



AAMSA

The Asian Association of Management Science and Applications

PROGRAM & ABSTRACT PROCEEDINGS OF ACMSA 2023

The 7th Asian Conference of Management Science and Applications



Okinawa, Japan

December 15-17, 2023

Supported by: Japan Industrial Management Association (JIMA)
The Operations Research Society of Japan (ORSJ)
Japan Society for Production Management (JSPM)
Consortium for Supply Chain & Operations Management (CSUPOM)

CONTENTS

Conference Chairs & Committees

Conference Theme

Preface

Conference Program

Parallel Session Schedule

Abstracts

Conference Chairs & Committees

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Organized Session Chairs

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Takashi Hasuike (Waseda University)

Conference Theme

“Engineering Management Science and Applications Pioneering Sustainable Future”

ACMSA2023 is to provide a forum for exchanging the latest research results related to management science and its applications pioneering Sustainable Future among researchers and practitioners within and beyond the Asian region. ACMSA2023 will host general sessions, special sessions, and an industry-academia collaboration forum.

Topics include:

- Accounting / Finance / Finance Engineering
- Computational Intelligence
- Decision Making / Analysis / Support Systems
- Enterprise Information System / ERP
- Environmental Technology and Management
- Facilities Design and Location
- Green Design / Green Manufacturing
- Human Factor / Industrial Ergonomics
- Human Resource Management
- Information Systems & Data Mining
- Inventory Systems and Management
- Logistics / Logistics Information System
- Management Science Education
- Manufacturing / Industrial Engineering
- Management Information Systems
- Marketing
- Operations Management
- Operations Research
- Optimization / Soft Computing / Meta-Heuristics
- Product Design / Product Development
- Productivity and Business Strategies Service
- Service Management
- Supply Chain Management
- Systems Design, Planning and Control
- Systems Engineering and Management Systems Simulation
- Project Management
- Quality Engineering / Quality Management
- Risk Management
- Technology Management
- Transportation Planning and Management
- Traffic Safety / High Speed Railway
- Uncertain Programming / Uncertainty Theory

Preface



Prof. Dr. Takahiro Ohno

Waseda University, Japan

Research Director of Institute of Value Creation Management,
Director of Japan Association for Management Systems,
Former President of Japan Industrial Management Association

Greeting Message

As you know, ACMSA, organized by AAMSA, has brought together many outstanding researchers in the field of management science in the Asian region. Researchers have gathered to share their research results, engage in discussions, disseminate research results that contribute to human development, and share insights gained during ACMSA discussions to generate valuable research results for the future. It is believed that the ACMSA 2023 will fulfill such a mission.

Today's globalized society respects diversity in both social structures and individual perspectives. This diversity has led to more complex and challenging issues, compared to solving problems based on a single set of values. The variables to be considered in these issues, such as the multitude of factors involved in the SDGs, have become increasingly diverse. The relationships between these variables have also become highly complex. From this perspective, the role that management science plays in the healthy development of humanity and society, especially in the context of this conference, is becoming more significant and extensive. Models constructed to solve problems are evolving into complex and large-scale structures.

The theme of this conference, "Engineering Management Science and Applications Pioneering Sustainable Future," is well suited to the current era. Many outstanding researchers who resonate with the theme will present their research results and promote forward-looking discussions that will be of great benefit to people around the world.

Okinawa was chosen as the venue for this event. Blessed with abundant natural resources, Okinawa faces the significant challenge of harmonizing human life with nature. It also faces economic development and geopolitical challenges, making it a microcosm of the diverse global society. Hosting ACMSA in this place is symbolic, providing a reflective space to consider the areas, challenges, and directions that management science should focus on. Integrating these perspectives in the midst of this beautiful nature and landscape will undoubtedly enrich the discussions.

Finally, after a four-year hiatus due to the COVID-19 pandemic, the ACMSA 2023 provides a valuable opportunity for researchers to present the results they have cultivated. I hope that each presentation venue will be filled with blossoming ideas, leading to the overall success of the conference. Thank you very much.



Assoc. Prof. Dr. Jing Sun

Nagoya Institute of Technology, Japan

Conference Chair of ACMSA 2023,
President of Asian Association of Management Science and
Applications

Welcome Message

It is our great pleasure and honor to welcome you to the Asian Conference of Management Science and Applications 2023. Welcome to Okinawa, Japan!

ACMSA2023 is organized by AAMSA (Asian Association of Management Science & Applications). Our AAMSA has organized many international conferences and workshops, and this conference would be the seventh one of ACMSA series, which is first time held in Japan. This conference is also supported by Japan Industrial Management Association (JIMA), Japan Society for Production Management (JSPM), The Operations Research Society of Japan (ORSJ), Consortium of Supply Chain & Operations Management (CSUPOM) of USA.

Today, the world is facing with a lot of new management problem and issues because of the coronavirus pandemic. In this background, ACMSA2023 is expected to contribute to provide a face-to-face forum, for exchanging the latest research results related to management science and its applications pioneering sustainable future, among researchers and practitioners within and beyond the Asian region.

In this conference, we are great honor to be able to invite three worldwide well-known keynote speakers: Prof. Taeho Park from San Jose State University, USA. Prof. Chen-Fu Chien from National Tsing Hua University, Taiwan, Prof. Kin'ya Tamaki from Aoyama Gakuin University, Japan.

We would like to express my deeply appreciation to the five Special Session Chairs, three Industry-Academia Collaboration Forum Chairs, two Organize Session Chairs and all the authors for their enormous contributions to our ACMSA2023.

I would also like to thank so much the international committee for their kindly support, program and organizing committee members for their tireless efforts to make the conference successful. Without their contributions, this conference would not have been possible.

Finally, we hope all of you will enjoy this excellent event and have a wonderful time in this beautiful city!



Prof. Dr. Yasutaka Kainuma

Tokyo Metropolitan University, Japan

President of Japan Industrial Management Association (JIMA)

Welcome Message

Dear ACMSA2023 participants:

It is a great pleasure that I welcome you to the 7th Asian Conference of Management Science and Applications in Okinawa and to hold this conference face to face for the first time in four years. JIMA has been a co-sponsor since the 1st conference in 2011 and JIMA is pleased to be able to support this conference, which is getting bigger and becomes more active with each conference.

The conference theme “Engineering Management Science and Applications Pioneering Sustainable Future” places engineering management in the center stage to address the challenges in the scientific research on global sustainable development. The breadth of this conference is apparent with the topics that include environmental technology management, operations management, supply chain management, systems design etc. Equally compelling, the methodological breadth of this conference is evident from the topics on empirical research as well as modelling and econometrics. Overall, this conference presents a broad view of management science and how the field responds to global challenges.

Lastly, it is you, the conference participants, who make the conference an exceptional experience. I look forward to having people from all over the world discuss the state, future, and possibilities of management science in the new COVID era in Okinawa.

Keynote Speakers



Prof. Dr. Taeho Park

San José State University, USA

Director of the School of Global Innovation and Leadership,
Director of Silicon Valley Center for Operations and Technology
Management

Topic: Supply Chain Risk Management in the Management Science

Keywords: Supply Chain, Risk Management, Management Science.

Abstract: Management science aims to support decision makers in reaching optimal solutions for given problems through the application of scientific methodologies. A wide range of scientific techniques, including mathematical programming, simulation, and risk analysis, have been developed to address complex challenges within various organizational sectors. Many industry-related issues are characterized by vague definitions, a mix of structured and unstructured constraints, the presence of stochastic variables and decision processes, a multitude of optimal or near-optimal solutions, and a need for the incorporation of decision maker preferences and insights. Despite the development of numerous management science (MS) tools, industries have encountered challenges in integrating these tools and techniques into their decision-making processes under uncertain environments with surrounding risks.

