformer) to enhance the classification of tomato images, specifically distinguishing between healthy and rejected tomatoes. We evaluated SEKansformer on a publicly available tomato dataset. Our experimental results demonstrate that SEKansformer significantly outperforms traditional convolutional neural network (CNN) models, such as ResNet50, VGG16, and AlexNet, as well as the standard ViT model. SEKansformer achieved highest performance in different evaluation metrics, such as accuracy, precision, recall, and F1 score, and exhibited the lowest training loss, highlighting its superior performance in this classification task.

Keywords: Kansformer, Vision Transformer, KAN, SENet, Tomato Detection

Zijue Chen (CSIRO), Dayalan Gunasegaram (CSIRO) and Heng Wang (CSIRO Data61). *Orientation-Invariant Melt Pool Feature Extraction via Unsupervised Machine Learning for Metal Additive Manufacturing.*

Abstract. Metal additive manufacturing (MAM) is a novel process that fabricates parts layer by layer, revolutionising how products are designed and produced. This innovative technique enables the creation of complex and optimised geometries that are challenging or impossible to achieve with traditional manufacturing methods. MAM offers several benefits, including reducing assembly weight through part consolidation, minimising material waste, and allowing for intricate designs tailored to specific applications. These unique advantages hold significant promise for industries such as biomedical, aerospace, space exploration, and defence, where customisation and/or weight savings are critical requirements. As a result, significant research efforts are being focused on enhancing the various processes within the MAM umbrella.

MAM encompasses several techniques, one of which is Directed Energy Deposition (DED). DED is distinguished by its process of feeding material—either powder or wire—onto a substrate to create new layers. During this process, both the feed material and the substrate are melted by a heat source, allowing them to bond before the melt pool solidifies into a new layer. Like all MAM processes, DED presents challenges in identifying optimal processing windows due to the numerous and often interacting tuneable parameters. Additionally, even when a process is carefully optimised, the dynamic nature of MAM can lead to unexpected variations. To address these challenges, researchers have developed closed-loop control (CLC) schemes to ensure consistent part quality.

Most CLC schemes in DED focus on identifying specific process signatures that serve as the bridge between tuneable parameters and the quality of the final product. By monitoring these signatures, the process can be adjusted in real-time, ensuring that the final parts meet the desired specifications. Melt pool behaviour is commonly used as a reference for process parameter adjustment in DED. However, current strategies have some drawbacks that can be improved. Traditional CLC algorithms often use only melt pool size and/or maximum temperature extracted from monitoring images to adjust parameters. In doing so, these methods ignore many useful details available in the melt pool image. To address this, some researchers have introduced machine learning-based process algorithms. These perform pre-processing, such as classification, on melt pool images and use these classification results for control. However, these methods require manual labelling, which is time-consuming and introduces human bias.

Two important challenges must be solved to enable the use of the original melt pool image in a control strategy. Firstly, an undesirable degree of latency must not be introduced. Secondly, since the melt pool shape depends on the scanning direction, the image processing algorithm must convert these orientation-dependent features into orientation-invariant references to serve as the basis for the control strategy. To address these challenges, this work proposes an unsupervised machine learning-based process method that:

- Utilises a small model with low computational demands, suitable for deployment on edge computing devices.
- Quickly extracts features and compresses the original image to a size that supports real-time communication.
- Ensures that the extracted features accurately reflect the original image content while achieving orientation invariance.
- Eliminates the need for manual labelling.

The value of the method will be demonstrated using melt-pool images obtained from DED experiments. This melt pool feature extraction approach is universally applicable for real-time monitoring, defect detection, quality control, and process control strategies in laser melting metal additive manufacturing processes.

Keywords: Metal Additive Manufacturing, Melt Pool Monitoring, Unsupervised Machine Learning, Directed Energy Deposition (DED)

Drew Mitchell (Monash University), Andreas Ernst (Monash University), Pierre Le Bodic (Monash University) and Simon Dunstall (CSIRO). *Approximation and aggregation schemes for accelerating Benders decomposition of power grid expansion planning.*

Abstract. Power grid expansion planning, at a transmission network scale, aims to find the least cost investment in candidate assets of various types: transmission lines; thermal and renewable generation; and storage, such that forecasted demand is satisfied. Integer variables are required to represent the build status of these assets, which must then operate under power flow constraints. This creates a complex mixed integer linear program (MILP) which is often prohibitively slow to solve. Benders decomposition can be used to separate this MILP into a master problem which makes investment decisions, and a subproblem that evaluates the operational cost of the power flow under these decisions. This subproblem is easier to solve than the monolithic MILP and informs the master of the effectiveness of a build solution via an optimality cut in each iteration. However, since the subproblem considers renewable and storage assets, a corresponding time series for renewable source variability and storage level tracking must be incorporated. This greatly increases the size and complexity of the subproblem which must calculate power flow in each time-period over the entire horizon. Considerable reduction in computation time has been achieved by partitioning the single subproblem into smaller, independent, approximate problems that can be solved quickly to generate slightly weaker Benders cuts much faster. These cuts narrow the search space before the larger problem is solved to generate accurate solutions. We further explore approximation schemes for cheap lower-bound cuts by considering network aggregation, asset type aggregation and minimum representative problems. These simplified problems can, in cases, be added directly to the master, acting as a warm start procedure to potentially cut poor solutions from the search space.

Keywords: Benders decomposition (BD), Generation storage and transmission expansion planning (GSTEP), Mixed-integer linear programming (MILP)

Yogesh Kumar Singh (INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR), Gourab Kumar Bagchi (INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR) and Jhareswar Maiti (INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR). *EXPLORING THE CAUSAL FACTORS OF SEDENTARY LIFESTYLE AMONG PROFESSIONAL WORK ENVIRONMENTS: THE ROLE AND POTENTIAL OF VIRTUAL REALITY INTERVENTIONS.*

Abstract. Prolonged periods of physical inactivity associated with sedentary lifestyles have emerged as a major global public health concern, increasing the prevalence of chronic illnesses like obesity, cardiovascular diseases, diabetes, and mental health issues, and several other illnesses. The objective of this study is to investigate the various elements that contribute to sedentary behaviour and assess the possibility of Virtual Reality (VR) applications as a novel approach to intervention. The study starts with a thorough literature analysis to determine and examine the social, psychological, and environmental factors that influence sedentary behaviour. Critical examination is given to elements including the work environment, urban planning, socioeconomic position, and psychological impediments like low self-efficacy and motivation. After the assessment of the literature, surveys and observational studies are used to gather empirical data in order to provide a thorough understanding of these causal relationships. Simultaneously, the study explores how VR applications can help reduce sedentary behaviour. With its immersive and interactive qualities, virtual reality technology presents special chances to get consumers moving by crafting entertaining and captivating virtual worlds. The study also examines the psychological mechanisms employed by virtual reality (VR) to enhance motivation, improve compliance with fitness routines, and overcome common barriers to physical activity. Virtual reality (VR) has the potential to be a powerful tool for health promotion because of its capacity to set realistic goals, foster social ties within virtual space, and provide fast feedback. But the study also points up problems, like user acceptability, accessibility, and the requirement for customised interventions to satisfy a range of user needs.

Keywords: Sedentary Lifestyle, Virtual Reality, Workplace Behavioral Intervention, Health Promotion

Biswajit Kar (Indian Institute of Technology Kharagpur) and Mamata Jenamani (Indian Institute of Technology Kharagpur). *Identification of Prioritized Optimal Vaccine Distribution Hub using Regional Infection and Comorbidity Status.*

Abstract. Our study addresses the critical need for effective vaccine distribution strategies in the face of a contagious virus outbreak causing Healthcare Emergencies. We propose a two-phase approach that integrates infection patterns and disease data to optimize facility locations for vaccine storage and distribution. We developed the Health Emergency Susceptibility Index (HESI) in Phase I. This index captures information about the infection pattern for the first few days and the regional comorbidity status that makes the infected people vulnerable to such virus attacks. This index is then used in an integrated Integer Programming model to prioritize facility locations by minimizing weighted distances in Phase II. The model, applied to the case of India, considers factors such as storage capacity, transportation distances (including air and ground options), costs, and vehicle capacity. Our findings reveal that using the HESI-based weighting schemes leads to the most cost-effective distribution strategy, ensuring comprehensive coverage of all vulnerable regions in India. The combined approach optimises facility locations and enhances responsiveness to regional vulnerabilities during health emergencies.

Keywords: Vaccine Distribution, Facility Location, Healthcare, Prioritized Facility

Swastik Sambhav (Indian Institute of Technology Kharagpur), Jhareswar Maiti (Indian Institute of Technology Kharagpur) and Suraj Gupta (Indian Institute of Technology Kharagpur). *INDEPENDENT HETEROGENEOUS SENSOR DATA FUSION FOR FAULT DETECTION AND DIAGNOSIS IN BEARINGS.*

Abstract. Rolling-element bearing is one of the most integral components of modern industrial machinery. Effective fault detection and diagnosis in these bearings are therefore vital for minimizing downtime and maintaining performance. This study introduces a new methodology for fault detection and diagnosis that complements traditional vibrational analysis by leveraging unsupervised machine learning techniques on independent feature-level fusion of heterogeneous multi-sensor data. Initially, features are extracted from multi-sensor vibration and temperature data across time, frequency, and time-frequency domains. Independent multi-sensor feature-level fusion is performed using sparse autoencoders (SAEs), for both vibrational and temperature information. Additionally, Normal and faulty states were identified using a one-class ν-SVM. The fused feature vectors of vibrational data and temperature signals, regarded as the fault indicators obtained only from normal working state are used to train an Adaptive Residual Convolution Neural Network (AR-CNN) for bearing fault detection and diagnosis. The proposed model was evaluated in the IEEE PHM 2012 Data Challenge. The results demonstrate that combining information from various sources and domains offers a more comprehensive and accurate assessment, thereby improving fault detection and diagnosis compared to traditional methods.

Keywords: Fault detection and diagnosis, Multi-sensor Fusion, Heterogeneous data, Adaptive Residual Convolution Neural Network

Thoravi Pise (Indian Institute of Technology, Kharagpur), Jhareswar Maiti (Indian Institute of Technology, Kharagpur) and Suraj Gupta (Indian Institute of Technology, Kharagpur). *Bayesian Deep Learning and Fusion Techniques for Bearing Fault Detection and Diagnosis.*

Abstract. Accurate fault detection in rotating machinery is crucial for preventing unexpected failures, and minimising operational costs. The proposed methodology leverages advanced multi-sensor data fusion techniques to improve the reliability and precision of fault diagnosis. By strategically placing multiple accelerometers on machinery, diverse vibration signals are captured, creating a comprehensive dataset for identifying potential faults. To overcome inconsistencies due to sensor placement and environmental factors, a novel feature fusion method is introduced, integrating both time-domain and frequency-domain features. These features are processed using a neural network fusion architecture, significantly enhancing fault detection accuracy. The fused feature vectors are used as machine health indicators and are analyzed with Bayesian deep learning for precise fault classification. The proposed approach is validated using NASA's publicly available benchmark dataset. Stratified sampling is employed to ensure robustness and avoid biases in model evaluation. The proposed method enhances the reliability of fault diagnosis, offering probabilistic insights that support more informed maintenance decisions. The results produced are on par with existing models, demonstrating the effectiveness of this approach.

Keywords: Fault Detection, Fault Diagnosis, Feature Fusion, Stratified Sampling, Bayesian Deep Learning

Umesh Kumar (Indian Institute of Technology, Kharagpur, West Bengal, India) and Haimanti Banerji (Indian Institute of Technology, Kharagpur, West Bengal, India). *MEASURING ACCESSIBILITY IN URBAN EDUCATIONAL SETTINGS: CRAFTING OF AN ACCESSIBILITY ASSESSMENT SCORING METHODOLOGY ALONG WITH ACCESSIBILITY RATING SYSTEM.*

Abstract. India's rapid urbanization presents significant challenges and opportunities in designing environments that enhance safety, health, and well-being. For equitable services and societal resilience, it's crucial to integrate ergonomics into built infrastructure design. The lack of accessible infrastructure in educational settings impedes the participation of students with disabilities, exacerbating social inequality. Addressing this issue is critical for advancing India's Sustainable Development Goals and ensuring equitable access to quality education. This paper develops an Accessibility Assessment Scoring Methodology (AASM) and Rating Scale tailored for urban educational settings, focusing on human factors engineering and ergonomics. By integrating qualitative and quantitative approaches, the AASM evaluates multiple dimensions of accessibility—ranging from physical infrastructure to digital resources and instructional practices. The methodology includes a detailed audit checklist (consisting 290 criteria across seven major categories), scoring metrics, and a rating system designed to provide actionable insights and drive improvements in accessibility. Applied to two senior secondary schools in Delhi, the methodology revealed significant gaps in accessibility, highlighting the need for enhanced infrastructure and support systems. This framework aligns with the principles of smart, sustainable, and resilient systems by promoting inclusive design and contributing to broader societal resilience. The paper underscores the importance of ergonomics in built-environment to enhance the comfort and functionality of educational spaces, ensuring that all users, including those with disabilities, can fully engage in the learning environment.

Keywords: Ergonomic in Architecture, Accessibility Assessment, Educational Infrastructure, Disability Inclusion, Scoring Methodology

Abhinav Katiyar (INDIAN INSTITUTE OF MANAGEMENT MUMBAI) and Vidyadhar Gedam (INDIAN INSTITUTE OF MANAGEMENT MUMBAI). *SUSTAINABLE SUPPLY CHAIN IN FERTILIZER INDUSTRIES.*

Abstract. Introduction

As a key supplier of nitrogen fertilizer, which is necessary to increase crop production, the urea manufacturing sector is significant to world agriculture. Notwithstanding, the sector has noteworthy obstacles concerning sustainability, such as elevated energy usage, noteworthy emissions of greenhouse gases, and the exhaustion of natural reserves. The need for sustainable supply chain procedures in the urea manufacturing sector is growing as the world's attention turns to sustainability. The notion of a sustainable supply chain in the urea manufacturing sector is examined in this extended abstract, which covers important topics including resource efficiency, waste management, environmental impact, and socioeconomic factors.

Background

Natural gas is the main feedstock used in the energy-intensive urea production process. This reliance increases carbon dioxide (CO2) emissions, which exacerbates climate change, in addition to contributing to the loss of non-renewable resources. In addition, the manufacturing of urea raises other environmental issues such soil erosion and water contamination from incorrectly disposed-of industrial wastewater and excessive fertilizer use in farming.

In the urea manufacturing sector, sustainable supply chain management (SSCM) entails incorporating social, environmental, and economic factors throughout the entire supply chain, from the procurement of raw materials to the ultimate distribution of urea. The objective is to preserve economic viability while reducing the environmental impact, improving resource efficiency, and advancing social equality.

Methodology

In order to examine the sustainability of supply chains in the urea manufacturing sector, this study uses a mixed-methods approach. A thorough analysis of the literature, case studies of top urea producers, and expert interviews are all part of the research. The goal of the research is to pinpoint possibilities, obstacles, and best practices for improving sustainability throughout the supply chain. The sustainability of various supply chain models is assessed using key performance indicators (KPIs) that are connected to social responsibility, waste management, resource efficiency, and environmental impact.

Key Findings

1. Resource Efficiency:

o Purchasing of Raw Materials: The transition from fossil fuel-based ammonia to renewable energy-derived green ammonia as a substitute feedstock for urea manufacturing has demonstrated potential to lower greenhouse gas emissions. The study emphasizes how green ammonia might help separate the urea industry's reliance on fossil fuels.

o Energy Efficiency: It has been determined that the use of energy-efficient reactors and process optimization strategies, among other technological advancements, is essential to lowering the energy intensity of urea manufacturing.

2. Waste Management:

o Zero-Waste Initiatives: Reducing waste has been achieved by the application of circular economy concepts, such as recycling CO2 emissions for urea synthesis. The possibility of using byproducts, like ammonia emissions, to produce other chemicals with higher value is also covered in the study.

o Advanced technologies for treating wastewater, such as membrane filtration and biological treatment, are crucial in reducing the water pollution caused by the production of urea.

3. Environmental Impact:

o Reducing Carbon Footprint: One practical method for cutting greenhouse gas emissions is to incorporate carbon capture and storage (CCS) technology into urea plants. The study also looks at how lifecycle assessment, or LCA, is used to examine how various supply chain models affect the environment.

o Sustainable Agriculture Practices: To lessen the negative environmental effects of urea application in farming, precision agriculture should be encouraged and slow-release urea fertilizers should be developed.

4. Socio-Economic Considerations:

o Community Engagement: The study emphasizes how crucial it is to involve local communities in sustainability projects, especially in areas where urea plants employ a large number of people. The social effects of urea manufacture on different stakeholders are evaluated through the investigation of social life cycle assessment (S-LCA) approaches.

o Economic Viability: Analyzed are the financial effects of switching to a sustainable supply chain, such as the price of implementing new technology and the possibility of generating new income streams by valuing waste.

Conclusion

It is essential for the urea manufacturing sector to make the shift to a sustainable supply chain in order to solve the social, economic, and environmental issues related to urea production. This report gives suggestions for improving sustainability, identifies best practices, and does a thorough examination of the sustainability of the urea supply chain as it stands today. The results indicate that even while a great deal has been accomplished, there is still a great deal that can be done, especially when it comes to waste management, resource efficiency, and socioeconomic impact. Stakeholder engagement tactics, circular economy ideas, and the adoption of green technologies will be essential in guiding the sector toward a more sustainable future.

Implications for Future Research

The creation of integrated frameworks that take into account the interactions between environmental, social, and economic issues when evaluating the sustainability of urea supply chains should be the main goal of future study. Furthermore, investigating how digital technologies like blockchain and the Internet of Things (IoT) may improve supply chain traceability and transparency may open up new possibilities for sustainability improvement. To assess the long-term socioeconomic effects of sustainable supply chain projects on regional communities and the world's agriculture industry, more research is also required.