Supply chain systems modelled using various MS tools for the business must deal with increased market fluidity in global supply chains as a result of global sourcing and globalized markets. In today's environment, supply chain disruptions are more common than ever, ranging from supplier/buyer uncertainty, political upheaval, and technical disruptions to natural disasters, pandemics, and so on. As shown during the COVID-19, risks surrounding business supply chains have become increasingly global, growingly complicated, and even impacting global economy. A supply chain must not only deal with numerous uncertainties, but also return to normalcy within a reasonable time window, or even improve to a better state than before, as it recovers from risk occurrences. Thus, supply chain risk management of mitigating supply chain risks and sustaining supply chain resilience involves several risk stages: risk identification, risk assessment, risk management, and business continuity management. The plethora of supply chain risk research built up a substantial repository of theories. But there is still work to be completed. Risks were individually categorized in existing literature, however, need to be managed under a relational structure that connects risk categories into an organic entirety. Occurrence of one risk often led to rippling effects that triggered or precipitated other risks to manifest. So, assessing risks individually could be misleading or misunderstanding the scale, magnitude, and scope of risk events. Risk vulnerabilities often struck together, and their impacts are entangled. Thus, this presentation emphasizes needs for a systematic and structural study of the risks and their inter-relationships.

Keynote Speakers



Prof. Dr. Chen-Fu Chien

National Tsing Hua University, Taiwan

Executive Vice President of National Tsing Hua University,
President of Asia Pacific Industrial Engineering & Management
Systems Society (APIEMS),

Director of the Artificial Intelligence for Intelligent Manufacturing
Systems (AIMS) Research Center

Topic: Smart Semiconductor Manufacturing and Industry 3.5 and Blue Lakes Strategy for Holistic Migration

Keywords: Industry 3.5, Blue Lake Strategy, Smart Manufacturing

Abstract: Focusing on realistic needs to empower smart production for semiconductor manufacturing, we have conducted many empirical studies with leading companies as semiconductor industry has been migrating for advanced technologies driven by Moore's Law. Global Manufacturing networks are facing disruptive challenges due to new technologies and solutions such as Big Data, Internet of Things, artificial intelligence, Cloud, and multimode sensors, in which the paradigms of production and service are shifting. Semiconductor business ecosystem has been migrated for coevolution with fast clock speed. Indeed, Industry 3.5 was proposed as a hybrid strategy between the existing Industry 3.0 and to-be Industry 4.0 to address fundamental objectives for smart manufacturing while employing artificial intelligence and big data analytics as disruptive innovations under the existing infrastructure. In addition, this study aims to propose "Blue Lakes Strategy" that is more practical and feasible for sustainable manufacturing, while Blue Ocean Strategy was proposed to simultaneously strive for differentiation and low cost via creating a new uncontested market and new demands. For validation, this speech will introduce a number of empirical studies to illustrate Industry 3.5 and Blue Lakes Strategy. Furthermore, collaborative research with leading semiconductor manufacturing companies for employing smart manufacturing solutions for sustainability and circular economy will be used for digital transformation and smart sustainable manufacturing. This talk will conclude with discussion of the implications of Industry 3.5 and Blue Lakes Strategy as effective alternatives to empower healthy business ecosystem for the ongoing industrial revolution.

Keynote Speakers



Prof. Dr. Kin'ya Tamaki

Aoyama Gakuin University, Japan

Director of SDGs and Circular Economy Partnership Institute,

President of Aoyama Human Innovation Consulting Inc., Taiwan

Topic: International and Japan Trend Researches on Circular Economy (CE) CE International Standard, CE Policy, and Case Studies of Advanced CE Companies: Research Framework of New Theories and System Techniques for CE-Oriented Sustainability Management

Keywords: Circular Economy (CE), SDGs, CE International Standard (ISO), CE Trend Research, CE Theory and System Technique

Abstract: In the past, the Japanese manufacturing industry was primarily based on the business model of merely selling end products to the market and on the 3R tactics (reuse, reduce, and recycle) for to follow up on waste disposal. "Target 12.3: Food Loss Reduction" and "Target 12.5: Waste Reduction" included in "SDGs (Sustainable Development Goals) Goal 12: Producer and Consumer Responsibility" are related to the circular economy (CE); Target 12.5 stipulates that the targeted social issues should be resolved on a global scale by 2030. The European Union's (EU) CE Commission has defined CE as follows: "CE is an economic policy that will enhance new competitiveness by creating new business opportunities and innovative and efficient production methods and consumption styles, protecting companies from resource depletion and price volatility".

Our research theme was selected as "development, empirical research, and dissemination of new theories and system techniques of the circular economy (CE) to meet the SDGs Goal 12: Producer and Consumer Responsibility" (Principal investigator: Kin'ya Tamaki, for Grant-in-aid for Scientific Research, Basic research (B), from 2022 to 2025, Japan). The first research purpose is to explore how to proceed international trend research concerning CE international standard (ISO), CE policies in each area and country (Japan, EU, USA), and case studies of advanced CE companies in each industry such as automotive sector, electrical and electronics, construction, agriculture and food, chemicals and materials, and software and platforms. The second research purpose is to delineate the research framework and to research and develop five new theories and system techniques for CE-oriented sustainability management as described below:

- (1) CE multi-generational value chain management (CE-VCM)
- (2) Cyclical resource supply and resource collection
- (3) CE product planning and digital marketing
- (4) Smart product and service lifecycle design
- (5) Sharing platform and application software compatible with CE-VCM

Conference Program

The 7th Asian Conference of Management Science and Applications (ACMSA 2023)
December 15-17, 2023, Okinawa, Japan

December 14th (Thursday)	
18:00-20:00	Registration
December 15th (Friday)	
08:00-09:00	Registration
09:00-10:20	Parallel Sessions 1A, 1B, 1C 2F - Room: MIYARABI (A) (B) (C)
10:20-10:30	Coffee Break
10:30-11:50	Parallel Sessions 2A, 2B, 2C 2F - Room: MIYARABI (A) (B) (C)
11:50-13:00	Lunch Break Okinawa Kariyushi Beach Resort Ocean Spa, 1F - The DINING Danryu-Mansai
13:00-13:15	Opening Ceremony 3F - Room: NIRAI KANAI, Chaired by Dr. Kotomichi Matsuno (Waseda University)
	Greeting Message Prof. Dr. Takahiro Ohno (Waseda University) Research Director of Institute of Value Creation Management, Director of Japan Association for Management Systems Former President of Japan Industrial Management Association
	Welcome Message Prof. Dr. Jin Sun (Nagoya Institute of Technology) President of The Asian Association of Management Science and Applications, Chair of ACMSA 2023
13:15-14:05	Keynote Presentation (I) 3F - Room NIRAI KANAI, Chaired by Prof. Dr. Yong Yin (Doshisha University)
	Keynote Speaker 1 Prof. Dr. Taeho Park (San José State University) Director of the School of Global Innovation and Leadership Director of Silicon Valley Center for Operations and Technology Management
14:05-14:20	Coffee Break
14:20-15:10	Keynote Presentation (II) 3F - Room NIRAI KANAI, Chaired by Prof. Dr. Yu Song (Fukuoka Institute of Technology)
	Keynote Speaker 2 Prof. Dr. Chen-Fu Chien (National Tsing Hua University) Executive Vice President of National Tsing Hua University, President of Asia Pacific Industrial Engineering & Management Systems Society (APIEMS), Director of the Artificial Intelligence for Intelligent Manufacturing Systems (AIMS) Research Center
15:10-16:00	Keynote Presentation (III) 3F - Room NIRAI KANAI, Chaired by Prof. Dr. Masahiro Arakawa (Nagoya Institute of Technology)
	Keynote Speaker 3 Prof. Dr. Kin'Ya Tamaki (Aoyama Gakuin University) Director of SDGs and Circular Economy Partnership Institute, President of Aoyama Human Innovation Consulting Inc.
16:00-16:15	Coffee Break
16:15-17:55	Parallel Sessions 3A, 3B, 3C 2F - Room: MIYARABI (A) (B) (C)