Keywords: fertiliser industries, circular economy, life cycle assessment, sustainable supply chain

Faisal Alkaabneh (American University of Sharjah) and Sam Jotham Sutharson (North Carolina A&T State University). *Vehicle Routing Problem with Synchronization for Mobile Health Clinics.*

Abstract. As an important means of providing medical services in developing countries and remote areas, Mobile Health Clinics (MHCs) focus on distributing medical supplies and providing basic health needs to underserved communities. We model this problem as a vehicle routing problem with multiple synchronization constraints and heterogeneous demand (VRPMSC-HD) and formulate a mixed integer linear programming (MILP). We propose a matheuristic based on adaptive large neighborhood search (ALNS) combined with an intensive local search phase to solve large-scale instances on the model. We assess the advantages and disadvantages of the proposed approach by comparing its solutions with the solutions of the vehicle routing problem with multiple trips (VRP-MT). Interestingly, the proposed approach leads to longer total traveled distance/time when taking into account the routing of the resupply truck and the MHCs. On the other hand, the proposed approach achieves significant reduction in the latest arrival metric leading to faster completion of services and higher utilization of a fleet of MHCs. Lastly, we demonstrate the excellent performance of the proposed ALNS metaheuristic in solving large-scale instances of the model.

Keywords: Vehicle routing problem with multiple synchronization constraints, Mobile health clinics, Humanitarian logistics, Metaheuristic

Juite Wang (National Chung Hsing University). *R&D PARTNER SELECTION USING THE DEEP LEARNING APPROACH.*

Abstract. Effective partner selection is crucial for the success of R&D collaborations, but it often relies on expert judgment, which can restrict choices to familiar entities and overlook potential strategic advantages from unexpected firms. While existing analytical methods using patent data exist, there is a lack of a comprehensive deep learning approach for recommending R&D partnerships. This study addresses this gap by developing a deep learning framework that integrates text analytics, bibliometric analysis, and link prediction based on patent data to recommend potential R&D collaborations between organizations. For text analytics, we employ Augmented Sentence-BERT (Bidirectional Encoder Representations from Transformers), a transformer-based technique, to extract two key metrics from patent textual data: technological similarity and breadth. In bibliometric analysis, we assess patent indicators from four perspectives—technological strength, R&D openness capability, R&D linkage, and collaboration effect. For link prediction, we apply nine measures to evaluate the potential formation of collaborations. Focusing on the self-driving vehicle industry, the study identifies a growing trend in R&D collaborations, with organizations increasingly forming clusters of interconnected partners and exploring a greater number of potential collaborative opportunities. The illustrative examples demonstrate that the recommended candidate partners often align with or resemble past partners from previous periods, enabling organizations to expand their search for potential qualified and reliable partners and strategically shape their R&D collaboration strategies at an early stage.

Keywords: deep learning, network analysis, bibliometric analysis, natural language processing, R&D partner selection, autonomous vehicles

Yifan Xin (UNSW Canberra at ADFA), Ismail Ali (UNSW Canberra at ADFA), Peter Shi (Macquarie University), Daryl Essam (UNSW Canberra at ADFA) and Ripon Chakrabortty (UNSW Canberra at ADFA). *Repetitive Carbon Gaming Under Dynamic Carbon Pricing and Products' Demand.*

Abstract. Under the cap-and-trade mechanism, governments prioritize stabilizing industrial carbon allowances to meet environmental targets and ensure market predictability while manufacturers in the supply chain strive to maximize profits within these constraints. This research introduces a model known as Carbon Gaming, which incorporates repeated game theory and optimization approaches to investigate the strategic trade-offs made by manufacturers and governments as they pursue their respective objectives. The proposed model is formulated as a repeated non-convex Mixed-Integer Quadratically Constrained Programming (MIQCP) problem. Numerical examples validated the proposed model, demonstrating that the settings of carbon taxes and subsidies, along with carbon price uncertainty, significantly influence the decision-making processes of both manufacturers and the government in the game. This research captures multi-period fluctuations in carbon prices and demand under different carbon policies, offering manufacturers insights into adjusting emission-reduction technologies and producing green products while also guiding governments in formulating carbon policies and refining the cap-and-trade mechanism.

Keywords: Supply chain, Cap-and-trade regulation, Carbon policy, Green product, Repeated game theory

Ying Zhang (University of Science and Technology Beijing) and Zhipeng Feng (University of Science and Technology Beijing). *Fault Diagnosis Method of Harmonic Reducers Based on Time-Frequency Decoupled Representation.*

Abstract. Harmonic reducers are often used in robotic arms or aerospace equipment, which typically operate under complex working conditions. The imbalance in operational time across various working conditions leads to sparse or missing data/labels. Decoupling the "working condition" and "fault" information from the original monitoring signals can enhance the amount of data used for model training. Therefore, it is crucial to ensure that the extracted fault features are unaffected by working conditions, meanwhile, preserving the integrity of compressed features to reconstruct the original signal.

To address this problem and objective, a decoupling model is proposed to model the semantic vector of "working conditions," enabling the extraction of condition-independent fault representations, and achieving cross-condition diagnostic tasks. Firstly, the signal is analyzed using WVD (Wigner-Ville Distribution), a time-frequency distribution that balances the resolution in both time and frequency domains. Then, WVD is employed to train a two-stage convolutional residual network to obtain decoupled representations of the vibration signal. In the first stage of training, the representation model compresses the data to obtain the shallow features, which contain pixel-level texture structure features of the training sample set. Then these features are gradually abstracted and compressed in the deeper layers of the model to achieve the desired representation. Then the network reconstructs the input samples based on these features to ensure the completeness of the information carried by the compressed features. In the second stage, swapping features forces the decoder to reconstruct samples with corresponding semantics through different combinations of the two parts of the features with an optimized loss function. By decoupling "working condition" and "fault" information, this method effectively eliminates the influence of working conditions on fault diagnosis. Finally, the features extracted by the decoupled representation model are classified, and fault diagnosis is performed using transfer learning, support vector machines, or clustering matching methods based on different label quantities. This method fully leverages the efficiency and interpretability of the decoupled representation model, enhancing the effectiveness of cross-condition fault diagnosis. The effectiveness of this method is validated on multi-condition and multi-fault experimental data from harmonic reducers, and the results demonstrate that it can effectively decouple "working condition" and "fault" information, achieving high performance for cross-condition fault diagnosis.

Keywords: Time-Frequency Decoupled Representation, Harmonic Reducers, Fault Diagnosis

Yasuhito Fujisawa (Sophia University), Kenta Nakamura (Figurout Co., Ltd), Sen Zhang (Figurout Co., Ltd) and Haruka Yamashita (Sophia University). *BUSINESS MODEL ESTIMATION FOR DISCOVERING BLUE OCEANS.*

Abstract. Today, there is a growing awareness of investment and entrepreneurship in Japan. However, when doing this, it is essential to minimize the risk of failure. One way to do this is to discover blue oceans in the market. A specific way to discover blue oceans is through business models. Analyzing a business model means understanding "to whom," "what," and "how" the business provides value, and by measuring the number of combinations, it is possible to discover areas with few rivals. However, there is no comprehensive dataset that organizes information on the above three for each startup. Also, creating such data manually would require a huge amount of effort. Therefore, this time, we will build an AI model that automates the creation of a dataset containing the business model information mentioned above. Form 10-K, which is submitted to the SEC, is used as an explanatory variable to input the model. This document has a format and is divided into each item, so it is possible to extract uniform data. As specific data, we will use the text data listed in Item 1. BUSINESS in PART 1. This contains information on "how each company is doing business" as recognized by itself, so it is useful data for automating the creation of the business model dataset this time. The output, the objective variable, is composed of three variables: "to whom," "what," and "how," and is prepared by annotating each company. As for the model to be used, this time we trained several models, mainly NLP models, to process text data, and tested each one to find the most suitable one. After discovering the optimal model, we used it to automatically create a dataset for unannotated data, and then graphed this dataset to visually discover blue oceans.

Keywords: Business model, Blue Ocean, Machine Learning, Natural Language Processing

Jun Wang (Beijing Foreign Studies University). *Joint optimization of condition based maintenance and spare inventory control for redundant system considering stochastic lead time.*

Abstract. Maintaining a system of multiple degrading components requires having a supply of spare components to replace deteriorated ones in a timely manner. Decisions on whether to replace the deteriorated components are made based on the statuses of components and the system and are further restricted by the inventory level of spares. Inventory replenishment decisions themselves depend both on system status and maintenance policy. Both maintenance and replenishment decisions affect the system reliability and system maintenance and spare inventory cost. This paper studies the joint optimization of a condition-based component replacement and spares ordering policy (CBRSOP) for a k-out-of-n:F system of non-repairable degrading components under various system statuses, in which the maintenance time is not negligible and the uncertainty of it and the lead time are both considered. The CBRSOP is optimized using a reinforcement learning algorithm, i.e., Q-learning algorithm, to determine whether and how many components to be replaced, and whether and how many spares should be ordered upon each decision point, to minimize the long run total cost, e.g., the component replacement and spare holding cost. The convergence of the algorithm is proved. We demonstrate the efficiency of the model and solution method by testing k-out-of-n:F systems with different numbers of components and discretized degradation states.

Keywords: condition based maintenance, spare inventory, reinforcement learning

Jian Zhou (Nanjing University of Science and Technology) and Xiaoting Nie (Nanjing University of Science and Technology). *RESILIENCE-ORIENTED EXPANSION PLANNING OF INTERCONNECTED MULTI-ENERGY MICROGRIDS BASED ON DEEP REINFORCEMENT LEARNING.*

Abstract. The rise in greenhouse gas (GHG) emissions due to the growing electricity demand from traditional energy sources has resulted in an increase in global warming-related extreme events, which contribute to power grid outages and even aggravate their impacts. Reducing GHG emissions from power grids and improving power resilience are of significant interest among researchers and practitioners. Microgrids are receiving increasing attention for their ability to integrate renewable energy sources and supply independent power. While most of the existing researches about microgrids focus on either microgrid grid-connected mode or microgrid islanded mode, which is not consistent with the actual operation of microgrids. Therefore, this paper conducts long-term expansion planning of interconnected multi-energy microgrids (IMMGs) taking into account the uncertainties of renewable generations and customer load demand. The objective is to minimize the total cost for microgrid expansion planning (MEP), power outage loss and GHG emissions while considering both grid-connected and islanded modes. Taking three IMMGs as an example, a deep reinforcement learning-based framework is developed to optimize MEP decisions about the type and capacity of power generation and storage units to invest in each microgrid, as well as the time of investments. The research findings show that the difference in the value of lost load and load demand of the customers served by each microgrid and the direction of power transmission between microgrids remarkably affect the optimization of resilience-oriented MEP. Furthermore, the effectiveness of the proposed framework on cost-effective MEP with resilience improvement is validated in both grid-connected and islanded operation modes while considering real-world power system interdependencies and multiple uncertainties.

Keywords: interconnected multi-energy microgrids, expansion planning, deep reinforcement learning, power resilience, operation mode

Elnaz Emami (The University of Sydney, School of Civil Engineering, Sydney, Australia) and Mohsen Ramezani (The University of Sydney, School of Civil Engineering, Sydney, Australia). *Virtual parking locations for micromobility sharing systems* .

Abstract. One of the most critical aspects of bike sharing systems is the location of parking. Dockless bike sharing systems allow users to park bikes anywhere, introducing challenges for operators, users, and non-users alike. Bikes parked on pathways can obstruct pedestrians, while bikes parked in hard-to-access areas pose difficulties for users attempting to retrieve them. For operators, bikes in inaccessible locations tend to remain idle for longer periods, reducing profitability and increasing the risk of damage. Conversely, docked bike-sharing systems require users to pick up and return bikes to designated stations, leading to longer walking distances and higher maintenance costs for operators. This study introduces a virtual parking (v-parking) strategy to address these challenges. V-parking locations are dynamically determined and introduced to users upon bike pickups. The objective is to minimize the total distance each user walks to his/her destination and maximize the grouping of bike, while respecting regional capacity constraints.

Keywords: Bike sharing system, Shared micromobility system, Parking strategy, Rebalancing

Mohit Sharma (Punjab Engineering College (Deemed to be University) Chandigarh, India) and Mohit Tyagi (Punjab Engineering College (Deemed to be University) Chandigarh, India). *ARTIFICIAL INTELLIGENCE DRIVEN DIGITAL TRANSFORMATION MET CHALLENGES ANALYSIS FOR SUPPLY CHAIN IMPROVEMENT IN CONTEXT OF CIRCULAR ECONOMY.*

Abstract. Digital transformation can bolster the circular economy (CE) within organizations, enabling them to uphold the economic, social, and environmental pillars of sustainability. Today, technology and sustainability stand as two crucial pillars for the advancement of any industry. Artificial Intelligence (AI), a data-driven technology, is seen as a crucial facilitator of CE. AI includes various swiftly advancing disruptive technologies that significantly alter multiple aspects of individuals, businesses, society, and the environment. The swift evolution of AI has sparked revolutionary changes in supply chain management (SCM).AI offers several benefits in SCM, such as enhanced optimization, precise forecasting, improved quality, cost savings, and safer work environments. AI enhances productivity and efficiency, hence facilitating the transformation of supply chains (SCs) into more "circular" systems by minimizing inefficiencies in resource loops. Nevertheless, the implementation of emerging technologies like AI and the concepts of CE presents a multitude of challenges. In this current study, various challenges related to AI-driven supply chain are identified for improvement and analyzed using the mathematical algorithm Fuzzy DEMATEL technique. The analysis reveals that fear of disrupting the existing business model emerges with the highest prominence score (5.341) and relation value (1.012). Consequently, it appears to be the most significant challenge. The results of this study might provide valuable insights for stakeholders and researchers in effectively addressing the challenges associated with AI-driven SC.

Keywords: Circular economy, Artificial intelligence, Supply chain, Supply chain management, Fuzzy DEMATEL

Shagun Smith (Punjab Engineering College (Deemed to be University), Chandigarh, India), Ravinderjit Singh Walia (Punjab Engineering College (Deemed to be University), Chandigarh, India) and Anju Singla (Punjab Engineering College (Deemed to be University), Chandigarh, India). *SUSTAINABLE BIO-MEDICAL WASTE MANAGEMENT ALLIEND OBSTACLES ANALYSIS USING ISM FUZZY-MICMAC APPROACH.*

Abstract. The ever-increasing Bio-Medical Waste (BMW) generation has posed serious threats to environmental sustainability and public health at large. The present study aims to explore the obstacles faced by the healthcare sector during BMW management. Based on the extant literature and interviews with health professionals, patients and other individuals visiting hospitals the study identified various obstacles related to considered theme. The list was further refined using factor analysis before employing ISM approach. The study contributes by presenting a well-structured framework offering a vivid visual of the interrelationships among key obstacles. Based on analysis, Lack of awareness regarding BMW, its lethal effects and the importance of its management was found to be the most pressing concern. Fuzzy-MICMAC further aids in determining the mutual relationship among the obstacles facilitating their prioritization, and decision-making. The outcomes of the study will provide a useful roadmap to the policymakers, environmentalists and all stakeholders associated with healthcare to realign the initiatives towards BMW management for the development of targeted strategies to enhance BMW management practices and promote sustainability in public health.

Keywords: Bio medical waste, Obstacles, ISM, Fuzzy MICMAC, Healthcare

Tanzila Azad (School of Systems & Computing, UNSW Canberra, ACT 2610, Australia), Humyun Fuad Rahman (Newcastle University Business School, Newcastle University,5 Barrack Road, Newcastle upon Tyne, NE1 4SE, UK), Daryl Essam (School of Systems & Computing, UNSW Canberra, ACT 2610, Australia) and Ripon K. Chakrabortty (School of Systems & Computing, UNSW Canberra, ACT 2610, Australia). *OPTIMIZATION OF ENERGY-AWARE BI-OBJECTIVE PRODUCTION SCHEDULING AND VEHICLE ROUTING PROBLEM CONSIDERING TIME OF USE PRICING.*

Abstract. Over the past decade, the rise in energy consumption has driven researchers to find ways to reduce it. These efforts often involve improving planning related to production and distribution operations in supply chains, which can be costly and time-consuming. To address this challenge, we propose a bi-objective model that schedules production and distribution together to minimize the total cost of energy consumption and the sum of earliness and tardiness penalties. A mixed-integer linear programming model converts the weighted sum of both objectives into a single objective. By analyzing and comparing the performance of these approaches with randomly generated test sets, we derive managerial insights from our numerical experiments. Findings underscore the importance of energy-aware strategies for economic efficiency and environmental sustainability in industrial enterprises.

Keywords: Integrated scheduling, Flexible job shop, Vehicle routing, multi-objective optimization

Song Xu (Shanghai Maritime University), Xiangyue Ou (Shanghai Maritime University) and Kannan Govindan (University of Adeliade). *An adaptive genetic hyper-heuristic algorithm for a two-echelon vehicle routing problem with dual-customer satisfaction in community group-buying.*

Abstract. This study focuses on a novel variant of the classical two-echelon vehicle routing problem (2E-VRP), termed the two-echelon vehicle routing problem with dual-customer satisfaction (2E-VRP-DS) (i.e. time windows satisfaction and freshness satisfaction) in community group-buying. It is important to obtain better solutions for the 2E-VRP-DS with long-distance distribution in the first echelon and last-mile delivery in the second echelon. Therefore, a new mathematical model is established for the 2E-VRP-DS that incorporates three objectives: minimising the total distribution costs, maximising time windows satisfaction, and maximising product freshness satisfaction. To solve the mathematical model, an efficient adaptive genetic hyper-heuristic algorithm (AGA-HH) was proposed, complemented by a k-means clustering approach to generate initial solutions. The adaptive genetic algorithm is considered to be a high-level heuristic, and ten local search operators were considered as low-level heuristics to expand the search region of the solution and achieve robust optimal results. Three sets of experiments were conducted, and the results demonstrated the superiority of AGA-HH in solving the 2E-VRP-DS, showing improvements in distribution costs reduction, time windows compliance, and product freshness preservation. Moreover, sensitivity analyses were carried out to show the influence of the number of DCs and the tolerance range of product freshness, discovering some managerial insights for companies. Future work should consider and investigate VRPs in other new business modes.

Keywords: Vehicle routing problem, Dual-customer satisfaction, Adaptive genetic hyper-heuristic algorithm

Zhao Zhao (Tianjin University), Yida Xu (Tianjin University) and Zhaofang Mao (Tianjin University). *Enhanced Electric Vehicle Milk-Run Scheduling through Improved Simulated Annealing Algorithms Considering Time-of-Use Pricing.*

Abstract. In the realm of manufacturing logistics, the use of tow trains for circular deliveries—moving goods from storage to assembly lines—is a prevalent practice. This process diverges from standard vehicle scheduling by incorporating the timing and scheduling of electric vehicle (EV) charging sessions, a critical factor in the EV scheduling paradigm. Our research delves into the intricacies of scheduling and charging under the influence of time-of-use (TOU) electricity pricing, which is characterized by varying electricity costs throughout the day, and aims to balance the workload among EVs to ensure equitable distribution. To tackle these challenges, we introduce an adaptive neighborhood simulated annealing algorithm, benchmarking its performance against commercial solvers and tabu search methods. The results from our experiments indicate that our proposed algorithm excels in handling medium to large-scale scenarios. Furthermore, a sensitivity analysis on the operational costs of the vehicles offers valuable insights, showing potential reductions in the deployment of EVs without compromising operational efficiency. By integrating task allocation with charging strategies, and taking into account TOU pricing and workload equilibrium, our study presents a pathway for manufacturing enterprises to achieve significant cost reductions and enhanced operational efficiency within their logistics frameworks.

Keywords: Electric vehicle scheduling, Time of use pricing, Simulated annealing algorithm

Yida Xu (Tianjin University), Enyuan Fu (Tianjin University), Zhao Zhao (Tianjin University) and Zhaofang Mao (Tianjin University). *An adaptive large neighborhood decomposition search algorithm for the location-routing problem with pickup facilities.*

Abstract. In the context of contemporary logistics, the processes associated with the last-mile delivery have become increasingly time-consuming and uncertain. This is due to the proliferation of unpredictable factors and the growing heterogeneity and specificity of customer demands. Inefficiencies in the design of distribution networks can result in an increased incidence of failed deliveries and suboptimal vehicle utilisation. In order to mitigate these challenges, parcel delivery companies have implemented a variety of advanced storage solutions, including pick-up points and lockers. The objective of this study is to enhance the last-mile distribution network by integrating self-pickup facilities within the context of heterogeneous customer demands. Demand can be classified into two distinct categories: general goods and special goods (such as irregular and refrigerated items). Each category requires a different transportation strategy. We subsequently address the Location-Routing Problem with Pickup Facilities and Heterogeneous Demands (LRP-PFHD). In order to address this complex issue, we propose the use of a mixed integer linear programming (MILP) model, the objective of which is to minimise the total cost. Given the NP-hard nature of the problem, we have developed an Adaptive Large Neighbourhood Decomposition Search (ALNDS) algorithm to solve the LRP-PFHD. The effectiveness and efficiency of the proposed approach are evaluated using generated instances based on benchmark datasets. A comparative analysis indicates that our method is more effective than commercial MILP solvers, such as Gurobi, particularly for large-scale instances. Furthermore, a comprehensive sensitivity analysis of pivotal parameters (e.g., facility opening costs, transportation costs) is conducted to elucidate their impact on the results and to furnish practitioners in the parcel delivery industry with actionable insights.

Keywords: Last-mile delivery, Location, Mixed integer programming model, Meta-heuristic

Abhinav Katiyar (INDIAN INSTITUTE OF MANAGEMENT MUMBAI) and Vidyadhar V Gedam (INDIAN INSTITUTE OF MANAGEMENT MUMBAI). *Can Circular Economy Reduce Social Impacts in Manufacturing? Perspectives from Emerging Economies.*

Abstract. India's industrial industry is expanding and rising, requiring massive quantities of cash, energy, resources, and labor from its workforce. The amount of money allocated to the country's growth is increasing and will do so for the foreseeable future. In order to manage this exponential growth in a sustainable way, planning and promoting manufacturing development along a sustainable route is necessary. This study examines the Social-Life Cycle Assessment (S-LCA) of the Manufacturing Sector in developing nations and considers the social implications for each stakeholder group. Furthermore, changes in the social consequences on various stakeholders are also investigated in the case of a Circular Economy (CE) scenario.

Research Methodology: The study uses four case studies of the manufacturing industries to examine social impacts using the United Nations (UN) Social-Life Cycle Assessment (S-LCA) principles. The social impact scores (SICs) of the present business-as-usual (BaU) scenario and Circular Economy (CE) scenarios were compared for each stakeholder category. Additionally, in order to understand the societal repercussions and how they will differ in the Circular Economy (CE) scenario, professionals and experts were questioned and interviewed.

Results & Findings: The BaU scenario's value chain actors work well in the assigned social impact categories, as evidenced by their highest social ratings. Additionally, the stakeholders in the local community are the ones with the lowest social welfare, which in turn affects the stakeholders in the consumer market. Workers would benefit socially the most and the neighborhood the least if the Circular Economy (CE) were to take off. The results demonstrate how much each social impact category has changed as a result of the adoption of the Circular Economy (CE), along with accompanying performance criteria.

Contribution to Literature: The study provides insightful information about the social effects of the manufacturing industries and potential trade-offs that society may have while adopting the Circular Economy (CE) in these businesses. The results can aid in the development and implementation of policies for the welfare of various stakeholders by policymakers and decision-makers in the manufacturing sectors. When analyzing the social effects of the manufacturing industry and the advantages of moving toward a circular economy (CE), the study is helpful.

Keywords: Manufacturing Industries, Circular Economy (CE), Stakeholder Impacts, Social Life Cycle Assessment (S-LCA), Sustainability

Abhinav Katiyar (INDIAN INSTITUTE OF MANAGEMENT MUMBAI) and Vidyadhar V Gedam (INDIAN INSTITUTE OF MANAGEMENT MUMBAI). *"Deconstructing Barriers to Circular Economy: A Fertilizer Industry Analysis".*

Abstract. ABSTRACT

The fertilizer industry (FI) is notorious for its high energy requirements, dependence on finite natural resources, and detrimental environmental effects. Only the FI is responsible for the 14.2 billion tons (BT) of material usage and the 1580 tons of resource extraction per acre. It becomes imperative for FI to implement a Circular Economy (CE) to increase efficiency, energy, and resource reuse given the resource- and energy-intensive industry. Nevertheless, there hasn't been much movement made by FI to adopt CE.

Research Methodology: The proposed study recognizes and investigates the obstacles preventing CE implementation in FI. Fifteen obstacles preventing CE in FI have been discovered and divided into seven groups. After conducting an extensive literature review and consulting with experts, the identified barriers were determined. The DEMATEL technique is used in the study to assess the barriers and determine their causal relationship. According to the survey, lack of regular and bulk material supply, lack of understanding and awareness, and governmental restrictions rank as the main obstacles to the implementation of CE in FI.

Results & Findings: The results offer a comprehensive comprehension of the critical factors contributing to the CE's derailment in FI and establish a solid foundation for the methodology and tactics employed to surmount the obstacles to CE acceptance. Insights into management and policy from the study also helped the FI's decision-makers successfully surmount CE barriers.

Keywords: Fertilizer Industry (FI), Circular Economy (CE), Barriers, DEMATEL, Sustainable Development (SD)

Divanshu Sharma (FEIT, University of Technology Sydney), Nagesh Shukla (Griffith University, Queensland), Sanjoy K. Paul (UTS Business School, University of Technology Sydney) and Biswajeet Pradhan (FEIT, University of Technology Sydney). *SUPPLY NETWORK MAPPING FOR SUPPLY CHAIN VISIBILITY AND RESILIENCY.*

Abstract. The study aims to develop and utilise a supply network (SN) map to enhance supply chain (SC) visibility and resiliency. The study utilises publicly available secondary data sources to develop a detailed SN map from scratch. It employs an advanced machine learning (ML) and natural language processing (NLP) approach to extract SC data from unstructured data sources. To address the limitations of the ML model used in state-of-the-art studies for developing SC maps from unstructured data, we aim to develop an advanced ML model to automatically generate a dynamic SN map. Unlike existing methods, which primarily focused on named entity recognition and basic relationship classification, the proposed research significantly advances SC relationship extraction. NLP-driven real-time SC visibility enhances operational efficiency and reduces costs by automating data extraction, optimizing inventory, and improving logistics planning. NLP-driven SC mapping aids the government in identifying vulnerabilities and ensuring economic stability by enhancing market insights and supporting SMEs.Study advances research, update education with the latest SC technologies, and disseminate knowledge through publications and industry collaboration.

Keywords: Supply Network mapping, Supply chain resiliency, Supply chain visibility

Aniket Todkar (Sardar Vallabhbhai National Institute of Technology, Surat) and Jayesh Dhodiya (Sardar Vallabhbhai National Institute of Technology, Surat). *A sustainable fixed-charge multi-objective 5D shortest path problem under uncertain environment by Aspiration level based NSGA-II and III: Application to logistics system.*

Abstract. This study explores the sustainability challenges in transportation systems, which involve the complex interplay of environmental, economic, and social factors. Vehicles typically rely on various fuels, leading to greenhouse gas emissions and environmental pollution. In this context, the research focuses on a sustainable fixed-charge multi-objective multi-route multi-conveyance multi-driver shortest path problem. The primary objective is to determine the most efficient route that minimizes costs, time, risk, carbon emissions, and distance between sources and destinations. In real-world scenarios, the parameters of fixed-charge multi-objective multi-route multi-conveyance multi-driver shortest path problems are often uncertain and can be predicted based on human judgment. Liu's uncertainty theory, a well-regarded tool for managing such uncertainties, is employed in this study. The model incorporates zigzag uncertain variables to represent these uncertain parameters. The research further develops the expected and optimistic value models of the fixed-charge uncertain multi-objective multi-route multi-conveyance multi-driver shortest path problem and provides deterministic transformations of these models. To solve the deterministic model, two multi-objective genetic algorithms-aspiration level-based non-dominated sorting genetic algorithms (NSGA)-II and III are utilized. The proposed model is applied to a fish transport system, comparing compromise solutions obtained from the hybrid genetic algorithm, NSGA-II and NSGA-III. Additionally, a sensitivity analysis of the objective functions is conducted concerning the shape parameter and aspiration level. Finally, the coverage performance measure is calculated to demonstrate the effectiveness of the proposed methods.

Keywords: Multi-objective shortest path problem, Aspiration level, Genetic algorithm, NSGA-II, NSGA-III

Bodrunnessa Badhon (PhD Student, School of Systems & Computing, UNSW Canberra, Australia), Sreenatha G. Anavatti (Senior Lecturer, School of Eng & Tech, UNSW Canberra, Australia) and Ripon K. Chakrabortty (Senior Lecturer, School of Systems & Computing, UNSW Canberra, Australia). *Enhanced Interpretability in Project Risk Management: Interpreting the Antecedents by Capturing the Interdependencies in Risk Factors.*

Abstract. This paper proposes two frameworks—Interpretive Structural Modelling with Local Interpretable Model-agnostic Explanations (ISM-LIME) and Knowledge Graph with LIME (KG-LIME)—to enhance interpretability in project risk management. While machine learning has proven to be a powerful tool for predicting and analyzing risks in increasingly complex projects, its "black box" nature often obscures decision-making processes. Current explainable AI (XAI) techniques, such as LIME, SHAP (SHapley Additive exPlanations), and G-LIME (Global-LIME), provide valuable insights into feature importance but struggle with capturing the intricate relationship and cascading effects among multiple risk factors. Our proposed frameworks address these limitations by not only elucidating the impact of individual risk factors and interpreting the antecedents but also by revealing their interconnections and cascading effects. Through a comparative analysis, this study demonstrates how ISM-LIME and KG-LIME overcome the shortcomings of traditional XAI methods. ISM-LIME offers a clear hierarchical representation of risk interactions, while KG-LIME provides a detailed network-based view that captures complex interdependencies. This comparison highlights the strengths of each approach in improving risk assessment and decision-making.

Keywords: ExplainableAI(XAI), Project risk management, LIME, Interpretive structural modelling (ISM), Knowledge graph (KG)

Lynette Cheah (University of the Sunshine Coast). *INVESTIGATING THE POTENTIAL FOR INTEGRATED FREIGHT AND PASSENGER TRANSPORT IN CITIES.*

Abstract. Growing urban populations are driving strong demand for urban goods movement, prompting interest in innovative urban logistics solutions. The integration of passenger and freight transport offers good potential for more-efficient city logistics operations. By leveraging spare capacity in passenger transport modes, it is possible to fulfil urban freight deliveries without compromising the level of service for passengers. Three cases are presented. First, we explore the feasibility of engaging ride-hailing services to perform parcel deliveries. By developing an agent-based simulation of passenger and freight flows in the case of Singapore, we demonstrate how otherwise-idle ride-hail road vehicles have the potential to fulfill parcel deliveries, reducing delivery vehicle kilometers traveled and traffic congestion with minimal impact on passenger travel.

Next, we examine how e-commerce carriers can leverage the existing urban rail networks for parcel deliveries. Parcels are initially transported by delivery vehicles from a warehouse to hubs located at train stations, then transferred by rail to satellite stations, from which smaller vehicles complete final deliveries to end destinations. Moving freight on transit is demonstrated to reduce delivery vehicle kilometers traveled. Finally, we examine crowdshipping where public transport passengers can serve as individual couriers. These "crowdshippers" pick up parcels from lockers near or at their origin stops, hand-carry the parcels over their journey using transit and deliver the parcels to their final destinations with minimal detour. Results show that supplementing conventional delivery with crowdshipping using public transport can achieve benefits. Up to 11% of parcels can potentially be redirected to crowdshippers, reducing required vehicle fleet size, delivery vehicle distance, associated emissions and costs by almost 20%. There are different and creative ways to integrate freight and passenger transport in cities. Data-driven simulations and models reveal the potential to yield economic, environmental and social benefits.

Keywords: urban freight, city logistics, co-modality, freight on transit, cargo hitching, crowdshipping

Anders Thorstenson (Aarhus University) and Erland H. Nielsen (Aarhus University). *Queuing for a Free Lunch? M/G/1 Queues With Randomly Generated SEPT Priority.*

Abstract. In waiting-line management, increased variability of arrivals or service times is commonly viewed as detrimental to queuing system performance. This perception has recently been challenged. By adding an artificial mean-preserving spread to the service time in a simple queuing model and using the information obtained from this added spread, it is possible to invoke the Shortest Expected Processing Time (SEPT) rule to dynamically sequence the queue. As can be shown analytically, the SEPT sequencing minimizes the expected waiting time for the customers. Thus, an increase in service time variability in fact improves the expected performance of the queuing system.

In this paper, we simulate the same queuing system and add a mean preserving spread as referred to above. Results show that even though - as predicted analytically - the mean waiting time is reduced by use of the SEPT, changes in higher moments (variance, etc.) of the waiting time distribution are not uniform across different service time distributions. These higher moment changes could cause some customers to renege or balk, or might induce other types of customer dissatisfaction. We also argue that the requirements for the differentiated service time policy to be operationally sustainable are quite restrictive, which limits its practical applicability. Thus, the management insight is that, even if an increase in expected service times for some customers is initially considered to be acceptable in view of the overall reduced mean waiting time, this reduction might not be obtained without additional charges that should also be considered.

Keywords: Priority sequence, Poisson arrival, Reneging, Simulation, Single server queue, Variance, Waiting time

Sean Arisian (La Trobe Business School, La Trobe University) and Thi Thuy Trinh Cao (La Trobe Business School, La Trobe University). *GLOBAL AGRICULTURAL SUPPLY CHAIN RESILIENCE UNDER UNCERTAINTY.*

Abstract. In recent years, the global agricultural supply chain has faced challenges driven by escalating geopolitical events such as the US-China trade war and the Russian invasion of Ukraine. External uncertainties driven by such events can impose risk propagation and impact global supply chain resilience (GSCR). This highlights the necessity of broader studies on GSCR that consider the impacts of external uncertainties not only at a firm level but also from the perspective of supply chains or policy makers. Existing literature on GSCR primarily emphasizes operational disruptions from organizational viewpoints, overlooking how geopolitical uncertainties affect network resilience at the supply chain and/or national level. This study addresses this gap by considering interconnection and interdependence of GSCs amidst uncertain events. This paper aims to (1) investigate the impacts of geopolitical uncertainties on GSCR and (2) identify network structure in response to specific events to enhance GSCR. Specifically, we conduct network simulations based on multiple disruption scenarios to examine the multidirectional impacts of these events on GSCR. The results reveal that geopolitical uncertainties have not only negative but also positive effects on GSCR through shifts in network structures. Our study contributes to the theoretical understanding of GSCR by integrating in the context of geopolitical uncertainties. For practical contribution, our research provided valuable insights and policy recommendations to support agricultural supply chain decision-makers in minimizing network disruptions and enhancing GSCR

Keywords: Global Supply Chain Resilience, Agricultural Supply Chain, Supply Chain Network, Geopolitical Uncertainties, Supply Chain Risks, Supply Chain Disruptions

Yongfeng Jing (School of Reliability and Systems Engineering, Beihang University), Jian Jiao (School of Reliability and Systems Engineering, Beihang University), Jiayun Chu (China Academy of Launch Vehicle Technology) and Shujie Pang (China Aero-Poly technology Establishment). *An optimization method for task resource rescheduling in avionics systems considering partitions failures.*

Abstract. In Integrated Modular Avionics (IMA) systems, the partitioned resource-sharing model leads to multiple tasks competing for limited computational and communication resources, which may result in resource conflicts and task delays, especially under partition failures. Such failures introduce greater uncertainty and burden to task scheduling, leading to degraded system performance and potential safety risks. Therefore, optimizing task resource scheduling in the presence of partition failures, balancing task completion time with system load, is a critical issue that remains inadequately addressed in current research. This paper presents a multi-objective task allocation and scheduling reconstruction optimization method under partition failure conditions. First, a mathematical model is established to optimize task rescheduling, with the objectives of minimizing task completion time and balancing system load, while considering constraints such as task priority and resource thresholds. To solve this model, we adopt a hybrid algorithm combining Multi-Objective Particle Swarm Optimization (MOPSO) and Non-dominated Sorting Genetic Algorithm II (NSGA-II). MOPSO leverages the global search capability of particle swarms to explore the solution space, while NSGA-II ensures the diversity and distribution of the Pareto optimal solution set through non-dominated sorting and crowding distance mechanisms. By integrating the strengths of both algorithms, the proposed hybrid method efficiently solves complex optimization problems with multiple objectives. Finally, the effectiveness of the method is validated through a case study on an IMA system, yielding an optimized scheduling solution.