December 16th (Saturday)	
09:00-10:20	Parallel Sessions 4A, 4B, 4C 2F - Room: MIYARABI (A) (B) (C)
10:20-10:30	Coffee Break
10:30-12:10	Parallel Sessions 5A, 5B, 5C 2F - Room: MIYARABI (A) (B) (C)
12:10-13:00	Lunch Break Oriental Hotel Okinawa Resort & Spa, 2F - Qwachi
13:00-14:20	Parallel Sessions 6A, 6B, 6C 2F - Room: MIYARABI (A) (B) (C)
14:20-14:30	Coffee Break
14:30-15:50	Parallel Sessions 7A, 7B, 7C 2F - Room: MIYARABI (A) (B) (C)
15:50-16:00	Coffee Break
16:00-17:00	Parallel Sessions 8A, 8B, 8C 2F - Room: MIYARABI (A) (B) (C)
17:00-18:00	Break
18:00-20:00	Conference Dinner and Award Ceremony 3F - Room NIRAI KANAI, Chaired by Prof. Dr. Jing Fu (Fukuoka Institute of Technology)
	Greeting Message Prof. Dr. Yanwen Dong (Fukushima University) Vice-President of AAMSA, Co-chair of ACMSA 2023 Okinawan Entertainment Performance Award Ceremony Prof. Dr. Chunhui Xu (Chiba Institute of Technology) Organizing Committee of ACMSA 2023
December 17th (Sunday)	
09:00-10:20	Parallel Sessions 9A, 9B, 9C 2F - Room: MIYARABI (A) (B) (C)
10:20-10:30	Coffee Break
10:30-11:50	Parallel Sessions 10A, 10B, 10C 2F - Room: MIYARABI (A) (B) (C)
End of ACMSA 2023	

Parallel Session Schedule

Parallel Session Schedule

December 15th (Friday)

December 15th (Friday)	
09:00-10:20	Session 1A: General Session, 2F - Room: MIYARABI (A) Business and Economic Decision-making Session Chair: Ryuta Takashima (Tokyo University of Science), Makoto Goto (Tokyo University of Science)
09:00-09:20	Yuto Kitamura , Makoto Shimoshimizu, Makoto Goto and Yuan Tian. American Pandemic Options: Premiums and Greeks
09:20-09:40	Yutaro Oga , Ryuta Takashima and Kazuya Ito. Investments in Corporate Social Responsibility: A Real Options Approach
09:40-10:00	Lixuan Zhou , Ayuko Komura and Hirohisa Hirai. Relationship between Earnings Briefing Transcripts' Tone and the Reaction of Financial Markets for Chinese Listed Companies
10:00-10:20	Jin Zhang , Takuya Tajima and Takehiko Abe. A Study on Detection Method of Falling Symptoms: Fall Prediction in the Behavioral Patterns of Elderly People by LSTM Using Accelerometers

09:00-10:20	Session 1B: General Session, 2F - Room: MIYARABI (B) Business and Economic Analysis Session Chair: Naoki Watanabe (Nagoya City University), Kao-Yi Shen (Chinese Culture University)
09:00-09:20	Kazuya Ito and Ryuta Takashima. An Economic Evaluation of Grid Interconnection between Central Asia and Neighboring Regions
09:20-09:40	Hideaki Sakawa and Naoki Watanabe. Impact of COVID-19 Travel Subsidies on Stock Market Returns: Evidence from Japanese Tourism Companies
09:40-10:00	Kao-Yi Shen . Multiple-Rules-Based Approach to Explore Corporate Governance: A Case Study from Taiwan

09:00-10:20	Session 1C: General Session, 2F - Room: MIYARABI (C) Management Science and Technology Session Chair: Oleg Komlik (College of Management Academic Studies), Masaru Ishioka (Fukushima University)
09:00-09:20	Mayato Hattori , Kotomichi Matsuno, Terumasa Matsuyuki, Kenta Nakagawa, Yoshikuni Edagawa and Takahiro Ohno. Visualising Individual and Group Effectuation Degree Co-evolution in Group Discussions
09:20-09:40	Eriko Saito and Takahiro Ohno. The Social Capital and Vocational Readiness of Female Students Cultivated in Japanese Women's University -Their Respective Transformation Processes and Relationship -
09:40-10:00	Oleg Komlik . Global Virtual Teams: Leveraging Scholarly Insights to Managerial Applications
10:00-10:20	Yusuke Maruyama and Masaru Ishioka. Designing Knowledge-Sharing Organization for Ambidexterity

10:30-11:50	Session 2A: General Session, 2F - Room: MIYARABI (A) Management Science and Technology Session Chair: Takuya Tajima (Fukuoka Institute of Technology), Yu Song (Fukuoka Institute of Technology)
10:30-10:50	Haojie Liu , Zhaoyang Liu, Hanlin Liu, Xiaodong Liu, Cheng Li and Yu Song. An Integrated Model for Staff Scheduling for Multi-Task Call-Centers
10:50-11:10	Souto Yoneda and Masahiro Arakawa. Development of an integrated GA and PSO scheduling method considering the skill level of the workers
11:10-11:30	Zhaoyang Liu , Yu Song, Haojie Liu, Cheng Li, Hanlin Liu and Xiaodong Liu. Solving Daily Shift Scheduling Problems in Multi-task Call Centers using Quantum Computer
11:30-11:50	Fumiya Ishizu and Takuya Tajima. A study of optimizing the preparation control process for brewing with image determination using CNN

10:30-11:50	Session 2B: Special Session, 2F - Room: MIYARABI (B) Game Theory and Resilient Financial Networks Session Chair: Frank Page (London School of Economics and Political Science)
10:30-10:50	Jing Fu , Frank Page and Jean-Pierre Zigrand. A Building Block of Systemic Risk: Short-term Financial Networks
10:50-11:10	Yiwei Zheng and Yu Deng. Digital information disclosure, investor sentiment, and corporate default risk
11:10-11:30	Jing Fu , Frank Page and Jean-Pierre Zigrand. Strategic Financial Networks, Equilibrium Dynamics and Endogenous Systemic Risk
11:30-11:50	Jean-Pierre Zigrand . Common Knowledge, Coordination and Rational Limits to Arbitrage

10:30-11:50	Session 2C: General Session, 2F - Room: MIYARABI (C) Sustainable Production and Operations Management Session Chair: Yong Yin (Doshisha University), Jiahua Weng (Kanagawa University)
10:30-10:50	Atsuya Kawai , Shingo Akasaka, Jiahua Weng and Katsunari Ikezawa. Common design of parts for multi-generation multi-product considering uncertainty of demand and recovered quantity
10:50-11:10	Yuan Jialiang , Akasaka Shingo and Weng Jiahua. Method for Expanding the Capacity of a U-Shaped Processing Line by Considering the Utilization of Existing Transfer Robots
11:10-11:30	Yong Yin . Resilient and Responsive Production Systems
11:30-11:50	Yuka Matsubayashi , Mari Ito, Ryuta Takashima, Takamori Ukai, Masaki Koizumi, Akemi Yano, Shunsuke Matsushima and Sadaaki Inokuchi. Decision support system for hospital bed management

16:15-17:55	Session 3A: General Session, 2F - Room: MIYARABI (A) Business & Economic Decision-making Session Chair: Kotomichi Matsuno (Waseda University), Chunhui Xu (Chiba Institute of Technology)
16:15-16:35	Motoi Shinji , Makoto Shimoshimizu, Makoto Goto, Martyn Williams, Naoto Noguchi, Shohei Sasaki and Akihiro Takai. Prediction Model for Opta Index Using Football Player Performance Data
16:35-16:55	Hiroki Ishii and Masaru Ishioka. Study on Effective Brand Strategies Focusing on Technology Brand
16:55-17:15	Ruikang Deng , Kotomichi Matsuno, Yoshikuni Edagawa, Takaaki Kawanaka and Takahiro Ohno. Revenue Prediction Model for Movie Box Office Considering Emotion Values Related to Hedonic Consumption
17:15-17:35	Wei Jiang , Chunhui Xu and Masakazu Ando. A New Price Prediction Method for Financial Instruments Based on Similarity
17:35-17:55	Yanli Huo , Chunhui Xu. A Method for Forecasting Export Tendency