Keywords: Avionics systems, Partition failures, Rescheduling, Multi-objective optimization

Yuan Yuan (School of Reliability and Systems Engineering, Beihang University), Tingdi Zhao (School of Reliability and Systems Engineering, Beihang University) and Jian Jiao (School of Reliability and Systems Engineering, Beihang University). *Unmanned aerial vehicle swarm collaborative task allocation method under uncertain disturbance.*

Abstract. The unmanned aerial vehicle (UAV) swarms, characterized by high mobility, low cost, and flexible configuration, are widely used in various civilian and military fields such as aerial communication, geological exploration, and strike missions. However, when operating in complex natural or confrontation environments, UAV swarms face increased uncertain disturbances including component failures, external attacks, and environmental impacts. The most existing UAV swarm task scheduling methods are difficult to meet the real-time task assignment requirements under multi-source disturbances and dynamic task changes. Therefore, this paper investigates the collaborative task allocation methods for UAV swarm under uncertain disturbances. Firstly, the architecture and characteristics of UAV swarm are analyzed, and then the disturbance factors that UAV swarm may face are identified. Secondly, the UAV swarm network model under uncertain disturbance conditions is constructed based on complex hypergraph theory. Then, a collaborative task allocation algorithm for UAV swarm is proposed, considering uncertain disturbances and UAV resources constraints, to achieve distributed cooperative decision-making and meet the requirements for effective and timely task allocation. Finally, the feasibility of the proposed method is verified by a case study.

Keywords: UAV swarm, complex network, task allocation, contract network protocol

Ranit Senapati (Indian Institute of Technology Kharagpur) and Biswajit Mahanty (Indian Institute of Technology Kharagpur). *RELIABILITY ANALYSIS AND UNCERTAINTY QUANTIFICATION OF A SIX DEGREE OF FREEDOM PROJECTILE MODEL SUBJECT TO INPUT UNCERTAINTY.*

Abstract. In designing an artillery external ballistics system, it is crucial to accurately quantify the impact of various uncertain input parameters on the projectile's trajectory to enhance overall attack efficiency. The complexity of an artillery firing system arises from the interdependencies among multiple inputs and outputs, which are represented by a set of equations known as the 6-DOF model that must be solved numerically. The uncertain input parameters may be in the form of manufacturing tolerances (mass, moment of inertia), uncertainties in operating conditions (muzzle velocity, elevation angle, azimuth angle), or environmental factors (wind speed). As a result of these uncertainty inputs, the outputs of the model (range and deviation) may assume values that reduce the lethality of the projectile. It is important to identify and address the potential failure points with a reliability analysis in order to ensure that the artillery system performs consistently under various conditions, thus enhancing the overall operational effectiveness. In order to find the failure probability, reliability analysis of the 6-DOF model is usually carried out by using importance sampling or Monte Carlo sampling. However, such methods require a higher number of functional evaluations thus consuming a substantial amount of time. In this paper, we propose a metamodel-based algorithm based on Adaptive Kriging combined with Monte Carlo sampling (AK-MCS) to calculate the reliability index with a much smaller number of functional evaluations.

Keywords: Reliability Analysis, External ballistics, Monte Carlo sampling, Adaptive Kriging

Shabnam Rahnamay Bonab (Monash University, Australia) and Hossein Reyhani Yamchi (Tabriz University, Iran). *Circular Economy Adoption Challenges in the Electrical and Electronic Equipment Supply Chain.*

Abstract. Embracing a circular economy (CE) has the potential to impact the reduction of carbon footprints within supply chains positively. The electrical and electronic equipment (EEE) supply chain, propelled by technological advancements, population growth, and heightened competition, has experienced substantial expansion. This growth, however, has given rise to environmental challenges, particularly in the proper disposal of hazardous e-waste. Integrating CE principles into the EEE supply chain holds the promise of bolstering sustainability by diminishing waste, decreasing energy consumption, mitigating greenhouse gas emissions, and optimizing resource efficiency through a digitized supply chain. Despite these potential benefits, the transition to a CE is challenging, necessitating a comprehensive evaluation and investigation accompanied by corresponding measures. Assessing barriers to CE implementation in the EEE supply chain poses a multi-criteria decision-making challenge. This study will identify and categorize barriers to CE implementation into political, financial, economic, supply chain, technical, and organizational dimensions. We will employ spherical fuzzy linguistic variables and the CoCoSo ranking method to assess these barriers amidst data uncertainties. The proposed methodology will undergo validation through sensitivity analysis, culminating in a comparative assessment that highlights its effectiveness. This research aims to provide valuable insights for stakeholders seeking to navigate the complexities of CE adoption in the EEE supply chain.

Keywords: Circular Economy, Supply Chain, sustainability

Kannan Govindan (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), University of Adelaide), Devika Kannan (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), University of Adelaide) and Laura Gregersen (Centre for Sustainable Supply Chain Engineering, University of Southern Denmark). *Sustainable Plastic Waste Management in Developing Countries- A systematic literature review.*

Abstract. A total of 6.3 billion tons of plastic have been produced globally, with only 9% recycled, 12% incinerated, and 79% discarded into the environment. Approximately half of the produced plastics are single-use, primarily for packaging, which is a significant source of mismanaged plastic waste, accounting for around 36%. Various studies have found that plastic waste is the second largest waste type in household waste, comprising 15-35% worldwide.

To address the environmental challenges associated with the rise in plastic waste, the United Nations, during the 1992 Conference on Environment and Development, agreed to promote proper solid waste management in both developed and developing countries, with 178 countries signing the agreement. Comparing the United Nations Environment Program's Global Waste Management Outlook from 2015 to the current one from 2024 shows that despite calls for action and efforts over the past decades, there has been little impact on the amount of waste generated. The study also highlights that waste generation has increased, leading to more pollution and millions of tons of municipal waste, particularly affecting developing countries. These countries often lack the necessary infrastructure and resources to manage the growing plastic waste effectively. Additionally, they are burdened by the uncontrolled import of waste, making it even more challenging to manage plastic waste properly.

Inadequate plastic waste management leads to serious environmental and health issues. To improve plastic waste management in developing countries, it is essential to implement effective practices. The aim of this paper is to explore the current practices, drivers, and barriers to sustainable plastic waste management in developing countries. By systematically reviewing the literature, this work seeks to assess the feasibility and effectiveness of various practices in the field of sustainable plastic waste management.

The systematic literature review reveals that sustainable plastic waste management in developing countries is a complex and multifaceted challenge. These countries use various low-cost practices, driven by factors such as economic and business opportunities, environmental and health protection, policy and regulatory frameworks, technological advancements, community engagement, public awareness, sustainability, and the circular economy. However, effective implementation is hindered by economic, social, cultural, policy, technical, and logistical barriers.

Keywords: Sustainable Plastic Waste Management, Developing Countries, Practices, Drivers, Barriers, Critical Success Factors (CSFs), Key Performance Indicators (KPIs).

Minji Kim (Kyung Hee University), Kyungjin Park (Kyung Hee University), Jisung Moon (Kyung Hee University), Cheolhyeon Han (Kyung Hee University), Byunghun Song (Korea Electronics Technology Institute), Jieun Jung (Korea Electronics Technology Institute) and Jumyung Um (Kyung Hee University). *Blockchain-based digital product passport using federated learning for recycling decision optimization.*

Abstract. As the revitalization of the circular economy becomes important, the recognition of recycled parts using vision is being discussed as a way to increase the recycling rate and reuse rate of waste. However, there are limitations in accurately treating and training various wastes in recycling centers, and it is also practically difficult for manufacturers to train models for all recycling environments. To address this, this paper proposes a methodology that combines Federated Learning and blockchain-based Digital Product Passport. Manufacturers use synthetic data to pre-trained baseline models for various scenarios and send these weights to recycling centers using digital product passport. The recycling center uses real data to fine tune the baseline model. This weight is shared through the Digital Product Passport, which updates the global model based on it. This paper presents a new methodology for efficiently improving the recycling process and is expected to contribute to achieving the goals of the circular economy.

Keywords: Recycling, Digital Product Passport, Federated Learning, Blockchain

Nur Fatin Syamimi Kamaruddin (International Islamic University Malaysia), Nadirah Abdul Rahim (International Islamic University Malaysia) and Mahayaudin M. Mansor (Universiti Teknologi MARA). *Corrective Maintenance Time Model Of The 2-Parallel Configuration Of The Earth Station System Using Curve Fitting.*

Abstract. An earth station system serves as key hubs in the ever-changing environment of satellite communication technology, allowing uninterrupted data interchange between the Earth and orbiting satellites. These systems are essential for a range of applications like telecommunications, remote sensing, and global positioning. In this research, a 2-parallel configuration is chosen for the Earth station system design because the literature suggests that it has the lowest operational cost and is reliably acceptable if compared to other parallel configurations. However, the 2-parallel configuration comes with the issue of care and upkeep, especially in the context of corrective maintenance which is the aim of this study. Corrective maintenance, or repairing components and systems after failure, is critical to the Earth station system operation. This study uses curve fitting techniques by using the Monte Carlo method from MATLAB software to foresee system component failures and predict their behavior over time. The useful insights can be extracted from previous maintenance data by using curve fitting, allowing one to make informed decisions regarding when and how to do maintenance. The results demonstrate the curve fitting of the combination of the corrective maintenance of each subsystem with different mean time between failure (MTBF) which are 1,3,5,7, and 10 years, and it is shown that the first degree of polynomial has the lowest RMSE which is 1.35. Furthermore, the corrective maintenance time model is developed not only to analyze component failures but also to assist in deriving appropriate maintenance guidelines that can help system engineers repair the failed subsystem.

Keywords: 2-Parallel Configuration, Monte Carlo, MATLAB, Curve Fitting, Corrective Maintenance Time

Md Mahmudul Hasan (School of Systems and Computing, UNSW Canberra, 2600, ACT, Australia), Sreenatha Anavatti (School of Engineering and Technology, UNSW Canberra, 2600, ACT, Australia) and Ripon K Chakrabortty (School of Systems and Computing, UNSW Canberra, 2600, ACT, Australia). *Efficient Question Answering Model for the Customer Requirements Elicitation in Digital Supply Chain Network.*

Abstract. The supply chain domain is rapidly transforming into digital platforms, integrating concepts and technologies from Industry 4.0 and 5.0. This digital supply chain network (DSCN) is experiencing increasing dynamic demands due to the ever-increasing number of online customers. Consequently, the process of fulfilling tasks by manufacturers and suppliers has become more complex to accommodate customers' desire for mass customisation, compounded by customers' lack of clear, well-directed, and structured requirements. This paper introduces an efficient Extractive Question-Answering (EQA) model designed to create a domain-specific question-answering source. The repository captures clear and structured customer requirements in the DSCN. The proposed EQA model consists of Retentive Network (RetNet) and Reinforcement Learning (RL) that can extract multiple answers from long text documents significantly well. As a benchmark, we used the MASH-QA (Multiple Answer Spans Healthcare Question Answering) dataset to train and validate the proposed model. The final model demonstrates lower computing resource consumption and high accuracy compared to other state-of-the-art models.

Keywords: Digital Supply Chain, Customer Requirement Elicitation, Question Answering, Retentive Network, Reinforcement Learning

Li Guan (School of Computer Science, Faculty of Engineering & Information Technology, University of Technology Sydney), José M. Merigó (School of Computer Science, Faculty of Engineering & Information Technology, University of Technology Sydney), Alireza Abbasi (School of Systems & Computing, University of New South Wales, Canberra) and Ripon K. Chakrabortty (School of Systems & Computing, University of New South Wales, Canberra). *Improving Risk Management for International Construction Projects: An AI-empowered Approach to Proactive Decision Making.*

Abstract. The implementation process of International Construction Projects (ICP) involves a large number of activities and stakeholders, facing not only the typical risks of domestic construction projects but also the complex and diverse risks peculiar to international transactions. Under the complexities from both the internal and external ICP environments, the ICP risks are highly interdependent connecting via various cause-effect relationships. Risk propagation effects can easily occur throughout an ICP lifecycle and further amplify the negative influence of risks on realising project objectives. This work aims to develop an artificial intelligence-empowered approach for proactive decision making in the ICP risk assessment and treatment processes considering complex risk interdependencies. To achieve the research objective, a risk interdependency network (RIN) is first constructed to represent the identified ICP risks and their cause-effect relationships. Then, we develop a simulation-based RIN model for risk assessment by capturing the stochastic behaviour of risk occurrence and including the effects of dynamic risk propagation in an ICP RIN. Several risk indicators from different perspectives are proposed to evaluate the importance of individual risks and the project-level risk. Based on the risk assessment results obtained, appropriate risk treatment actions can be formulated to mitigate critical project risks and risk propagation effects. Moreover, through a scenario analysis, the performances of alternative sets of risk treatment actions are examined using the simulation-based RIN model. An illustrative example is also provided to demonstrate the application and efficacy of the proposed approach for proactive decision making in the ICP risk management. The findings from this study enables ICP practitioners to gain a better understanding of project risk profiles in an entire project lifecycle and to deal with risks more proactively and effectively.

Keywords: Risk assessment, Risk interdependency network, Proactive decision making, International Construction Projects, Risk management

Shuqin Xu (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), University of Adelaide), Devika Kannan (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), University of Adelaide), Kannan Govindan (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), THE UNIVERSITY OF ADELAIDE) and Qi Xu (Glorious Sun School of Business and Management, Donghua University, Shanghai 200051, China). *THE IMPACT OF BLOCKCHAIN ON NEGATIVE PRICES IN THE ELECTRICITY SUPPLY CHAIN.*

Abstract. When negative prices in the electricity market occupy a relatively large proportion of the total time, it will harm the sustainable development of the electricity sector. To overcome these issues, adopting blockchain-based technology into the electricity market may improve the predictability and reliability of power demand and allow for trading more quickly with smart contracts. In this work, we consider an electricity supply chain comprising one power generator and one power retailer. This paper explores the impact of blockchain technology on negative prices and the effect of blockchain investments of different supply chain players on renewable power consumption and power trading. The results show that investing in blockchain technology alleviates the fluctuation of negative prices. When the unit cost of blockchain investment is lower than a threshold, the generator and power retailer jointly investing can further alleviate the fluctuation. Besides, when the unit cost of investing in blockchain technology is higher than a threshold, investing in blockchain leads to higher power demand when the negative price rate increases. Moreover, when adopting blockchain technology, the generator and power retailer jointly investing performs better in improving renewable power consumption and total power demand. However, when the unit cost of investing in blockchain is higher than a threshold and the share of the generator investing is lower than a threshold, investing in blockchain results in less renewable power consumption than without blockchain. The government can offer some incentives to generators and power retailers to adopt blockchain technology to relieve the impact of negative prices. Only when generators invest in blockchain the government can help reduce the unit cost below a certain level. Generators and power retailers should cooperate in investing in blockchain, when the cost of adopting blockchain is lower than a threshold, they can reduce the impact of negative prices.

Keywords: Negative prices, Blockchain adoption, Electricity sector, Renewable power consumption

Yehan Dou (Macquarie University), Peter Shi (Macquarie University) and Monica Ren (Macquarie University).
Leveraging Artificial Intelligence for Optimising Supply Chain Finance: A Conceptual Model for Decision-Making Under Risks.

Abstract. The global COVID-19 pandemic has significantly disrupted global supply chain systems, exposing vulnerabilities and accelerating the need for innovative financial solutions. In addition, businesses are also facing techno-geopolitical uncertainties, which are causing a decline in investments. The existence of these uncertainties, combined with the current financial condition of the post-pandemic era, has heightened the financial burdens for enterprises, particularly for emerging ones, thus making it more difficult to secure capital and increasing the costs related to financing. Supply Chain Finance (SCF) has vital strategies for decreasing financial costs and improving the efficiency of financing by offering longer payment periods and better financing options.

Given the current circumstances, firms must judiciously select the most efficient SCF strategies and decisions when confronted with heightened uncertainties. To make well-informed and effective judgements regarding funding methods, it is imperative to construct a conceptual model capable of effectively navigating the complexities of this intricate landscape. Transparent and precise data, along with advanced technological tools, are essential for making optimal judgements amid these uncertainties. Artificial intelligence (AI) technology can augment decision-making, enhance operational efficiency, and predict future occurrences through the utilisation of machine learning and data analytics, rendering it a promising choice.

This study employs a mixed-method approach, integrating qualitative and quantitative research methods to provide a comprehensive understanding of the applications of the SCF strategies. The qualitative analysis involves conducting comprehensive interviews with industry experts and reviewing case studies of companies that have successfully implemented SCF solutions following the outbreak. These insights provide a thorough understanding of the challenges and opportunities in supply chain financing. The quantitative analysis process using structural equation modelling (SEM) involves constructing a theoretical model that specifies the relationships between AI application, supply chain finance optimisation, and strategy selection and decision. Subsequently, the model is subjected to testing and validation using the gathered data, enabling the calculation of both the direct and indirect impacts of artificial intelligence on financial optimisation and strategic decision-making in the domain of supply chain finance.

The conceptual model is formed by integrating the qualitative and quantitative findings. The article investigates the key factors that influence decision-making in SCF, the application of AI to enhance these decisions, and the impact of these methods on the supply chain's resilience and sustainability. The model is carefully constructed to offer both academic insights and practical benefits, aiding managers in methodically incorporating AI into SCF operations and procedures.

This paper makes an academic contribution by bridging the gap between SCF theory and practice, emphasising the importance of AI in financial decision-making within supply chains. It also provides valuable insights for professionals seeking to enhance their supply chain finance strategies. The findings indicate that AI technology enables businesses to make quicker and more efficient decisions, selecting the most suitable financing methods to maximise benefits. The systematic application of AI in SCF not only reduces uncertainty but also promotes the development of resilient and sustainable supply networks in the post-pandemic era.

Keywords: Supply chain finance, Artificial intelligence, Optimisation, Risks

Sayem Ahmed (School of Systems & Computing University of New South Wales, Canberra), Ripon Kumar Chakrabortty (School of Systems & Computing University of New South Wales, Canberra) and Alireza Abbasi (School of Systems & Computing University of New South Wales, Canberra). *BI-OBJECTIVE SUSTAINABLE FLEXIBLE JOB SHOP SCHEDULING PROBLEM WITH BATCH CONSIDERATION.*

Abstract. Modern manufacturing companies face significant pressure to reduce their environmental footprint, especially concerning energy usage and its consequent effects. Sustainable and just-in-time scheduling attracts attention due to increasing environmental regulation and customer awareness regarding energy consumption and on-time delivery. This study investigates a sustainable, flexible job shop scheduling problem with transportation and sequence-dependent setup times, addressing the need to balance operational efficiency with environmental responsibility in modern manufacturing. Unlike traditional approaches that focus solely on cost minimization, this research formulates a bi-objective mixed-integer linear programming (MILP) model that minimizes total earliness/tardiness costs and total carbon emissions. Minimizing earliness and tardiness costs by optimizing the order sequence to meet due date requirements enhances customer satisfaction. Simultaneously, minimizing carbon emissions promotes resource utilization and minimizes environmental impact through reduced energy consumption in order processing, machine setup and idle state, job transportation, and auxiliary equipment. The results demonstrate that the proposed MILP model effectively tackles small to medium-sized instances, pinpointing optimal solutions that carefully balance operational efficiency with environmental sustainability. This study employs the Gurobi optimizer to obtain optimal or near-optimal solutions, providing manufacturers with a decision-making tool for more sustainable and efficient production schedules. The findings of this research have the potential to contribute to a more competitive and environmentally responsible manufacturing sector.

Keywords: Flexible job shop, Sustainable scheduling, Customer satisfaction, Carbon emission

Parthkumar P. Sartanpara (Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat.) and Ramakanta Meher (Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat.). *Analytical Insights and Applications of the Fractional Riccati Differential Equation in Advanced Optimization and Control Systems.*

Abstract. The fractional Riccati differential equation (FRDE) is a versatile tool in optimization, adept at handling complex dynamics involving memory, time delays, and stochastic effects. This paper presents an analytical solution approach to the FRDE, highlighting its critical applications in various optimization contexts. The FRDE is instrumental in the design of optimal control strategies, particularly for fractional-order systems, by facilitating the development of feedback control laws that minimize cost functions. It also supports dynamic programming by approximating value functions, and it enhances stochastic optimization by providing robust strategies for systems influenced by both deterministic and random disturbances. Additionally, the FRDE addresses time-delay systems, optimizing performance where memory effects are significant. Its applications extend to financial mathematics, aiding in option pricing and portfolio optimization in fractional models. The analytical solutions derived offer valuable insights into fractional-order systems, making the FRDE indispensable in fields such as engineering, economics, finance, and beyond.

Keywords: Caputo fractional derivative, Analytical method, Numerical simulation, Fractional Riccati differential equation, Optimal Control

Seyed Mohammad Khalil (School of Built Environment The University of New South Wales, Sydney, NSW 2052, Australia), Mohammad Mojtahedi (School of Built Environment The University of New South Wales, Sydney, NSW 2052, Australia), Christine Steinmetz-Weiss (School of Built Environment The University of New South Wales, Sydney, NSW 2052, Australia) and David Sanderson (School of Built Environment The University of New South Wales, Sydney, NSW 2052, Australia). *OPTIMISING EVACUATION PLANNING FOR VULNERABLE POPULATIONS: A TWO-STAGE STOCHASTIC PROGRAMMING AND BENDERS' DECOMPOSITION APPROACH.*

Abstract. This study introduces a novel two-stage scenario-based mixed-integer stochastic programming model to optimise the evacuation of vulnerable individuals from aged care centres during disasters. The model addresses the challenges of transit-based evacuation, focusing on the efficient transportation of individuals with limited access to private vehicles to safe shelters within strict time constraints. In the first stage, the model determines the optimal assignment of evacuation centres to receiving aged care centres and the allocation of volunteers to these centres. The second stage refines the detailed evacuation plan by considering various disaster scenarios, which account for uncertainties such as road closures, varying travel times, and the likelihood of different disaster impacts. The objective function is designed to minimise total evacuation costs, which include pre-establishment agreement costs between evacuation and receiving centres, travel costs for evacuees, and suitability costs related to the skills of volunteers. To efficiently solve this complex optimisation problem, the model employs a two-level logic-based Benders' decomposition approach. This method iteratively addresses high-level strategic decisions in the master problem while refining these decisions through scenario-specific evaluations in the sub-problems. The approach ensures that the final solution is cost-effective and robust against the uncertainties inherent in disaster situations. The applicability of the model is demonstrated through scenarios based on historical flood data from Lismore, New South Wales. This case study illustrates the model's potential to significantly improve evacuation operations by reducing costs, ensuring timely evacuations, and providing safe transportation for vulnerable populations. This model significantly enhances the efficiency and effectiveness of humanitarian and emergency logistics. It provides a robust framework for decision-makers to plan and execute evacuations in unpredictable disaster environments. Additionally, it offers valuable insights for policymakers and practitioners in disaster management, helping to improve preparedness and response efforts.

Keywords: Emergency Response, Evacuation Planning, Stochastic Programming, Benders' Decomposition

Brian Lee (School of Built Environment, UNSW Sydney), Lee Roberts (City Futures Research Centre, UNSW Sydney), Sunhyung Yoo (School of Built Environment, UNSW Sydney) and Maryam Bostanara (City Futures Research Centre, UNSW Sydney). *BARRIERS AND ENABLERS: EXPLORING SAFETY, STORAGE, AND SOCIAL INFLUENCES ON SCHOOL COMMUTE AND RECREATIONAL CYCLING AMONG ADOLESCENTS IN SYDNEY.*

Abstract. This study investigates the determinants of cycling for both commuting and recreational purposes among high school students in Greater Sydney, Australia, filling an existing gap in literature which mainly focuses on commuting alone. Utilizing discrete choice models, we analyzed a sample size of 325 public high school students, focusing on demographics, attitudes towards cycling, perceived safety of different cycling lane types, and other environmental factors. Notably, our results indicate a higher prevalence of recreational cycling (51% cycled for recreation in the past year) compared to commuting (16%), due to factors such as the absence of secure cycling lanes, the burden of carrying school materials, and inadequate bike parking facilities at schools. Commuting cyclists, though fewer, displayed more consistent cycling habits and greater risk acceptance towards existing cycling infrastructures.

Our findings underscore the critical impact of perceived safety and infrastructure adequacy on cycling frequency. Students expressed higher safety concerns with painted lanes compared to separated paths, highlighting the need for infrastructure improvements to enhance safety perceptions. Additionally, the presence of social networks significantly influenced cycling habits, with students more likely to cycle when accompanied by peers or family members who also cycle. The study further emphasizes the roles of home-to-school distance, gender, and the availability of safe bike storage in shaping students' cycling choices.

To foster a cycling culture among students, we recommend the development of fully segregated cycling lanes to schools, enhanced bike parking facilities, and incentives for using cargo racks and e-bikes. Such initiatives could address barriers like heavy commuting loads and safety concerns, potentially sustaining cycling habits into adulthood. Key encouragements for cycling include faster travel times compared to walking and social influences from cycling peers. Addressing these factors through targeted policy interventions could significantly enhance cycling participation among adolescents, fostering a more sustainable and healthy transportation future.

Keywords: Active transport, School commuting, Safety perceptions

Keisuke Nagasawa (Hiroshima University), Katsumi Morikawa (Hiroshima University) and Katsuhiko Takahashi (Hiroshima University). *RESILIENT SUPPLY CHAIN FOR DISRUPTION WITH MITIGATION STRATEGIES BY AN OPTIMIZATION-BASED APPROACH.*

Abstract. Supply chains in recent years have been subject to potential disruptions from pandemics, natural disasters, and conflicts. The pandemic caused by the new coronavirus negatively impacted many industries on an unprecedented scale. The need for supply chains that can respond to demand in the event of a disruption has influenced the decision of the decision makers and operation of supply chains. Many supply chain research have been conducted on non-essential goods such as automobiles and plastics, but few studies have been conducted on essential goods such as medical products. The probability of occurrence and damage from disruption or disaster that occur once every few years to several hundred years are difficult to estimate, and the expected costs are too high to realize the benefits. However, from a humanitarian perspective, medical supply chains must be designed to maintain some degree of functionality even in the event of such disruptions.

In this study, we propose a model for maintaining the resilient supply chain by implementing mitigation strategies before and after disruptions occur. The resilient supply chain is to reduce the percentage of products that cannot be supplied in response to increases or decreases in demand and supply after a disruption occurs. We consider satisfying level of demand for decision makers when a disruption occurs. In this study, we developed and approach by a mathematical optimization-based model that allows decision makers to set the degree to which demand can be met and allowable for decision makers to total costs.

Keywords: Supply chain management, Resilience, Mathematical optimization

Qingyu Liu (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), THE UNIVERSITY OF ADELAIDE), Kannan Govindan (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), THE UNIVERSITY OF ADELAIDE) and Devika Kannan (Centre for Sustainable Operations and Resilient Supply Chains (CSORSC), University of Adelaide). *PACKAGING 4.0: THE IMPACT OF POLICY MECHANISMS ON IOT-ENABLED PACKAGING ADOPTION IN CIRCULAR SUPPLY CHAIN.*

Abstract. With increasing global attention to environmental sustainability, achieving a circular economy is critical. In the retail sector, the rapid growth of packaging waste sharply contrasts with low recycling and reuse rates, prompting governments worldwide to implement various policy mechanisms, including unsubsidised mandatory policy (UMP) and subsidised voluntary policy (SVP), to advance circular supply chains. With the advancement of Industry 4.0 technologies, retailers are increasingly adopting Internet of Things (IoT) solutions to enhance the recycling and reuse of packaging within their logistics systems. IoT helps by using RFID tags and sensors for accurate sorting and real-time tracking to ensure used packaging is returned for recycling. However, the policy environment influences the decision to implement IoT-enabled packaging. This paper examines the effectiveness of these policies in recycling and reusing packaging material and explores the conditions under which the retailer should adopt IoT-enabled packaging for recycling under different governmental policy mechanisms. We develop a game-theoretic model to analyse the adoption of IoT-enabled packaging within a supply chain comprising one retailer and one logistics provider. Traditionally, SVP is seen as more effective in the absence of financial incentives, while UMP is thought to be more effective in the presence of improving compliance. Our findings, however, contradict this: in the absence of IoT, both UMP and SVP can achieve a win-win outcome for social welfare and retailer profitability, but when IoT-enabled packaging is adopted, only SVP achieves such outcomes. These results provide theoretical support for policymakers in designing effective policy mechanisms, emphasising the synergy between policy and technology adoption. Additionally, our findings offer strategic insights for retailers considering the adoption of IoT-enabled packaging. Regardless of the policy environment, the benefits of IoT are reduced under high government pressure and high recycling costs. Therefore, retailers must carefully assess the context before investing in such technology.

Keywords: Circular supply chain, IoT technology, Recycling, Environmental policy, Game theory.

Rafat Rahman (Department of Mechanical & Production Engineering, Ahsanullah University of Science & Technology, Dhaka, Bangladesh), Farzana Sultana (Department of Mechanical & Production Engineering, Ahsanullah University of Science & Technology, Dhaka, Bangladesh), Mahmudur Rahman Farhan (Department of Mechanical & Production Engineering, Ahsanullah University of Science & Technology, Dhaka, Bangladesh), Sayem Ahmed (School of Systems & Computing, University of New South Wales, Canberra, ACT 2610, Australia) and Ripon Kumar Chakrabortty (School of Systems & Computing, University of New South Wales, Canberra, ACT 2610, Australia). *DESIGNING AN INTEGRATED MULTI-ECHELON, MULTI-PERIOD HEALTHCARE SUPPLY CHAIN NETWORK.*

Abstract. The healthcare sector faces unique supply chain management challenges because of the wide range of product life cycles, growing levels of outsourcing, and globalization. Selecting cooperators and forming alliances across different supply chain echelons is particularly crucial when designing a multi-echelon network. This study presents a mixed-integer linear programming (MILP) model to design a multi-echelon, multi-period healthcare supply chain network (HSCN) in the context of a developing country. It aims to improve operational efficiency and cost-effectiveness by selecting optimal partners, production planning, and inventory control at each echelon. The proposed model demonstrates a 100% customer service level (CSL) while minimizing total supply chain costs and maintaining low average inventory levels. The findings highlight the model's effectiveness in optimizing strategic, tactical, and operational planning for designing an efficient and competent HSCN. The study provides a comprehensive framework for decision-makers and provides a foundation for future research.

Keywords: Healthcare supply chain network, Mixed-integer linear programming, Multi-echelon supply chain, Customer service level

Sweikcha Nahar (Managed Sourcing Services, mjunction Services Limited, Kolkata) and Swayam Sampurna Panigrahi (Operations, IFMR GSB, Krea University). *The curious case of Women in Operations and Supply Chain Management domain.*

Abstract. More times than not, the job roles in the Operations and Supply Chain Management (OSCM) domain picturizes a man, probably wearing a safety helmet, doing a task that would be considered physically tedious by many. On the contrary, there are a handful of studies reporting the advantages of having a better representation of women in the OSCM workforce like emotional intelligence and empathy leading to a socially sustainable business (Ruel & Fritz, 2021). Yet, the gender gap of the OSCM domain is potentially one of the largest hurdles in the attainment of the 5th SDG declared by the United Nations. Although women made up more than half of the world's workforce in 2019, only 37% of the supply chain employees constituted women (Stiffler et al, 2019).

Studies have revealed that there is a consistent low women participation and representation in the OSCM domain ((Ruel et al., 2020; Zinn et al., 2018)). However, with growing awareness on the role of women in the betterment of our society, many scholars speculated that the low representation of women in the workforce was a demand-supply mismatch. It was reported in 2014 that there were six supply chain jobs for every qualified individual (Ruamsook and Craighead, 2014). Despite the growing number of women opting for various OSCM related courses, the gender bias and discrimination persists. Women remain underrepresented in OSCM, particularly in senior ranks. Authors reported that even though the number of women in academic institutions opting for OSCM is around 50% but their representation in industry is still low (Zinn et al., 2018).

Moreover, representation is not the only challenge. The pay parity between a man and a woman in the same rank and position has grown to 16 % in the last two decades in the OSCM domain (Eshkenazi, 2018). In 2019 alone, it was reported by the Institute of Supply Management Survey that male workers in the OSCM domain earned a significant percentage of 22.6% more than their women counterparts.

Fortunately, amidst the present conditions, scholars and certain organizations are striving towards the active inclusion of women in the OSCM domain. Especially at a time when supply chain resiliency and risk mitigation is of utmost importance, reports prove that a supply chain with higher number of women shall be more robust over time. Authors advocated that women have better communication and collaboration skills that can foster cross-functional as well as inter-company integration (Nix and Stiffler, 2016). In an interesting debate, authors concluded that all-women supply chain was found to be more collaborative than mix-genders supply chain or all-men supply chain. Furthermore, it was highlighted that higher levels of collaborative behavior enhances efficiency. Additionally, all-women teams were found to not only exhibit the highest levels of efficiency, but also the lowest income inequalities between buyers and suppliers. (Ma et al, 2020). If the supply of skilled and educated women is not the rationale behind the low representation of women in OSCM, then, what is? Despite the innate characteristics of intuition, flexibility, empathy, leadership, and multi-tasking abilities among women across ages, what is inhibiting their involvement in the OSCM domain?

In this study, we have identified the various challenges that hinder the representation of women in OSCM roles. In order to identify the challenges, we have conducted an exhaustive survey of literature (journal articles, book chapters, company reports, agency reports and etc.,) and also consulted some women experts who are currently employed in the OSCM domain. We have adopted the Delphi technique to conduct this research where the women experts were asked to contribute their opinion. Through the Delphi technique, it was possible to aggregate their opinions and extract further underlying themes in a systematic manner. Six major themes were identified, which are (1) Career progression and professional development in OSCM, (2) Gender stereotypes in OSCM, (3) OSCM Environment (4) Unfair HR policies for OSCM (5) Access to power in OSCM network and (6) Work-Life balance in OSCM. In addition to the above, this study aims to determine the most critical challenges faced by women in OSCM domain.