16:15-17:55	Session 3B: Industry-Academia Collaboration (I), 2F - Room: MIYARABI (B) Underground Logistics Session Chair: Qunzhi Wang (Southwest Jiaotong University)
16:15-16:35	Xuegui Wang , Yong Yin, Cheng Liang and Jinqu Chen. Research on the Layout of Metro Logistics Distribution Center Based on SLP
16:35-16:55	Siyu Tao , Rao Pei, Hanbing Yang and Yong Yin. The Analysis Method of the Comprehensive Benefit of Subway Logistics
16:55-17:15	Siyu Tao , Yue Zhao, Hanbing Yang, Tao Feng and Ximei Chen. Research on the Development of the Urban Functions of the Integrated Passenger Transport Hub in Railway
17:15-17:35	Yineng Lv , Qunzhi Wang, Yue Bai and Bin Zheng. Research on utilizing urban rail transit in the fresh e-commerce front warehouse model
17:35-17:55	Dan Shan , Qunzhi Wang, Bin Zheng and Xiaobo Liu. Feasibility Analysis of Urban Rail Transit in Fruit and Vegetable Logistics

16:15-17:35	<p>Session 3C: General Session, 2F - Room: MIYARABI (C) Business Environment & Management</p> <p>Session Chair: Sadami Suzuki (Yokohama National University), Masahiro Arakawa (Nagoya Institute of Technology)</p>
16:15-16:35	<p>Dongjian Wu and Manabu Sawaguchi. Study on Feature Analysis of the Patent Strategy at EUVL equipment manufacturer "ASML"</p>
16:35-16:55	<p>Kaoru Kuramoto and Satoshi Kumagai. Proposal of set-items considering the accuracy of demand forecasting</p>
16:55-17:15	<p>Yoshihiko Suzuki and Sadami Suzuki. The Employment Method of the Temporary Workers for Seasonal Products under the Working Population Decrease</p>
17:15-17:35	<p>Motoki Suzuki, Makoto Shimoshimizu and Makoto Goto. Industry Entry Strategies by Friendly M&A: Big Leap or Serial Merger</p>

December 16th (Saturday)

09:00-10:20	Session 4A: General Session, 2F - Room: MIYARABI (A) Sustainable Production & Operation Session Chair: Yutaka Takahashi (Sensyu University), Ruriko Watanabe (Waseda University)
09:00-09:20	Mitsuki Nakano , Kotomichi Matsuno, Takahiro Ohno, Yoshikuni Edakawa and Takaaki Kawanaka. Consumer Purchase Intentions for Assorted Sets of Non-Standard Vegetables through E-Commerce
09:20-09:40	Kento Komae , Kotomichi Matsuno, Ruriko Watanabe and Yoshitaka Tanimizu. A Multi-Period Dynamic Pricing Model for Fresh Foods Considering Customer Perceptions
09:40-10:00	Lu Qian and Dongyu Dai. Pinduoduo and the Transformation of Agriculture: Tackling Rural Area Dilemmas through Supply Chain Management
10:00-10:20	Kenji Yasuda , Reiko Fuseya, Shingen Yamamoto, Jun Miyoshi, Ryuzo Takahashi and Yutaka Takahashi. Simulation for Decision Support of Shipment Strategy in Prawn Aquaculture Using System Dynamics

09:00-10:20	Session 4B: Special Session, 2F - Room: MIYARABI (B) Theories and Techniques for Circular Economy Session Chair: Kin'Ya Tamaki (Aoyama Gakuin University)
09:00-09:20	Yoshiki Nakamura , Nozomi Oomiya, Hiroki Kozu and Kinya Tamaki. A Case Study of Sustainable Development Goals and Circular Economy Methodology
09:20-09:40	Hiroyuki Kameda . A preliminary consideration of software development process in a circular and sustainable society
09:40-10:00	Masahiro Arakawa , Won Young Park, Takeshi Abe, Kazuhiro Tazaki and Kinya Tamaki. Development of a Method for Service Creation and Product Design to Realize a Circular Economy
10:00-10:20	Masahiro Arakawa , Won Young Park, Takeshi Abe, Kazuhiro Tasaki and Kinya Tamaki. Development of Service and Product Design Processes Considering Product Life Cycle Management for a Circular Economy

09:00-10:20	Session 4C: General Session, 2F - Room: MIYARABI (C) Optimization in Production Operations Session Chair: Yanwen Dong (Fukushima University), Shao-Chin Sung (Aoyama Gakuin University)
09:00-09:20	Yanwen Dong and Noriki Ogura. Mass data analysis of the relationship between workers' assembly performance and their Five Factor Personality
09:20-09:40	Xiaowen Zhao , Ryuji Ogawa and Shao-Chin Sung. On Searching Optimal Worker Assignment in Multi-Stage Production Lines
09:40-10:00	Momona Tamagawa , Haruka Ohba and Shinya Mizuno. Optimizing Facilities by Adjusting Node and Server Numbers in a Closed BCMP Queueing Network
10:00-10:20	Yosuke Yamamoto , Yu Ogasawara and Kimitoshi Sato. Bundle Sales in Nested Demand Structure

10:30-11:50	Session 5A: Organized Session, 2F - Room: MIYARABI (A) Optimal Integration Model for Production System Session Chair: Mitsuyoshi Horikawa (Iwate Prefectural University)
10:30-10:50	Chihiro Hayashi and Hisashi Yamamoto. Hierarchical production planning for a plastic container manufacturer - Basic research for scheduling optimization in a combined flow shop of processing-assembly and hybrid types -
10:50-11:10	Mitsuyoshi Horikawa . Visualization of Worker Behavior for Process Improvement
11:10-11:30	Xiaowen Zhao , Jing Sun, Hisashi Yamamoto and Mitsuyoshi Horikawa. Applied Research on Workers Assignment Optimization using the InQross System
11:30-11:50	Kazuma Noda , Jing Sun and Hisashi Yamamoto. Optimal Allocation Rule in Limited-Cycle Multiple Periods Considering Quality and Worker Levels

10:30-11:50	Session 5B: General Session, 2F - Room: MIYARABI (B) Logistics and Operations Management Session Chair: Shinya Mizuno (Juntendo University), Kotomichi Matsuno (Waseda University)
10:30-10:50	Masatoshi Tanaka. Supply chain coordination with production, transportation, and demand uncertainties considering subsidies
10:50-11:10	Haruka Ohba, Koji Ishizuka and Shinya Mizuno. Development of a Vehicle Routing Model for School Lunch Centers in Japan
11:10-11:30	Xuyang Chen, Kotomichi Matsuno, Yoshikuni Edagawa, Takaaki Kawanaka and Takahiro Ohno. Standby Location Determination System for Food Delivery Personnel
11:30-11:50	Hisashi Kurata. Effectiveness of Different Pricing Strategies at Reducing the Workload of Home Delivery Services

10:30-12:10	Session 5C: General Session, 2F - Room: MIYARABI (C) Information Technology and Management Session Chair: Kimitoshi Sato (Kanagawa University), Kaoru Kuramoto (Aoyama Gakuin University)
10:30-10:50	Wataru Nugata and Kimitoshi Sato. Reduction of Hotel Reservation Plans Using the Clustering Method and Its Profit Effects
10:50-11:10	Ayako Yamagiwa and Masayuki Goto. Multi-Task Learning for Estimating Consumer Impressions of Product Images
11:10-11:30	Ryota Hasegawa, Kaoru Kuramoto and Satoshi Kumagai. Analysis of corporate value factors by cluster considering non-financial information
11:30-11:50	Miho Mizutani, Ayako Yamagiwa and Masayuki Goto. A Clustering Method Using Embedded Representations Based on User Ratings
11:50-12:10	Yuta Kudo, Makoto Shimoshimizu, Makoto Goto, Martyn Williams, Naoto Noguchi, Shohei Sasaki and Akihiro Takai. An Option Pricing Framework for Valuation of Football Players: Transfer Offers and Sellouts