The study aims to deepen the understanding of a number of issues that are separately discussed in previous literature on women representation in OSCM domain. The outcomes of the research will help the authors suggest suitable measures to the decision makers across the OSCM domain to address the most critical challenges and thereby build an inclusive and diverse supply chain.

Keywords: Women, Men, Gender, Operations, Supply chain management

Mohiuddin Sarker (Department of Mechanical & Production Engineering, Ahsanullah University of Science & Technology, Dhaka, Bangladesh), Nazmush Sakib (Department of Mechanical & Production Engineering, Ahsanullah University of Science & Technology, Dhaka, Bangladesh), Sayem Ahmed (School of Systems & Computing University of New South Wales, Canberra) and Ripon Kumar Chakrabortty (School of Systems & Computing, University of New South Wales, Canberra, ACT 2610, Australia). *SUSTAINABLE SUPPLIER SELECTION AND ORDER ALLOCATION OF RAW MATERIALS CONSIDERING DEMAND FLUCTUATIONS.*

Abstract. Industries that face a dynamic market always struggle to find the optimal supplier and ordering policy. The rapid changes in demand also pose significant challenges for decision makers. Thus, to assist the decision-makers with supplier selection and optimal ordering policy under demand uncertainties, a multi-criterion, multi-period, and multi-objective mixed integer linear programming (MILP) model is proposed by considering procurement costs, lead times, inventory, shortage and carbon emission costs. Sales data of a pharmaceutical company is collected, and the future demand is forecasted using the Prophet forecasting model. The output of forecasted demand is then used as the input of the MILP model. Weighted objective, preemptive goal programming and non-preemptive goal programming are used to address the challenge of multi-criteria mathematical programming. The decision makers will be able to choose the best supplier among many suppliers and will also be able to get the ordering policy and inventory policy for each time period. A sensitivity analysis is done to study the impact of inventory factors and shortage factors on the objective values. The proposed framework can be used as a decision-making tool by corporate organizations to assist supply chain managers in assessing supplier selection and order allocation by predicting demand while keeping the sustainability of the environment in mind.

Keywords: Order allocation, Sustainable supplier selection, Carbon emission, Prophet forecasting model, Inventory Policy

Jumyung Um (Kyung Hee University), Jongsu Park (Kyung Hee University) and Shokhikha Amalana Murdivien (Kyung Hee University). *Generative artificial intelligence toward autonomous factories.*

Abstract. Due to the shortage of experts and volatile market change, traditional production systems have reached the challenge of their productivity. To overcome this the "Factory of the Future" is transitioning towards autonomous factory systems augmented by generative artificial intelligence. This paper explores artificial intelligence applications of key factory components—Man, Machine, Method, and Material—restructuring them to be more resilient, flexible, and modular. Robots and machine operate autonomously after training in own digital twins. Human operators are supported by digital intelligence assistants and wearable device. And the information of the components is utilized to various neural network trainings and real-time intervention to factory system. All the manufacturing data is managed by the concept of digital threads that is the manufacturing information standardized by meta data model through the whole product life cycle. Each application case of factory components is introduced with real-world case studies from the machine tools, automotive, and semiconductor industries.

Keywords: Smart Factory, Autonomous Factory, Generative artificial intelligence, Large language model

Wu Xiaodan (Hebei University of Technology), Zheng Haopeng (Hebei University of Technology), Yin Xiaomin (Hebei University of Technology) and Yue Yang (LUT University). *MULTI-AGENT DEEP REINFORCEMENT LEARNING FOR MULTI-ECHELON ORDERING DECISIONS UNDER DEMAND ALLOCATION.*

Abstract. This paper introduces a multi-agent deep reinforcement learning model based on B2B steel platform supply chain order decision-making problem, which uses neural networks to construct the strategy function and value function, and uses HAPPO algorithm to construct effective ordering strategies and evaluates the performance of MADRL in minimizing the total cost of this supply chain. We also investigate whether the use of the MADRL algorithm helps to mitigate the bullwhip effect in supply chains. We apply Heterogeneous-Agent Proximal Policy Optimisation (HAPPO) to a serial supply chain ordering decision problem centred on a B2B steel platform and introduce two exogenous parameters, self-interest and demand allocation parameter, when constructing the reward function. Our results show that different demand allocation parameters correspond to different degrees of optimal self-interest and that the system achieves the lowest overall cost when each participant's minimisation objective is a combination of its own cost and the overall cost of the system, which is not optimal when it is completely self-interested or when it focuses only on the overall cost. In addition, the total cost of ordering decisions constructed by HAPPO is lower, and reduces the bullwhip effect, compared to single-agent reinforcement learning and heuristic algorithms. The biggest insight given to us by the experimental results is that the existence of certain information sharing among the participants of the supply chain helps to mitigate the bullwhip effect and improve the overall performance of the system. Our experimental results also show the potential of MADRL in solving complex supply chain ordering decision problems.

Keywords: Multi-Agent Deep Reinforcement Learning, HAPPO, Ordering Decision, Demand Allocation

Rajesh Katiyar (International Management Institute (IMI) Bhubaneswar) and Virendra Balon (NICMAR University, Pune). *An Evidence-Based DEMATEL Method for Identifying Critical Barriers in Megaprojects Initiative.*

Abstract. Mega-projects are large-scale initiatives that involve significant investments of financial, technical, and human resources. They can range from infrastructure projects, such as highways, airports, and dams, to social and cultural projects, for instance sports stadiums, museums, and festivals. The megaprojects can also include scientific and technological initiatives for space exploration and large-scale research programs. These projects often have significant impacts on the communities and societies in which they are located, both during construction and after completion. Megaprojects involves massive budgets, extensive timelines, and large teams of people working across multiple disciplines. Another defining feature of mega-projects is their complexity. Due to the size and scope, mega-projects require extensive planning and coordination for successfully execution. This often involves the integration of multiple technical and organizational disciplines, including engineering, finance, project management, and stakeholder engagement. Such projects can also involve complex regulatory environments, requiring close collaboration with government agencies and stakeholders as well.

Megaprojects can have significant economic impacts, both positive and negative. On the positive side, they can create number of jobs and may help in boosting the economic growth in the construction and related industries. On the other side it can have a negative impact on economy predominantly if the experience cost overruns or delays. Therefore, the aim of this study is to identify the critical barriers for megaprojects initiative and address the challenges. Extensive literature is reviewed to identify the critical barriers and discussed with the industry and academia experts. Finally, fifteen barriers were finalized for further study. Further, a decisionmaking trail and evaluation laboratory (DEMATEL) method is employed to analyse the causeand-effect group of identified barriers. DEMATEL method is a multi-criteria decision-making (MCDM) tool and considered as an effective method for identifying the cause-and-effect group among the barriers of a complex systems.

This method can convert the relationship between cause-and-effect barriers into an intelligible structural model of the system. Furthermore, this method can propose the most important criteria which affects other criteria. DEMATEL method has been extensively used in the fields like management, social sciences, environmental science, and engineering, etc. Recently, it has become very popular because of its ability to pragmatically visualize complicated causal relationships among the barriers. It was observed from the analysis that out of fifteen barriers, eight barriers are categorized into the cause group and seven are under the effect group. Cause group barriers have more impact on other barriers.

Monitoring and evaluation, quality assurance, adequate funding, strong leadership, flexibility and adaptability, sustainability, clear project goals and objectives, and compliance and regulations are the major cause group of barriers. Therefore, it is recommended that management or project managers of mega-projects construction firms should focus on monitoring and evaluation process since it observes the project progress against the goal and objectives. Sufficient funding is very essential to complete any mega-projects as enough funds may help in developing better infrastructure, improving research and development setup, purchasing latest technology, etc. Effective leadership can play a vital role as it can motivate and inspire the entire project team to complete the task within the given project deadline.

Keywords: Megaprojects, Critical barriers, DEMATEL, Cause-and-effect relationship

Ritwik Dash (PhD scholar) and Mamata Jenamani (PhD). *Analyzing Sensor Lifespan and Fault Identification in Cost-Effective Environmental Monitoring Systems.*

Abstract. Sensor failures in ambient monitoring systems can significantly compromise data accuracy and decision-making. While traditional condition monitoring focuses on machinery health, this study focuses specifically on the sensors by introducing a hybrid approach that combines physics-based models with data-driven techniques for early fault detection and remaining useful life prediction. We develop a health index that considers the impact of natural degradational factors such as fatigue and environmental factors on the sensors, as well as commonly occurring faulty instances in the sensor. The novelty lies in the condition assessment without relying on the availability of the failure data. Experimental results show that low-cost sensors often need recalibration or replacement before reaching their manufacturer-specified lifespan. The model's effectiveness is confirmed across multiple sensor types, providing consistent and accurate lifetime predictions to prevent system failures.

Keywords: Sensor Degradation Models, Remaining Useful Life, Fault Identification, Ambience Monitoring

Akram Badreddine Laissaoui (INSA Lyon), Taha Arbaoui (INSA Lyon) and Khaled Hadj-Hamou (INSA Lyon). *A two-stage stochastic approach for the green heterogeneous fleet sizing problem.*

Abstract. Heterogeneous fleet sizing is a well-known problem that caught the attention of research for decades. Considering the emerging energetic constraints and considering new ecologic-oriented objectives, this work attempts to solve the stochastic green heterogeneous fleet sizing with a 2-stage stochastic mixed integer program. To overcome the scalability barriers for large-sized instances, customers are clustered into geographical regions to simplify the graph and reduce its size. Thanks to the introduced clustering, a better scalability of the proposed formulation is achieved. A new set of scenario generators is introduced to represent the stochasticity of the problem. The proposed method yields excellent results for real-world large instances reaching a hundred customers and a fleet of six different vehicle types.

Keywords: Green heterogeneous fleet sizing, Two-stage stochastic approach, Sustainable transportation, mixed integer programming

Huang Jun (School of Economics and Management, Beihang University) and Zhao Qiuhong (School of Economics and Management, Beihang University). *Data-driven distributionally robust forest fire aviation emergency rescue network optimization problem.*

Abstract. Forest fires are highly uncertain and harmful, and thus require timely and effective response. According to the probability characteristics of forest fires, the construction of a robust aviation emergency rescue network is considered to be an effective way. This paper studies a location and allocation problem of aviation emergency rescue network for forest fires. The proposed problem is formulated as a multi-objective two-stage distributionally robust optimization (DRO) model, with the forest fire probability being the uncertain parameter. The first and second stages of the model correspond to pre- and post-disaster rescue operations. By leveraging multi-source data such as meteorological data, altitude data, a data-driven method for constructing Wasserstein metric ambiguity set is proposed. The problem is reformulated after dualizing the problem into a large-scale mixed-inter linear program. An iterative algorithm based on column generation is developed to solve the problem exactly. Via the case study of the Hainan province, we verify the effectiveness of the model, give reliable solutions and explore several managerial implications.

Keywords: Wasserstein Metric, Distributionally Robust Optimization, Uncertainty, Forest Fire, Aviation Emergency Rescue

Huiying Zhang (College of Management & Economics). *The influence of platform digital investment on supplier software selection in the POP context.*

Abstract. In the pop background, E-commerce platform provides basic version and supreme version software for suppliers. In order to study the impact of the platform's investment decision on the supreme software on supplier selection, based on the evolutionary game theory, this paper constructs a two-party evolutionary game model between platform and supplier, exploring what factors will affect the platform's digital investment on Supreme software and the suppliers' choice of supreme software and base software. Research finding:the initial digitalization level of the software, the software usage fee of the supreme version, the digital investment intensity, the cost ratio borne by the supplier for the platform, the data leakage risk loss coefficient and the income coefficient of market scale expansion will all affect the system balance.

The higher the initial digitalization level and lower the lower the usage fee of the software, the more the system can promote the evolution of the ideal state (the supplier chooses the supreme software , the platform actively invests in the digital); The digital investment with the optimal intensity makes the stability of the ideal strategy of the system the maximum, and the intensity is determined by the platform, but it is not the optimal choice of the supplier; The larger the cost ratio that the supplier bears for the platform, the more it can promote the system balance. The platform can appropriately increase its cost sharing ratio while providing suppliers with attractive digital software, which is conducive to system balance; The risk loss of data leakage and the income of market size expansion have negative and positive effects on the system equilibrium respectively. The combination of theoretical analysis and numerical simulation proves the importance of platform digital investment decision and the constraint of cost-sharing contract.

Keywords: Platform economy, Platform supply chain, Digital investment, Evolutionary game

Yiqun Zhang (Curtin University), Liyuan Zhang (Curtin University), Shaoli Wang (Curtin University) and Honglei Xu (Curtin University). *A Hybrid Approach to Hyperparameter Optimization for Dual Neural Networks.*

Abstract. We develop a new hyperparameter optimization method for dual neural networks in this paper, integrating the artificial hummingbird algorithm (AHA) with the Bayesian optimization technique. We establish a dual neural network model with gradient sharing to capture more features of the data. Then we employ the AHA to optimize the size of the hidden layers in the backpropagation (BP) neural network and use Bayesian optimization for adjusting the weight update parameters. Finally, experimental results demonstrate that the new optimization method can successfully enhance the model's classification accuracy on the MNIST and CIFAR-10 datasets.

Keywords: artificial hummingbird algorithm, Bayesian optimization, neural network

Fengjing Zhu (Institutes of Science and Development Chinese Academy of Sciences), Mingang Gao (Institutes of Science and Development Chinese Academy of Sciences) and Xueyan Shao (Institutes of Science and Development Chinese Academy of Sciences). *Improved Ordinal Priority Approach based on Group Consensus.*

Abstract. It is a meaningful research direction to study the interaction between individual experts in multi-criteria group decision making. In traditional group decision-making, experts are often regarded as independent individuals. However, experts are interconnected in society, and their opinions and power are often influenced by others. To quantify the impact of interaction among experts on decision making, we propose an improved ordinal priority approach based on group consensus (OPA-GC). In the first stage, fuzzy mathematics, grey correlation analysis and maximum entropy principle are used to build a static GRA-MaxEnt model that takes into account accuracy and fairness. This model divides the comprehensive weight of experts into individual weight and interactive weight by Shapley value and 2-additive fuzzy measure, reflecting the interaction between experts. In the second stage, the improved ordinal priority approach (I-OPA) model is used to calculate the net utility function of the expert for the indicator, and the final score of the alternative is calculated using the Choquet integral combined with the Shapley value of the experts. By collecting and processing subjective and objective data on clean energies, it is proved that OPA-GC can select the optimal scheme effectively.

Keywords: Multi-criteria ecision making, Group consensus, OPA-GC, Clean energy selection

Adji Candra Kurniawan (Universitas Pertamina), Delinda Amarajaya (Universitas Pertamina), Theodora Rinda Hernawati (Universitas Pertamina), I Dewa Gde Yogindra Adipramana (Universitas Pertamina), Agus Wicaksana (University of Adelaide), Anak Agung Ngurah Perwira Redi (Sampoerna University) and Josephine German (Mapua University). *ENHANCING RESILIENCE IN RETAIL FRANCHISE SUPPLY CHAINS: A HYBRID APPROACH OF OPTIMIZATION AND SIMULATION TO MITIGATE DISTRIBUTION CENTER DISRUPTIONS.*

Abstract. This study explores the enhancement of supply chain resilience in a coffee franchise in Indonesia by employing a hybrid approach of simulation and optimization using anyLogistix software. The focus is on the distribution network, which includes one plant in Tangerang and three distribution centers (DCs) in Bogor, facing challenges such as long delivery distances and frequent operational breakdowns. By simulating the impact of DC disruptions on the supply chain, the research identifies vulnerabilities that could lead to stockouts and delays. The hybrid approach combines control theory principles with simulation to model disruptions and optimization techniques to develop effective mitigation strategies. The findings reveal that the failure of a single DC can significantly impact the entire supply chain, necessitating detailed risk analysis and enhanced coordination among DCs. The study also emphasizes the importance of optimization in reconfiguring the supply chain to maintain service levels during disruptions. This research offers practical recommendations for the Coffee Company, including the implementation of robust communication protocols between DCs and the use of advanced technologies like anyLogistix for predictive analysis and decision-making support. The results demonstrate that while disruptions pose significant challenges, they also provide opportunities to improve operational resilience and competitive advantage.

Keywords: Supply Chain, Resilience, Disruption, Simulation, Optimization

Dae Young Ryu (Sejong University), Young Kwan Ko (Sejong University), Young Dae Ko (Sejong University) and Byeong Ju Jo (Sejong University). *Dynamic Pricing Strategy in Hotel Industry Under Competitive Situation.*

Abstract. Pricing is an important factor that affects a company's long-term success, and room pricing plays a significant role in determining market share in the hotel industry. With the development of information technology, online travel agencies have made it easier for customers to get information about hotel room prices, leading to an increase in hotel room bookings. Customers booking through online travel agencies tend to be price sensitive, so the hotel industry needs to consider effective pricing. Meanwhile, room prices are influenced by various of factors, including the type of room and customer, and the expected demand for specific date. Decision makers in hotels try to maximize revenue from room bookings by continually adjusting prices and understanding how demand changes. Since the demand for hotel rooms varies stochastically due to previous price decisions, this research aims to study hotel room pricing strategies that account for the stochastic nature of demand. It is assumed that two different hotels aim to maximize their revenue in a competitive situation by determining room prices. To address this, stochastic dynamic games are adopted as a research methodology. This approach allows for the analysis of hotel room pricing strategies considering future demand and revenue changes resulting from current pricing decisions. It is expected to contribute significantly to the research on pricing strategies in the hotel industry.