13:00-14:20	Session 6A: Industry-Academia Collaboration (II), 2F - Room: MIYARABI (A) Logistics Planning and Optimization Session Chair: Takashi Irohara (Sophia University)
13:00-13:20	Takuma Ohzeki , Tetsuya Sato, Yoshitaka Tanimizu and Ryunosuke Hamada. Operation Planning of Electric Buses Considering Uncertainty of Power Consumption
13:20-13:40	Yusuke Ishitani , Hiroaki Ueno, Tetsuya Sato, Yoshitaka Tanimizu and Ryunosuke Hamada. Solution Method of Stochastic Integer Programming for Planning the Introduction of Electric Buses
13:40-14:00	Rune Noguchi , Takashi Irohara, Takashi Tanaka and Naomi Sugiyama. Application of tabu-search-based method to order batching and routing problems in logistics warehouses
14:00-14:20	Shunichi Ohmori and Toru Kajino. Teaching logistics optimization through a real-world project-based learning

13:00-14:00	Session 6B: Organized Session, 2F - Room: MIYARABI (B) Mathematical and Information Technology for Plant Product Supply Chain Management Session Chair: Takashi Hasuike (Waseda University)
13:00-13:20	Tomoko Kashima , Shimpei Matsumoto and Takashi Hasuike. VEGETOMO, a Chat System that Connects Agricultural Producers and Consumers
13:20-13:40	Takaki Kawamoto and Takashi Hasuike. Forecasting Regional Order Quantities in E-commerce Websites Using Time Series Models
13:40-14:00	Takashi Hasuike and Yameng Huang. Two-step Optimization Method for Multi-objective Crop Planning Problem in Contract Farming System

13:00-14:20	Session 6C: Special Session, 2F - Room: MIYARABI (C) Sustainable Manufacturing and Service (I) Session Chair: Tetsuo Yamada (The University of Electro-Communications)
13:00-13:20	Xin Zhou , Keisuke Nagasawa, Katsumi Morikawa, Katsuhiko Takahashi and Daisuke Hirotsu. An Enhanced Bucket Brigade Order Picking System with a Conveyor
13:20-13:40	Hiroya Ichihara , Kazushi Okamoto and Atsushi Shibata. Real Estate Property Image Classification Based on Optimal Transport Costs
13:40-14:00	Miyu Kotegawa , Yuki Kinoshita and Tetsuo Yamada. Mix and Single Carbon Policy Evaluations for Cost-Effectiveness of GHG Reduction in Global Supply Chain Network
14:00-14:20	Daiya Watanabe , Jundai Koketsu, Aya Ishigaki, Ryuta Takashima and Hajime Nishida. Effect of Risk Aversion and Experiential Learning on Domain Knowledge Acquisition Using the Beer Game

14:30-15:50	Session 7A: Industry-Academia Collaboration (III), 2F - Room: MIYARABI (A) Smart Production Planning and Management Session Chair: Yoshitaka Tanimizu (Waseda University)
14:30-14:50	Nirmala Liyanaarachchi , Shingo Akasaka and Jiahua Weng. Scheduling of Design Engineers in an Engineer-to-Order Production System
14:50-15:10	Masaki Sano , Yoshitaka Tanimizu, Kotomichi Matsuno and Ruriko Watanabe. Delay Risk Assessment for Job Shop Scheduling Considering Uncertain Processing Times
15:10-15:30	Kagehisa Nakayama and Hisashi Onari. Analysis of Takt Time Extension in Assembly Lines with Multiple Elemental Works Allocated to a Process
15:30-15:50	Yuri Nagase and Testu Saito. An Investigation into Refining Accuracy of Business Quote Estimation by Digitalization in Small and Medium Manufacturing Enterprises in Japan

14:30-15:50	Session 7B: Special Session, 2F - Room: MIYARABI (B) Optimization for Sustainable Management Session Chair: Koichi Nakade (Nagoya Institute of Technology)
14:30-14:50	Mingjuan Zhao , Jing Sun and Koichi Nakade. A Mathematical Model of the Multi-objective Flexible Job-shop Scheduling Considering Human Factors
14:50-15:10	Yusuke Honda and Koichi Nakade. A Heuristic Algorithm for the Vehicle Routing Problem with Stochastic Travel and Service Times
15:10-15:30	Wataru Sakurai and Koichi Nakade. An Optimization Model of a Retailer and a Manufacturer in a Green Supply Chain
15:30-15:50	Risako Yamauchi and Jing Sun. An Integrated Model for Power Demand Forecasting and Power Procurement Using Economic Indicators

14:30-15:50	Session 7C: Special Session, 2F - Room: MIYARABI (C) Sustainable Manufacturing and Service (II) Session Chair: Tetsuo Yamada (The University of Electro-Communications)
14:30-14:50	Seigo Takahashi , Yuki Kinoshita, Nora Schelte, Thomas Spelten, Semih Severengiz and Tetsuo Yamada. Comparison of Different Procurement Options and Influence on Greenhouse Gas Emissions: Case of Bochum City
14:50-15:10	Koki Karube , Ryuto Kawane, Taku Hayashi, Masao Sugi and Tetsuo Yamada. Motion Capture Analysis of Learning Effect for Assembly Tasks
15:10-15:30	Zirui Wang , Lu Jin and Watalu Yamamoto. Maintenance Policy for Multi-unit Redundant Systems with Two Types of Opportunities
15:30-15:50	Leanne Russell and Daisuke Hirotani. Revised Mode Switching Policy for a Hybrid Closed-Loop Supply Chain

16:00-17:00	Session 8A: Special Session, 2F - Room: MIYARABI (A) Sustainable Supply Chain Management Session Chair: Taeho Park (San José State University)
16:00-16:20	Xiaohua Wang. Simulation Analysis of Inventory System Considering Advance Demand Information and Production Capacity
16:20-16:40	Pyunghoi Koo and Sung-Moon Jung. Supply contracts with capacity investment and bargaining powers for a two-stage supply chain
16:40-17:00	Kirana Horie and Jing Sun. Optimal Strategies of Electricity Plans Using Latent Class Analysis Considering Renewable Energy

16:00-17:00	Session 8B: General Session, 2F - Room: MIYARABI (B) Business and Economic Decision-making Session Chair: Hisashi Kurata (Yokohama National University), Yasushi Narushima (Keio University)
16:00-16:20	Motodamari Koki and Sun Jing. A multi-agent-model considering green energy coefficient and the entry /exit to electricity trading market
16:20-16:40	Yang Xiao and Hisashi Kurata. Optimizing Pricing Strategies in Dual-Channel Closed-Loop Supply Chains: An Analysis of Manufacturer's Corporate Social Responsibility Investment
16:40-17:00	Yasushi Narushima and Shoma Uda. Biofuels supply chain network equilibrium model in the aviation industry

16:00-17:00	Session 8C: Special Session, 2F - Room: MIYARABI (C) Sustainable Manufacturing and Service (III) Session Chair: Tetsuo Yamada (The University of Electro-Communications)
16:00-16:20	Katsumi Morikawa , Yasutoshi Yajima, Mana Kanda, Baku Takahashi, Kimiko Okamoto, Youichirou Hirohata and Kenta Kasaishi. Scheduling Vinegar Production and Filling Processes using a Mixed-Integer Programming Model: A Case Study
16:20-16:40	Lei Zhou , Shoichiro Miyamoto, Yoshinobu Tamura and Hisashi Yamamoto. A Note on Reliability Computation for Linear Consecutive-k-out-of-n:G Systems Using Domination
16:40-17:00	Keisuke Nagasawa , Katsumi Morikawa and Katsuhiko Takahashi. Sugarcane Supply Chain Network Design with Greenhouse Gases and Disposal

December 17th (Sunday)

09:00-10:20	<p>Session 9A: General Session, 2F - Room: MIYARABI (A) Management Science and Technology</p> <p>Session Chair: Haruka Yamashita (Sophia University), Masayuki Goto (Waseda University)</p>
09:00-09:20	<p>Haruka Yamashita, Manita Shresta, Masaaki Sugihara and Masayuki Goto. Follow-up survey on the effect of the educational program applying the concept of active learning in the field of Nepal</p>
09:20-09:40	<p>Masayuki Goto, Manabu Kobayashi, Takeshi Moriguchi, Yoichi Seki, Hideo Suzuki, Takashi Namatame, Kazuhide Nakata, Aya Ishigaki, Masao Ueda, Kimitoshi Sato, Kenta Mikawa, Haruka Yamashita, Tomoaki Tabata, Tianxiang Yang, Ayako Yamagiwa and Yutaka Tajiri. Online Flipped Conference Based Data Science Education Program and Its Educational Effectiveness in Multi-University Collaboration</p>
09:40-10:00	<p>Takuma Gocho, Kazuya Ito, Ryuta Takashima and Makoto Tanaka. Consumer Preferences and Willingness to Pay for Energy-Efficient Housing</p>
10:00-10:20	<p>Aoi Mineta, Masaki Miura and Yoshiyuki Higuchi. Application Procedures and Challenges of Reinforcement Learning Using Discrete System Simulation</p>

09:00-10:20	<p>Session 9B: General Session, 2F - Room: MIYARABI (B) Organization & Innovation Management</p> <p>Session Chair: Manabu Sawaguchi (Ritsumeikan University), Terumasa Matsuyuki (Graduate School of Project Design)</p>
09:00-09:20	<p>Terumasa Matsuyuki. On similarities between the processes of innovation and psychological healing</p>
09:20-09:40	<p>Shotaro Kamata and Masaru Isioka. Research on Organizational Structure and Innovation Models to Promote Innovation through Ambidexterity</p>
09:40-10:00	<p>Shinichiro Fujimoto and Manabu Sawaguchi. Study on Open Innovation characteristics of Air conditioner manufacturing companies</p>
10:00-10:20	<p>Yiwei Zheng and Yu Deng. Not all directors have the same roles: The roles of inside and outside directors in alliance portfolio capability and performance</p>

09:00-10:20	Session 9C: General Session, 2F - Room: MIYARABI (C) Business Environment Session Chair: Dongyu Dai (Josai International University), Yatong Xiao (Saitama University)
09:00-09:20	Yatong Xiao and Motoi Ihara. From Japan to China: Unpacking the Live Commerce Strategies of Brand Marketing in the Cross-Border E-commerce
09:20-09:40	Dongyu Dai and Shika Sone. Cultural Dynamics and Luxury Acceptance among Chi-na's Middle Class: Implications for Value Co-Creation in Novel Markets
09:40-10:00	Nalini Nathasha Thenuwara and Motonari Tanabu. Enhancing Financial Inclusion for the Elderly Population through Digital Banks and Digital Payments
10:00-10:20	He Zhang and Yang Xiao. Navigating the Complexity of Bottom-of-the-Pyramid Markets: A Comprehensive Case Study on ZTE Corporation's Strategies in Emerging Economies

10:30-12:10	Session 10A: General Session, 2F - Room: MIYARABI (A) Management Science and Technology Session Chair: Naoshi Shiono (Kanagawa institute of technology), Yukiko Nakahara (Kyusyu Sangyo University)
10:30-10:50	Yukiko Nakahara. Cleaning and Metal Corrosion Prevention Technology Using Ultrafine Bubbles (UFB)
10:50-11:10	Kanyu Miyoshi , Ryotaro Shimizu, Linxin Song and Masayuki Goto. Target-awared Source Data Selection Strategy for Transfer Learning
11:10-11:30	Daisuke Hasegawa and Naoshi Shiono. Average TSP tour length approximations for territory design
11:30-11:50	Haruse Takizawa , Ruriko Watanabe, Shunsuke Watanabe, Nobutada Fujii, Daisuke Kokuryo, Toshiya Kaihara, Yoshimi Fujioka and Takahiro Imafuku. A study on regional revitalization using parking lot usage history -An approach using a store recommendation system based on Bayesian networks-
11:50-12:10	Tianxiang Yang , Hideo Suzuki and Masayuki Goto. Cross-Lingual Analysis Based on Natural Language Model to Explore Nationality Differences in Traveler Value

10:30-11:50	Session 10B: General Session, 2F - Room: MIYARABI (B) Management Science and Technology Session Chair: Yuko Iwasaki (Yokkaichi University), Hiroki Kozu (Nippon Institute of Technology)
10:30-10:50	Tomoyuki Kato and Seiko Shirasaka. Fundamental Study of Lifecycle Management for Secure System
10:50-11:10	Yuko Iwasaki. Research on cyber security investment for realising social value
11:10-11:30	Sadami Suzuki and Ornida Kraiwuttianant. Quantifying the Impact of Physical Internet Systems under Decentralized Control
11:30-11:50	Hiroki Kozu , Yukio Maruyama and Yasuyuki Kourogi. A Study on Sensibility Evaluation of Salon Shampoo

10:30-11:50	Session 10C: General Session, 2F - Room: MIYARABI (C) Sustainable Operations and Productivity Management Session Chair: Yoshikuni Edagawa (Ritsumeikan University), Yoshiyuki Higuchi (Fukushima University)
10:30-10:50	Makiko Arima , Yoshikuni Edagawa, Chikako Kawahara, Kohta Suzuki, Koichi Sinohara, Nahoko Shirato, Yoshie Miwa and Yasuki Kishi. Results of Literature Search on the Effects of Menopausal Symptoms on Labor Productivity
10:50-11:10	Sana Ito , Yoshiyuki Higuchi, Kiyoma Maeda, Tadayuki Kawamoto and Naoko Kanazawa. Relationship between Accident Risk in Construction Machinery Maintenance and Eye-Tracking Data
11:10-11:30	Satoru Kaneko and Masahiro Arakawa. Verification of changes in service operations and effectiveness of on-site maintenance in an EV shift environment
11:30-11:50	Yoshiki Fujita , Yating Yu, Seiko Taki and Ryu Yamamura. Stress-Reducing Effects of the Sounds of Musical Instruments

Abstracts

Abstracts

Session 1A: General Session Business and Economic Decision-making

American Pandemic Options: Premiums and Greeks

Yuto Kitamura, Makoto Shimoshimizu, Makoto Goto and Yuan Tian

We analyze what we define as the American pandemic options with an infected population as the state variable. Through numerical calculations via Crank–Nicolson methods, the value function is found to be concave. This property is contrary to the standard Black–Scholes options. We also discover the differences between the pandemic and standard options in Greeks. As a result, Vega and Rho for the American and European pandemic options are different from those of the standard Black–Scholes options. The difference between pandemic options and standard Black–Scholes options arises because the value function of pandemic options is concave for the number of infected individuals. These findings may provide insights for developing optimal risk-hedging strategies for pandemic risks.

Investments in Corporate Social Responsibility: A Real Options Approach

Yutaro Oga, Ryuta Takashima and Kazuya Ito

In recent years, corporate social responsibility (CSR) activities have become increasingly common corporate initiatives, considering their impact on companies and their social aspects. This study aims to construct a theoretical model using the real options approach, considering market uncertainty, and analyze the relationship between investments in CSR activities and one of the company's risk indicators, beta. In the context of investments in CSR activities, we demonstrate the existence of an optimal investment amount during corporate crises, such as economic downturns. Beta exhibits the most significant reduction at this investment level. We evaluate a company's value and beta from the perspective of the amount of investment in CSR activities and the potential profitability of the intangible assets generated by CSR. Furthermore, we highlight the utility of investments in CSR activities and show that the effectiveness of external CSR activities depends on their recognition and visibility. Thus, such activities contribute to an increase in company value.

Relationship between Earnings Briefing Transcripts' Tone and the Reaction of Financial Markets for Chinese Listed Companies

Lixuan Zhou, Ayuko Komura and Hirohisa Hirai

The tone of financial texts contains emotional information expressed by the managers in listed companies and has an impact on the stock market. We use cumulative abnormal returns and market volatility to examine the financial market's response to the tone of earnings briefing transcripts of Chinese listed companies. We found that for industries that are in line with the preferential policy targets that the Chinese government vigorously develops, the stock market reacts more strongly to the tone of managers in earnings briefings. It also shows that investors are more sensitive to positive words than negative words expressed by managers in earnings briefings. Therefore, it can be believed that the prediction of the market reaction after the earnings briefing based on the tone of managers in the earnings briefing can be realized.