Keywords: Game theory, Hotel pricing strategy, Uncertain information, Hotel revenue management, Stochastic demand

Hadwyn Chen (Macquarie University) and Peter Shi (Macquarie University). *Exploring the Innovative Side of Supply Chain 5.0 - A Human-centric, Sustainable, Resilient, Value-oriented, Global Implementable Supply Chain Finance Model.*

Abstract. Since the onset of the 2018 US-China trade war, the chaotic COVID-19 pandemic, the destructive 2022 Russian-Ukraine war, and the 2023 Israeli-Palestinian conflict, the past six years have been marked by continuous global disruptions. These events have eroded global economic stability, leading to heightened uncertainty and unpredictability. The world economy now grapples with high inflation accompanied by staggered deflation, prolonged interest rate hikes, geopolitical power struggles, the devastation of wars, energy and food crises, economic restructuring, and volatile currency fluctuations, which all lead to chaotic and significant supply chain disruptions. Structural shifts in global logistics, escalating tariffs, and ongoing technological conflicts, particularly the 'chip war,' have further destabilised the global economic order. This instability has stunted economic growth and unbalanced the international landscape.

The current global environment presents unprecedented challenges for businesses, policymakers, and individuals. These challenges hinder creating value, fostering development, and driving innovation. In response, a critical need has emerged for a cutting-edge, technology-driven, finance-empowered, and value-oriented approach to supply chain development and innovation, aligned with the human-centric, sustainable, and resilient principles of Supply Chain 5.0. To address this need, a qualitative exploratory study was conducted involving field investigations (including visits to factories, companies, ports, and banks) and interviews and discussions with a variety of interviewees from different perspectives, such as industry experts, corporate executives, and academics (a total of 30). This research led to the development of two models: a high-level Supply Chain 5.0 ecosystem model (Figure 1) and an implementable Supply Chain 5.0 model (Figure 2) at a lower and practical level, complete with corresponding theoretical concepts. The second model reveals and enables the realisation of the innovative and implementable digital transformation of the traditional supply chain into a 'FinTech-driven' and 'Finance-empowered' Supply Chain 5.0. It includes two core sub-models: the 'Air Banking System,' which represents the next-generation banking front-end operational system that crucially serves as the foundational core for digital innovation in supply chain finance, and the 'SPLI Loan System,' an entirely novel approach to FinTech-driven, human-centric supply chain finance.

The findings of this research, including the two models and their associated theoretical concepts, offer a novel perspective and provide a means for systematically examining the innovative approaches and digital transformations necessary for developing and realising the human-centric, sustainable, and resilient Supply Chain 5.0. These findings also lay the groundwork for future research into Supply Chain 5.0, encompassing its technologies, systems, practical viability, and global implementability. From both practical and academic perspectives, this study makes novel contributions to the field, potentially stimulating further research on this critical topic.

Keywords: Supply Chain Management, Supply Chain 5.0, Supply Chain Finance, Innovation, Digital Transformation, Supply Chain Competitiveness, Sustainability, Industry 5.0, Supply Chain Collaboration, Supply Chain Integration, Supply Chain Fraud and Anti-fraud

Takayuki Kataoka (Kindai University), Katsumi Morikawa (Hiroshima University) and Katsuhiko Takahashi (Hiroshima University). *MULTI-OBJECTIVE OPTIMIZATION MODELS TO MINIMIZE THE NUMBER OF OPERATORS IN LABOR-INTENSIVE CELLULAR MANUFACTURING.*

Abstract. Cellular manufacturing (CM) has been widely documented as one of the most popular resilient production systems by a large amount of literature. Generally, the literature has two main concepts: one focuses on machine-intensive cells, and the other on labor-intensive cells. Furthermore, focusing on the approaches in labor-intensive cells, recent papers mainly focus on mixed integer and integer programming models regarding various multi-phase approaches. The model constitutes the basis of their current research. The model maximizes productivity to achieve optimal operator and product assignment in labor-intensive cells. However, despite its shortcomings, some previous papers have adopted a hierarchical approach based on two phases. To overcome some shortcomings, the previous paper tackles solving products, operations, cells, and optimal operators simultaneously through numerical experiments. In this paper, considering multi-objective optimization models, the new proposed model is comprehensively compared with the 2-phase model. As a result, we show that the proposed model leads to fewer operators or fewer unit times than the 2-phase model comprehensively and sustainably.

Keywords: Mixed integer programming model, Multi-objective optimization model, Labor-intensive cellular manufacturing

Jin Yantong (Southwest Jiaotong University), Juanli Du (Xi'an Traffic Engineering Institute), Yanan Ma (Hebei Provincial Department of Commerce), Gang Wu (Southwest Jiaotong University), Yangyan Shi (Macquarie Business School, Macquarie University) and Chaozhe Jiang (Southwest Jiaotong University). *Multimodal Transport Route Optimization for Bulk Commodities in supply chain 5.0.*

Abstract. With the globalization of trade, optimizing multimodal transport has become a crucial strategy for enhancing supply chain efficiency. Based on the development trends of Supply Chain 5.0, it is essential to comprehensively consider transportation costs and transit times, while also incorporating carbon emission costs to reflect the sustainability of societal and environmental development under Supply Chain 5.0. A multimodal transport model is constructed within a complex network structure, utilizing Deep Reinforcement Learning to identify and adapt to changing conditions for optimal routing. A case study using iron ore serves as an example. The results demonstrate improved cost efficiency, and transit time, along with significant social and environmental benefits. This research offers a robust multimodal transport route optimization solution within the Supply Chain 5.0 framework, providing valuable insights for logistics planners, policymakers, and stakeholders involved in the international bulk commodity transport sector.

Keywords: Supply Chain 5.0, Multimodal Transport, Route Optimization, Deep Reinforcement Learning, Bulk Commodities

Zainal Abidin Zailani (Faculty of Mechanical Engineering & Technology, Universiti Malaysia Perlis (UniMAP), Arau 02600, Malaysia), Ha Xichen (Faculty of Mechanical Engineering & Technology, Universiti Malaysia Perlis (UniMAP), Arau 02600, Malaysia), Muhammad Salihin Zakaria (Faculty of Chemical Engineering & Technology, Universiti Malaysia Perlis (UniMAP), Arau 02600, Malaysia.) and Muhammad Firdaus Mohd Nazeri (Faculty of Chemical Engineering & Technology, Universiti Malaysia Perlis (UniMAP), Arau 02600, Malaysia.).
COMPARATIVE MICROSTRUCTURAL ANALYSIS OF ALUMINUM ALLOY 7075 UNDER DRY AND CHILLED AIR DRILLING CONDITIONS.

Abstract. Aluminum Alloy 7075 renowned for its high strength-to-weight ratio, is widely used in aerospace, automotive, and marine industries. However, during drilling, the machinability becomes challenging due to frequent tool changes, serious burr formation and poor chip evacuation. Additionally, the alloy is prone to microstructural changes that can compromise its mechanical properties. Traditional petroleum-based cutting fluids are used widely in machining processes to alleviate machinability problems, though effective, raise significant environmental and health concerns. To address this, the study explores eco-friendly alternatives, specifically dry and chilled air cutting in drilling process. The objective is to evaluate the impact of these cutting conditions on the microstructure and hardness of this material. The research employs advanced methodologies, including X-ray diffraction (XRD), scanning electron microscopy (SEM), and Vickers hardness testing, to analyze crystallinity, phase transformation, grain size, strain and residual stresss. Results showed that the application of chilled air cutting enhances crystallinity, refines grain structure, reduces strain, and improves hardness compared to dry cutting. These findings aim to optimize machining parameters, ensuring the preservation of material's properties while promoting environmental sustainability.

Keywords: Aluminum Alloy 7075, Drilling, Microstructural Analysis

Firouzeh Rosa Taghikhah (University of Sydney) and Junbin Gao (University of Sydney). *One-Class TabNet: A Deep Learning Architecture for Imbalanced Data in Energy Investment.*

Abstract. Community renewable energy (CRE) investment prediction faces challenges due to inherent class imbalance and complex decision-making patterns in real-world investor data. Traditional methods relying on balanced datasets and conventional classification models often fall short in scenarios with scarce potential investor data. To address these limitations, we propose One-Class TabNet, a new deep learning algorithm designed for binary classification in imbalanced tabular data. This algorithm learns exclusively from the majority class (noninvestors) to identify potential investors. By combining a tabular data processing architecture with contrastive learning and reinforcement learning-driven feature selection, our algorithm captures complex patterns in CRE investment behaviors without requiring balanced class distributions or extensive data augmentation. This approach aims to improve prediction accuracy for minority class samples in highly imbalanced datasets. We evaluate the effectiveness of One-Class TabNet on five benchmark dataset, comparing it against both classical algorithm-level methods (Weighted Random Forest, One-Class SVM) and data-level approaches (SMOTE and AC-GAN). Our experimental results demonstrate that One-Class TabNet outperforms these state-of-the-art methods across key performance metrics, including the Receiver Operating Characteristic (ROC) and Precision-Recall Area Under the Curve (PR-AUC).

Keywords: Imbalanced classification, Deep learning, Energy cooperation, Decision analysis, Clean energy

Kasinda Henderson (UNSW Canberra) and Ripon Chakrabortty (UNSW Canberra). *A Machine Learning Prediction Model for Bushfire Ignition and Severity: The Study of Australian Black Summer Bushfires.*

Abstract. Australian bushfires are catastrophic, and their impacts span social, economic, and environmental factors. To reduce the damages experienced by bushfires, predicting Australian bushfire ignition allows for an early warning system to give first responders and disaster managers prompt and accurate information. Traditional methods of bushfire ignition prediction suffer from incorporating large-dimensional data and take extensive computational time. Applying machine learning (ML) models enhances accuracy and reduces the computational time required to predict bushfire ignition. This study proposes a predictive model that can take meteorological and topographical data and determine the probability of Australian bushfire ignition and severity using historical fire detection gathered from the Black Summer Bushfire Disaster. The Black Summer Bushfire Disaster occurred between December 2019 and February 2020. The fires affected numerous towns throughout Victoria, New South Wales, and the Australian Capital Territory; hence, the varying topographical and meteorological conditions allow fire ignition and severity influences to be explored.

The proposed methodology incorporates Random Forest (RF), Support Vector Machine (SVM), Gradient Boosting Trees (GBT), Convolutional Neural Networks (CNN), and K-nearest Neighbour (kNN) Algorithms. The proposed method relies on five datasets. Meteorological data is sourced from the Bureau of Meteorology (BOM), Australia. Topographic data is sourced from Geoscience Australia and the National Aeronautics and Space Administration's (NASA's) Aqua and Terra satellites, which utilize a Moderate Resolution Imaging Spectroradiometer (MODIS). Active Fire Point Data is also sourced from NASA MODIS, which can detect fires. The proposed methodology aims to act as an early warning system by providing a fire occurrence and fire intensity warning map and the probability of fire occurrence and fire intensity depending on the current meteorological climate.

Keywords: Machine Learning (ML), Predictive Analytics, Australian Bushfire, Black Summer Disaster

Stephen Oguta (Durban University of Technology), Sunday Ojo (Durban University of Technology), Benard Maake (Kisii University) and Charles Oguk (Rongo University). *Expert Analysis of a Robotic Gamification Training Model for Climate Change Literacy for Green Innovation and Entrepreneurship.*

Abstract. This study addresses a critical limitation in current design of gamification systems for education: the lack of sustained learner engagement and motivation due to predictable extrinsic reward schemes. To overcome this, we developed and evaluated an innovative robotic gamification model for Climate Change Literacy for Green Innovation and Entrepreneurship (CCL4GIE), integrating random reward mechanisms and social robotics. The model, based on Self-Determination Theory, Behavioral Reinforcement Theory, and the MDA Framework, was implemented on Moodle with a Nao robot integration. Eleven experts evaluated the prototype, showing high agreement across all dimensions (90.9% mean agreement rate). The random badge system proved particularly effective in promoting long-term engagement (100% expert agreement), significantly outperforming traditional point systems ($Z = -2.236$, $p = 0.025$, $r = 0.48$). Results support the model's efficacy in fostering sustained motivation and engagement in climate change education. This study contributes to addressing the engagement decay in educational gamification, offering insights into leveraging unpredictability and robotics for long-term learner motivation. Future research should include longitudinal studies to further validate the model's long-term impact.

Keywords: Gamification, Robot prototype, Climate change, green innovation entrepreneurship, expert analysis

Yang He (Tianjin University) and Weihua Liu (Tianjin University). *The impact of logistics-manufacturing integration announcement on the stock market value: an Evidence from China.*

Abstract. In the context of the servitized transformation of manufacturing industry, the cooperation form of logistics manufacturing integration (LMI) has gradually emerged. However, little is known about the stock market value that LMI brings to companies. Therefore, the purpose of this paper is to empirically demonstrate the impact of LMI implementation on shareholder value. Using loose coupling and signaling theories, we establish a framework for analyzing the influencing mechanisms of stock investors' reactions to LMI announcements. Based on 124 LMI announcements from companies listed in China's A-share market, the study uses an event study methodology to assess the impact of LMI on shareholder value and analyses the long-term impact of LMI implementation on companies' operational performance. The study find that stock investors react positively to LMI announcements, especially from manufacturers, but that it could hurt company's operating performance in the long term. Some interesting results include that specific asset investments increase the stock market returns from LMI announcements and the company's operating income growth rate in the long term. Close partnerships and supply chain concentration negatively affect companies' stock market returns but reduce operating costs.

Keywords: Logistics, Manufacture, Integration, Event study methodology, Stock market

Mahmoud Awad (American University of Sharjah), Raghed Hamza (American University of Sharjah), Malak El-Farra (American University of Sharjah), Shahd Mahmoud (American University of Sharjah) and Layan Shadid (American University of Sharjah). *VEHICLE ROUTING OPTIMIZATION OF FLOWER TRANSPORTATION.*

Abstract. Cut flowers is a significant segment of the global logistics industry, transported through cold chains to maintain their freshness and quality. However, flowers face a considerable challenge as approximately 9% of last-mile deliveries to retailers and customers in waste due to poor quality during transportation, impacting profit margins and resource utilization. This project investigates vehicle routing within the cold supply chains of the cut flower industry and proposes a model for optimizing truck routes from main depots to retail centers, considering transportation, environmental, and quality factors. The methodology involved conducting interviews, performing a literature review, collecting data, and performing experiments to develop an accurate mathematical model. A loss function for flowers was developed through a full-factorial design of experiment. A formulation was developed on General Algebraic Modeling System (GAMS), and a small case study on a local flower distributor was ran. The model yielded a solution that was 25% cheaper than the distributor's current practice. However, there was a need for a heuristic as GAMS failed to converge in larger cases, so a Genetic Algorithm was developed on MATLAB that had a difference of 10% from the optimal solution and was 3000% faster at times. This model can be applied to many other commodities by altering the loss function

Keywords: Vehicle routing problem, Quality, Flowers, VRP-TW

Reda Ghanem (School of Systems and Computing, University of New South Wales, Canberra, 2600, ACT, Australia), Ismail M. Ali (School of Systems and Computing, University of New South Wales, Canberra, 2600, ACT, Australia), Kathryn Kasmarik (School of Systems and Computing, University of New South Wales, Canberra, 2600, ACT, Australia) and Matthew Garratt (School of Engineering and Technology, University of New South Wales, Canberra, 2600, ACT, Australia). *Comparative Analysis of Simulation Models for Evolving Robot Collective Motion in Industrial Coverage and Inspection Tasks.*

Abstract. This study presents a comprehensive comparative analysis of simulation approaches for optimizing the collective motion behavior of robot swarms, with a focus on industrial applications. We investigate the feasibility of bridging the simulation-reality gap by utilizing fast, low-fidelity simulators for parameter evolution, thereby enhancing the efficiency of real-world deployments. Our analysis examines the transferability of optimized swarm parameters derived from two low-fidelity simulators to a high-fidelity robot simulation environment. These low-fidelity simulators are employed to fine-tune motion parameters for both ground and aerial vehicle swarms addressing complex coverage problems. The results indicate that while the differential drive simulator requires significantly more time to generate parameters compared to the point-mass simulator, it yields superior swarming behavior and coverage performance across both robot types in high-fidelity simulations. This work highlights the potential for effective parameter transfer to real-world scenarios, paving the way for advanced applications in areas such as autonomous inspection, environmental monitoring, and search-and-rescue operations.

Keywords: Swarm Robotics, Simulation-Optimization, Genetic Algorithm, Complete Coverage Problems

Hyeseon Han (School of Industrial and Management Engineering, Korea University, 145 Anam-ro, Seongbuk-gu, Seoul 02841) and Byung Duk Song (School of Industrial Engineering, Korea University). *OPTIMIZATION OF URBAN AIR MOBILITY OPERATIONS CONSIDERING SHARED RIDING AND VERTIPORT CAPACITY.*

Abstract. Urban Air Mobility (UAM) is emerging as a transformative solution to urban transportation challenges, offering an innovative approach to reducing congestion and improving travel efficiency. This study focuses on optimizing UAM operations by considering both shared riding and vertiport capacity constraints. Specifically, we propose a novel mathematical model that incorporates multiple variables such as battery usage, vertiport availability, passenger waiting times, and fare structures for both direct and stopover routes. The proposed model includes a detailed exploration of different passenger groups, their travel demands, and the capacity of UAM vehicles, factoring in seat availability and battery life. Additionally, the model aims to maximize profit while minimizing penalties associated with unserved passengers.

Numerical experiments were conducted under various scenarios to assess the efficiency of our model. The results demonstrate that our optimization approach effectively reduces idle time for UAM vehicles and minimizes total travel time, while also balancing the needs of passengers requiring both direct and stopover routes. Furthermore, the study reveals significant potential for energy and time savings through shared rides, without compromising service quality. This research contributes to the growing body of work on UAM by providing practical insights into the operational challenges of shared riding and vertiport limitations. It offers a scalable solution that can be adapted to future UAM deployments, supporting more efficient urban mobility systems.