A Study on Detection Method of Falling Symptoms: Fall Prediction in the Behavioral Patterns of Elderly People by LSTM Using Accelerometers

Jin Zhang, Takuya Tajima and Takehiko Abe

Falling is a major cause of reduced quality of the human life. For the elderly in particular, weaker strength in the lower limbs and more delicate bones make their lives more threatened by falls. At the same time, the aging of the population is increasing the pressure on caregivers. If we can detect the symptoms of falls earlier, more time can be gained to prevent falls from occurring, thereby protecting the lives of the elderly and reducing the stress on care organizations and caregivers. In this study, we designed a series of experiments to simulate the fall of elderly people, and at the same time, we used accelerometers to obtain various data of elderly people's body before the fall. In order to reduce the risk of the experiment, college students wearing the senior simulation suit will participate in the fall experiment instead of the elderly as subjects, and a protective device is designed to prevent the subjects from being injured in the fall experiment. Finally, we will use the LSTM to learn and model the data in order to achieve the purpose of being able to make real-time predictions of falls in the behavioral patterns of elderly people.

**Session 1B: General Session
Business and Economic Analysis**

An Economic Evaluation of Grid Interconnection between Central Asia and Neighboring Regions

Kazuya Ito and Ryuta Takashima

To promote decarbonization in the power sector, attention has been focused on the renewable energy resources found in Central Asia. Specifically, discussions are ongoing regarding ensuring a stable power supply within Central Asia through the interconnection of power grids and electricity export from Central Asia to neighboring regions using its abundant renewable energy sources. Our study evaluates the potential for the future deployment of renewable energy generation between Central Asian countries and assesses the feasibility of electricity sharing with the European Union or South Asia. We formulate a complementarity problem by considering the various market participants and elements in the electric power sector and evaluate the economic impact of interconnecting power grids in Central Asia, importing/exporting electricity to/from other regions, and implementing renewable energy generation. Our analysis results showed that interconnecting power grids and introducing renewable energy sources in Central Asia could help stabilize power supply and increase social welfare not only in Central Asia but also in the South Asian region and Europe.

Impact of COVID-19 Travel Subsidies on Stock Market Returns: Evidence from Japanese Tourism Companies

Hideaki Sakawa and Naoki Watanabel

This study examines stock market response to Japanese tourism firms after the gov-emment's announcement of travel subsidies during the COVID-19 pandemic in 2020, using a sample comprising 80 listed Japanese firms in tourism and travel-related sectors and an event study method to determine the impact of government responses to the pandemic. The study found that investors in tourism firms positive-ly reacted to the announcement of subsidies; this positive effect persisted for 50 trading days after the announcement, but was weaker for transportation firms. The results suggest that travel subsidies are important for the tourism industry, with a stronger link to travel-related firms, such as airlines and travel agencies, hotels, and amusement services. However, investors in tourism reacted negatively to policies that directly addressed the pandemic, such as social distancing measures. The results offer useful insights for policymakers and practitioners aiming to mitigate economic loss from disasters such as the COVID-19 pandemic.

Multiple-Rules-Based Approach to Explore Corporate Governance: A Case Study from Taiwan

Kao-Yi Shen

This study proposes a multiple-rules-based approach to evaluate the corporate governance performance of public-listed stocks in Taiwan. Although the importance of corporate governance has received rising attention, how to reveal the contextual relationship among crucial indicators still needs to be explored. Therefore, a novel rule-based model is proposed. The data from the Securities and Future Institute of Taiwan in 2018 was analyzed; the outcomes show the relationship among crucial indicators and support ranking three sample stocks in 2019. The ranking result is in line with the one from the Securities and Future Institute of Taiwan, which suggests the validity of this work.

Session 1C: General Session

Management Science and Technology

Visualising Individual and Group Effectuation Degree Co-evolution in Group Discussions

Mayato Hattori, Kotomichi Matsuno, Terumasa Matsuyuki, Kenta Nakagawa, Yoshikuni Edagawa and Takahiro Ohno

There are two common ways of thinking in the process of creating a new business: Causation thinking style and Effectuation thinking style. The first one is a planned strategy approach. It assumes that the necessary planning and analysis can be predicted through computation and statistical inference. On the other hand, the second one is an emergent strategy approach. Recently, market uncertainty has increased due to the diversification of customer needs and the shortening of product and service life cycles. In order to achieve more effective results in the new business creation process in such uncertain environment, a highly productive group structure is necessary.

There is much discussion about how to form groups that take into account the backgrounds of candidate members, such as their expertise fields and experience, as well as diversity and general aptitude such as leadership, followership, communication, self-management. However, these are all personal attributes and do not consider the impact of the combination of individual thinking styles, as well as the impact of emotions on group discussions that can express individual and group interaction. In this study, experiments are conducted in a project-based learning class with the theme of new business creation in a master's program. To improve the productivity of group work in the new business creation process, the process of co-evolution of the effectuation degree is visualised through an engineering approach that takes into account individual thinking styles and emotional attributes.

The Social Capital and Vocational Readiness of Female Students Cultivated in Japanese Women's University -Their Respective Transformation Processes and Relationship -

Eriko Saito and Takahiro Ohno

This study aimed to clarify the transformation process of social capital and vocational readiness among female students cultivated at women's university in Japan, as well as the relationship between these two factors. To achieve this objective, we examined that the evolution of social capital (SC) within the context of women's university (WUC) and in private life (PLC) for grade levels. Additionally, it was investigated the causal relationship between these two types of capital and vocational readiness (VR).

The results revealed that SC, WUC, and VR increased with each grade level, while PLC did not show significant differences between grades. More-over, "Work or Internship Experience", item of the WUC, exhibited a causal relationship with VR across all grades. However, other aspects of the WUC sub-item and PLC did not demonstrate a causal relationship with VR. Interestingly, WUC scores were consistently lower than PLC scores from the 1st grade, highlighting the need to emphasize the development of WUC in women's university.

Global Virtual Teams: Leveraging Scholarly Insights to Managerial Applications

Oleg Komlik

Global Virtual Teams (GVTs) are a common managerial practice and a wide-spread organizational feature. They are inherently and concurrently affected by cultural, interpersonal, and psychological characteristics that prescribe how team members work, function, and manage. This paper provides a categorized review of influential and valuable scholarly articles on GVTs whose findings could be applicable to practice. The paper focuses on micro and mezzo organizational levels and elaborates on three interrelated themes regarding GVTs: cultural, social and professional diversity in team composition; interpersonal communication and trust; and managing and leading GVTs. The paper contribution is in emphasizing and exemplifying that although GVTs are structured by physical and technological factors, GVTs' social aspects, relational attributes and cultural facets must be taken into managerial consideration in order to improve outcomes and leverage performance.

Designing Knowledge-Sharing Organization for Ambidexterity

Yusuke Maruyama and Masaru Ishioka

In recent years, companies have become commoditized due to the diversification of needs, resulting from the development of ICT and rapid changes in the market environment. Companies need to create Disruptive Innovations through making new businesses, because they are quickly imitated by competitors if they work on only their existing businesses. To address these issues, it is necessary to engage in ambidexterity that simultaneously deepens existing businesses and explores new businesses. Therefore, this study designs an organization structure that can work efficiently on both Exploitation and Exploration. Specifically, it considers improving the probability of new businesses to be explored and reducing the risk of new business failure through knowledge sharing by using Ambidexterity, Boost-Gate Method, and Internal Ecosystem Model.