Keywords: Urban Air Mobility (UAM), Shared riding, Vertiport capacity, Direct and stopover route, Optimization model

Hasan Turan (The University of New South Wales) and Rym M'Halla (King's College London). *Artificial Intelligence Enabled Portfolio Design under Uncertainty.*

Abstract. We aim at modeling and solving a single-period portfolio design problem under uncertainty by incorporating the decision maker's risk behavior. The problem includes the selection of projects to invest among a finite set of available candidate projects, where the success of each investment is uncertain and there exists a budgetary limitation. We model the problem as a stochastic integer (binary) programming model. We incorporate the risk-attitude of the decision maker into the portfolio optimization model by conditional value-at-risk (CVAR) due to its capability of capturing the worst-case performance of an investment portfolio.

We use a meta-heuristic; namely Simulated Annealing (SA) algorithm, to efficiently and effectively search candidate investment portfolio options. SA starts from an initial solution and traverse neighbors of that point through predefined and well-chosen neighborhood structures to find an optimal value of the objective function. The order of the neighborhood structures used greatly affects the performance of SA. Thus, we use a deep reinforcement algorithm; namely Double Deep Q Neural Network (DDQNN), to find the optimal ordering and selection of neighborhood structures. In this presentation, we discuss the details of the proposed approach and provide computational experiments to test the integration of SA and DDQNN while considering the risk behavior of the decision maker.

Keywords: Portfolio optimization, Conditional value-at-risk, Simulated Annealing, Double Deep Q Neural Network

Amr Eldahshan (Engineers Australia). *TRANSFORMING SUPPLY CHAIN MANAGEMENT WITH ARITIFICAL INTELLGIENCE, MACHINE LEARNING, DEEP LEARNING, QUANTUM COMPUTING, AND CLOUD COMPUTING: INNOVATION FOR BOOSTING EFFICIENCY AND REINFORCING RESILIECNE IN AUSTRALIAN INDSUTRY 5.0.*

Abstract. Industry 5.0 explores the application and integration of technologies to add value to the Australian Supply Chain Management through human robotic collaboration and more personalization through AI, ML, QC, CC, DL and Block Chain technologies. Industry 5.0 technologies aim to improve data driven decision making, enhance efficiency, increase resilience, sustainability, personalization, mass customization, innovation and agility. Aiming to develop, grow, use all of the abundance of Supply Chain Management problems require developing more advanced algorithms, technological adjustments, computational power dynamics, and innovational applications. This paper explores challenges and gaps in the transition, application, and processes of Industry 5.0 and proposes solutions and pathways as a merit of adding value to the Australian Supply Chain. Transitional challenges like building trust, change management, and data handling. Strategizing suitable approaches will refine the wellbeing for a smoother transition into the next global industrial revolution. Scalability and wellbeing will be focused on through expansion of commercialization of accurate quantum level technologies that decrease error and improve accuracy relevancy. Observation advantages will be explored through the wellbeing implications of highlighting the importance of applications. Building an Australian reinforced and efficient 5th generation supply chain hones to practically apply skills that improve the wellbeing of the industries through stable fully capable supply chain management. This technology can expand into Manufacturing, delivery, and operations management. This will help in the industry by the human machine collaboration, workforce skills and training, standardization and improve interoperability. With major industry transitions and implementations, Quantum computing and major growth strategy offers the business an upper hand in transforming businesses into more adept, intelligent, and successful metrics. Industry benefits range from mass customization collaborative robots, blockchain, security, and sustainability.

Keywords: Machine Learning, Deep Learning, Quantum Computing, Cloud Computing, Innovation

Huiying Zhang (Tianjin University) and Honghong Jia (Tianjin University). *THE IMPACT OF DIGITAL INVESTMENT IN E-COMMERCE PLATFORMS ON SUPPLIER SOFTWARE SELECTION.*

Abstract. This study examines the impact of digital investment by e-commerce platforms on the software choices made by suppliers. Based on evolutionary game theory, a two-player evolutionary model between the platform and suppliers is developed. The factors influencing digital investment in supreme version software by platforms and the subsequent supplier selection between basic and supreme versions are analyzed. The effect of cost-sharing contracts on system equilibrium is also considered. Numerical simulations show that the initial level of digitalization, software usage fees, digital investment intensity, and the proportion of costs borne by suppliers significantly impact system equilibrium.

Keywords: E-commerce platforms, Digital investment, Cost-sharing, Evolutionary, Game theory, Supply chain

Md Shahin (School of Engineering & Technology, UNSW Canberra), Milad Ghasrikhouzani (School of Engineering & Technology, UNSW Canberra) and Ripon K. Chakrabortty (School of Systems & Computing, UNSW Canberra). *Post-Relocation Sustainable Transport Consumption Behaviour: A Machine Learning Method.*

Abstract. This study investigates the longitudinal impact of residential relocation on public transport consumption behaviour. Using data from the Household Income and Labour Dynamics in Australia (HILDA) survey from 2011 to 2022, we analyse how relocation affects public transport consumption over total transport consumption (PTCr). The study employs the XGBoost machine learning technique to capture temporal dynamics and identify critical determinants of PTCr, outperforming the statistical method of lagged regression. The findings reveal that lower education, older age, and longer post-relocation periods contribute to a reduced PTCr, while higher education, younger age, and shorter post-relocation periods positively impact PTCr. Additionally, physical health, social networks, and reasons for relocation (e.g., better life and access to public transport) also play a significant role in shaping post-relocation transport consumption behaviour. These insights provide a nuanced understanding of transport consumption dynamics, offering valuable guidance for policymakers to promote sustainable transportation practices and reduce greenhouse gas emissions.

Keywords: public transport, energy consumption, personality traits, relocation, machine learning

Md Mizanur Rahman (University of New South Wales), Faycal Bouhafs (University of New South Wales), Sayed Amir Hoseini (University of New South Wales) and Frank den Hartog (University of Canberra). *Feature Relevance for Detecting Address Resolution Protocol Spoofing in Smart Homes with Machine Learning.*

Abstract. The Internet of Things (IoT) has revolutionized smart homes but also makes smart homes vulnerable to cyber attacks. One such attack is the Address Resolution Protocol (ARP) spoofing-based Man-in-the-Middle (MITM) attack. This form of attack puts the integrity of communication at risk in smart home networks. Identifying ARP spoofing in these settings is essential to maintain user security and privacy. Unfortunately, there is a lack of detection methods for ARP spoofing attacks in smart homes. Recent Machine-Learning (ML)-based detection techniques have severe limitations when applied to such environments: they were developed based on a single dataset typically originating from a single lab testbed mimicking a single home, whilst implicitly assuming applicability of the results to smart homes in general. We found that this assumption is incorrect: the performance of ML varies quite significantly from dataset to dataset and between algorithms. From an in-depth analysis of feature importance and impact on the outcomes of the algorithms, we conclude that only a very specific set of features is responsible for the lion share of the algorithms' performance. We, therefore, recommend that future smart home datasets to be used for training artificially intelligent detection techniques for ARP-spoofing in smart homes in general are sourced using a limited but standardized set of features as laid out in this paper, and use XGBoost as the algorithm of choice.

Keywords: Smart home, Internet of Things (IoT), ARP spoofing, Machine learning, MITM attack

Himanshu Gupta (Indian Institute of Technology (Indian School of Mines) Dhanbad) and Rishabh Sharma (Indian Institute of Technology (Indian School of Mines) Dhanbad). *SYNERGIZING HUMAN AND MACHINE CAPABILITIES: ENHANCING HUMAN-CYBER-PHYSICAL INTERACTIONS FOR GRID COMPLIANCE IN SMART MANUFACTURING.*

Abstract. The rapid progression of transformative technologies, including artificial intelligence (AI), the industrial Internet of Things (IIoT), big data analytics, and digital twin (DT), is revolutionizing smart manufacturing and reshaping human roles and interactions. This study focuses on Human-Cyber-Physical Systems (HCPS) within the GRID (Green, Resilient, and Inclusive Development) framework to enhance human-cyber-physical interactions. The importance of integrating human-centric approaches in smart manufacturing is underscored, emphasizing sustainable practices, system resilience, and inclusivity. Using the Best-Worst Method (BWM) and Interpretive Structural Modeling (ISM), this research evaluates and ranks key factors affecting HCPS. Stakeholder Engagement via Virtual Collaboration Platforms (SEVC) emerged as a crucial independent variable, highlighting the importance of collaborative decision-making. Other significant factors include sustainable material usage, adaptive supply chains, and robust energy management systems. The ISM analysis structured these factors into a six-level hierarchy, revealing their dependencies and driving powers. MICMAC (Cross-impact matrix multiplication applied to classification) analysis further categorized these factors based on driving and dependence power, offering insights into their interdependencies. The results emphasize the critical role of inclusive and collaborative practices, sustainable materials, adaptive supply chains, and efficient energy management in enhancing HCPS. These insights guide practitioners and policymakers in prioritizing efforts to promote sustainable, resilient, and inclusive manufacturing practices.

Keywords: Human-Cyber-Physical Systems (HCPS), GRID, BWM, ISM, MICMAC

Jiaqi Zhang (Tianjin University), Liangxing Shi (Tianjin University), Zhen He (Tianjin University) and Dennis Lin (Purdue University). *A multivariate EWMA scheme using an improved continuous ranked probability score under data-rich environment.*

Abstract. The development of new technologies has made it more common to acquire a large amount of data in a short period, and how to effectively utilize these data for process control is crucial for quality assurance. However, limited research focuses on multivariate monitoring schemes in data-rich environments, potentially hindering monitoring efficiency. Therefore, this study introduces a multivariate non-normal joint control scheme to simultaneously detect location and scale parameters. The scheme integrates continuously ranked probability scores (CRPS) with exponentially weighted moving average (EWMA) to design the statistics of the scheme, effectively capturing the shape of the cumulative empirical distribution and quantifying quality loss between sample characteristics and target values. The scheme's in-control and out-of-control performance is investigated through simulation. The results indicate that the proposed scheme is sensitive to small location and scale shifts. It performs robustly when the sample size increases. Comparative simulations highlight its superiority over two existing multivariate non-normal schemes. Finally, three real-world examples from the manufacturing industry illustrate the scheme's practical efficacy.

Keywords: multivariate joint monitoring chart, non-normal, CRPS, EWMA

Liangxing Shi (Tianjin University), Jiaqi Zhang (Tianjin University), Yingdong He (Tianjin University) and Zhen He (Tianjin University). *Sampling recommendation for product-quality-level prediction.*

Abstract. The imbalanced nature of product-quality-defect data hinders the performance of product-quality-level prediction. Many sampling methods have been proposed to deal with the imbalance problem. The performance of each sampling method varies depending on the characteristics of different datasets. However, few studies have considered dataset features to recommend sampling methods under product-quality imbalance data, which may lead to poor subsequent prediction of product-quality levels. This paper, therefore, proposes a new method called the continuous ranked probability score and collaborative-filtering-based sampling recommendation (CRPS-CFSR), which emphasizes mining data-distribution differences to recommend better sampling methods for the dataset. First, we developed an improved dataset-similarity metric, CRPS2, which measures the distance between data distributions within two datasets. CRPS2 can be used in cases where product-quality data are non-normal and nonparametric, which is more common in practice. Second, we combined a user-based collaborative-filtering algorithm with CRPS2 to recommend a sampling method for the dataset. This algorithm first tests the effectiveness of current sampling methods in classifying quality levels using historical datasets, and then it utilizes sampling method performance metrics and data similarity to make recommendations. Third, the proposed CRPS-CFSR method was evaluated on 12 product-quality datasets from the UCI repository; the results show that the CRPS-CFSR method had advantages over two existing benchmark algorithms and that the method matched the optimal sampling method with a higher probability.

Keywords: Quality-level prediction, sampling method, CRPS, collaborative filtering

Bijan Jamshid-Nejad (Central Queensland University) and Samira Alvandi (University of Technology Sydney).
AN INTELLIGENT SIMULATION MODEL FOR FLOW SHOP SEQUENCING.

Abstract. This study presents an intelligent simulation model for permutation flow shop sequencing of 20 jobs with 5 machines. Reinforcement learning (RL) has been used as a metaheuristic to evaluate and identify optimal heuristic sequencing rules. The model is flexible and can be applied for different sequencing problems with minor programming modification. The RL-based metaheuristics compares 11 sequencing rules to find the best sequencing heuristics. The results demonstrate that heuristics based on shortest processing times outperform other heuristics. Among those high-performing heuristics, the sequencing rule based on shortest processing times of the first two machines generates minimum average makespan in the shortest simulation time. The paper emphasizes the necessity for future investigations to repeat this study for other sequencing and scheduling problems like job shop environments. Overall, this research contributes valuable insights into the application of reinforcement learning algorithms in sequencing, addressing the complexities of modern production systems.

Keywords: Simulation, Flow Shop, Sequencing, Reinforcement Learning

Zahra Namazian (PhD Candidate in Data Science and AI at Monash University, OPTIMA), Peter Stuckey (Data Science and AI at Monash University, OPTIMA) and John Betts (Data Science and AI at Monash University, OPTIMA). *New Product Demand Forecasting for Beauty Retail using Seasonality.*

Abstract. Accurate demand forecasting is a critical task for retailers to efficiently meet customer demand.

However, predicting demand for new products during their launch period is a major challenge, as retailers often lack historical data or clear indicators of customer preferences.

This challenge is made more complicated by high variability in demand, the influence of social media, marketing strategies, and the timing of the product's launch within the retail calendar. Although the demand trajectory of comparable products launched recently may offer some useful insights, identifying these products is often difficult and time-consuming. To address these challenges, we propose a novel system for new product demand forecasting that estimates a product's demand trajectory over its launch period. Our method predicts new product demand over their launch period using gradient boosting trained on the aggregate demand of a cluster of products having a similar

demand profile. Seasonal effects are integrated to further improve accuracy. Unlike traditional methods that rely on manual or heuristic-based selection, our model assigns new products to predicted clusters based on their features, producing representative demand trajectories drawn from these clusters. Experimental results from our real-world case study shows that this approach outperforms forecasts by human experts, reducing both forecasting costs and the operational expenses associated with managing forecast errors. This model proves to be highly effective for retailers with various seasonal demand patterns, offering a scalable and data-driven solution for managing new product launches.

Keywords: New product forecasting, Product Demand trajectory, Seasonality, Demand prediction

Lusheng Shao (The University of Melbourne) and Jayashankar Swaminathan (University of North Carolina at Chapel Hill). *USING FEED SUPPLEMENTS TO CURB LIVESTOCK METHANE EMISSIONS?* .

Abstract. Feed supplements have recently been touted as an effective means to reducing methane emissions from livestock (e.g., cattle and sheep). In this paper, we examine the environmental implication of this innovation in a supply chain setting. We develop a parsimonious game theoretical model to study a farmer's production and adoption decisions and the manufacturer's pricing decision for the supplement. We find that the use of feed supplement may have unintended consequences because it could incentivize the farmer to increase the livestock production quantity, resulting in more methane emissions. Although reducing the feed supplement's production cost (e.g., R&D grants) incentivizes more adoption of the supplement, the total methane emissions may be higher. Similarly, providing financial incentives to farmers for methane emission reductions (e.g., carbon credits) may cause more damages to the environment. We extend our model to a competitive setting with two symmetric farmers and demonstrate that these findings are robust in this setting. These results vanish when the farmer does not strategically adjust its livestock quantity, thereby highlighting the important role of endogenizing the farmer's production decision when examining the effectiveness of feed supplement in curbing methane emissions. Our findings also caution that government support to the manufacturers for production cost reductions (or to the farmers for cutting methane emissions) may backfire from the environmental perspective.

Keywords: methane emissions, livestock production, feed supplement, sustainable agriculture

Juan Huang (Shanghai Normal University) and Zhe Gao (Shanghai Normal University). *Digital Intelligence Based Classical Ballet Education, A Future Possibility.*

Abstract. This paper explores and provides a prospect for the potential of digital intelligence (data science and artificial intelligence) technologies in era of digitized society to empower the foundational training in classical ballet education. Focusing on the key aspects and challenges in current classical ballet education in Chinese dance academy, we propose an intelligent course design in four sequential steps to build a comprehensive classical ballet curricular system with advanced digital intelligences. First, virtual stage with intelligent perception and simulation modules are adopted to enhance students' stage performance by providing a real performance scene during classroom and to improve their aesthetical sensitivities. Second, wearable sensing devices are under development with the dancing clothes together to monitor, recognize and modify the real time in situ students' dance movements and muscle practices for a high standardized instruction in accordance with the so-called classical levels. Third, Generative AI (GenAI) with large language models specified in acoustic and image processing are introduced into both the classroom and extracurricular instructions to inspire the innovative integration of music and movement for a better choreography and for a chance of self-learning. Fourth and finally, a teaching experimental platform equipped with multimodal data reception and processing techniques will be created. This platform can breakthrough limitations spatially and temporally and therefore improve the teacher-student interaction for a more sustainable comprehensive instruction. We practiced our system with digital intelligences of movement monitoring system and GenAI techniques in the fundamental ballet movement class for sophomore students in dance department of Shanghai Normal University. Critical indices of music rhythm, stage performance, dance skill, movement standardization, content completeness, harmony of dance and music, and humanity interpretation were compared between the experimental class taught in our system and the class taught in traditional methods. Students with the new system outperforms in all seven indices, displaying the strength of our proposed system. In summary, we believe, with our proposed curricular system equipped with advanced digital intelligences, we can provide a great opportunity for classical ballet education for both teachers and students, help them breakthrough the old limitations, transcend the education instruction spatially and temporally, inspire the motivations of self-education and self-innovation, and eventually help the performance art of Ballet Dance itself in the new digitized era.

Keywords: Data and intelligence, virtual stage, wearable devices, data science, generative artificial intelligence, multimodal data, classical ballet education, dance choreography, dance movement, stage performance, classroom and curricular system