Session 2A: General Session

Management Science and Technology

An Integrated Model for Staff Scheduling for Multi-Task Call-Centers

Haojie Liu, Zhaoyang Liu, Hanlin Liu, Xiaodong Liu, Cheng Li and Yu Song

This study aims to develop a Mixed Integer Programming (MIP) model for employee scheduling in multi-task call centers. such problem is a complex challenge, as each employee can handle only one task during specific time slots of the day. The model takes into consideration the proficiency of employees in handling various tasks to optimize their productivity. Additionally, to meet the employees' working hour requirements, the model imposes constraints on the upper and lower limits of the number of working days per month for each employee. Previous research has typically treated daily scheduling and monthly scheduling separately, primarily due to their complexity. However, this study utilizes the MIP modeling approach to combine the traditionally separated aspects of daily and monthly scheduling into a comprehensive MIP model. This optimization plan will assist organizations in effectively allocating human resources, enhancing operational efficiency, and maximizing overall performance.

Development of an integrated GA and PSO scheduling method considering the skill level of the workers

Souto Yoneda and Masahiro Arakawa

In make-to-order plants that produce a wide variety of products in small lots, the production lead time must be reduced to meet the due date specified by the customer. In this study, we propose an integrated scheduling method in which GA and local search methods are used to allocate the work of jobs to machines to obtain the best chromosomes. PSO is used to assign works of jobs to the workers. The production scheduling problem is challenging to find optimal solutions because of the large number of valuables. PSO is one of the effective methods in the meta-heuristics method for the reduction of computation time. Therefore, this study attempts to develop PSO and GA. PSO is used to seek the worker's assignment, and GA is used to seek the job assignment. The performance of the proposed method is investigated using some scheduling models.

Solving Daily Shift Scheduling Problems in Multi-task Call Centers using Quantum Computer

Zhaoyang Liu, Yu Song, Haojie Liu, Cheng Li, Hanlin Liu and Xiaodong Liu

The multiskilled call center scheduling problem involves assigning call center employees with varying skill levels to different tasks, aiming to maximize customer satisfaction while minimizing operational costs. Traditional Mixed Integer Programming (MIP) models can be used to formulate and solve such scheduling problems of various scales. However, in certain cases, especially when dealing with large or complex problems, MIP models encounter exponential computational complexity. Therefore, there is an urgent need to explore novel and effective approaches. Quantum computer emerge as a promising paradigm, offering innovative solutions for tackling complex problems. In quantum computer, we can initially use the Quadratic Unconstrained Binary Optimization (QUBO) method to formulate the model, facilitating subsequent problem-solving using a quantum annealing machine.

In this study, we propose a QUBO-based solution for the daily shift scheduling problem in call centers. By using the QUBO model to formulate the problem, we demonstrate the potential of the proposed QUBO-based approach in dealing with real call center scheduling instances. In the future, the quantum annealing machine is expected to provide accurate and near-optimal solutions within a reasonable time frame in quantum computer, offering valuable decision support for call center management.

A study of optimizing the preparation control process for brewing with image determination using CNN

Fumiya Ishizu and Takuya Tajima

The sake brewing industry is generally considered to be very susceptible to population changes, and is threatened with declines in consumption due to drops in the drinking age population. The aging of the sake brewing industry and the lack of successors to the Toji (master brewers) are emerging as major issues. As a result, the sake brewing industry is currently forced to make a $\times 1$ number of choices in response to this situation. This research aims to standardize the optimal timing for brewing processes and semi-automate brewing process management by having AI analyze data on product conditions collected in the actual brewing process. This will also make it possible to semi-automate brewing process management. This analysis will optimize the brewing process, which previously required the Toji's rule of thumb and many years of intuition, by accumulating and processing image information on the state of fermentation of the mash in the tanks. Ultimately, the project aims to solve problems such as the lack of successors for brewers and the Toji.

Session 2B: Special Session
Game Theory and Resilient Financial Networks

A Building Block of Systemic Risk: Short-term Financial Networks

Jing Fu, Frank Page and Jean-Pierre Zigrand

This paper proposes a short-term financial network (i.e., short-term lending and investment network) formation process for the analysis of endogenous systemic risk, where each player forms two networks: (i) one consisting of short-term borrowing, lending or repayment connections with the other players, and (ii) one consisting of investment connections with some subset of possible (perfectly divisible) risky investment projects. With this essential building block, we will be able to study the emergence of equilibrium network dynamics that fully takes into account the feedback between network structure, strategic behavior, and risk, and provide a strategic approach to making global assessments of systemic risk in short-term financial networks.

Digital information disclosure, investor sentiment, and corporate default risk

Yiwei Zheng and Yu Deng

This study uses the Tobit model to conduct empirical tests to examine the effect and mechanism of digital information disclosure on the corporate default risk of listed companies in China's A-share market between 2009 and 2020. We found that digital information disclosure significantly reduces corporate default risk. An analysis of the moderating effect of investor sentiment shows that digital information disclosure can release positive market signals and reduce default risk more effectively when investor sentiment is negative. Furthermore, the scenario analysis suggests that there are specific macroeconomic and corporate annual report sentiment scenarios that lower companies' default risk by catering to digital information disclosure. This study enriches the research on the economic benefits of corporate digital information disclosure and factors affecting corporate default risk. It explores the correlation among digital information, investor sentiment, and corporate default risk in annual report text from the perspective of information disclosure for the first time. This contributes to a more scientific and comprehensive understanding of the economic connotations of corporate digital information disclosure. It provides objective evaluation criteria for companies' digital transformation and offers valuable conclusions for improving the relevant supervision and restraint mechanisms of digital information disclosure.

Strategic Financial Networks, Equilibrium Dynamics and Endogenous Systemic Risk

Jing Fu, Frank Page and Jean-Pierre Zigrand

This paper has two main objectives: first, to provide a formal definition of endogenous systemic risk that is firmly grounded in equilibrium dynamics of short term financial networks (i.e., short-term lending and investment networks); and second, to construct a discounted stochastic game (DSG) model of the emergence of equilibrium network dynamics that fully takes into account the feedback between network structure, strategic behavior, and risk. Based on our definition of systemic risk we also propose a formal definition of tipping points and spheres of influence. Using these tools, we provide a strategic approach to making global assessments of systemic risk in short term financial networks. Our approach is based on three key facts: (1) the equilibrium dynamics which emerge from the game of network formation generate finitely many disjoint basins of attraction as well as finitely many ergodic measures (implying that, starting from any short term financial network, in finite time with probability one, the dynamic sequence of networks arrives at one of these basins, and once there, stays there), (2) each basin of attraction can be decomposed into a transient set and a set of networks visited infinitely often (vio) by the process of network formation and the characteristics homogenous with respect to its default characteristics (meaning that if a basin contains networks having a particular set of defaulted players, then all networks contained in this basin have the same set of defaulted players), and (3) the unique profile of basins generated by the equilibrium dynamics carries with it a unique set of tipping points (special networks) - and these tipping points provide an early warning of network failure.

Common Knowledge, Coordination and Rational Limits to Arbitrage

Jean-Pierre Zigrand

We propose a rational framework which generates asset prices that appear irrational. This is accomplished by studying rational expectations equilibria in the presence of two realistic market frictions: immediacy risk and asset-specific orders (investors have to submit one separate demand for each asset, which must not be contingent upon the prices of the other assets). Trading within an institution becomes decentralized into trading desks because the market frictions imply that higher order uncertainty remains unresolved among traders of the same investor. The resulting network of imperfectly coordinated traders and the resulting lack of common knowledge prevents them from fully exploiting arbitrage opportunities, mispricings and gains from trade, the so-called limits-to-arbitrage. Rational expectations equilibria are characterized by informational as well as allocational inefficiencies.

Session 2C: General Session**Sustainable Production and Operations Management****Common design of parts for multi-generation multi-product considering uncertainty of demand and recovered quantity****Atsuya Kawai, Shingo Akasaka, Jiahua Weng and Katsunari Ikezawa**

Circular supply chain systems are intended to promote reuse of parts. However, as product life cycles shorten, recovered parts with retaining value are increasingly being recycled or disposed due to a lack of diverse reuse applications. Since multi-product constraints such as physical and functional requirements are not considered in part design, the existing circular supply chain systems are focused on single product reuse. This research proposes a common design method of parts that takes into account reuse in different products depending on the functional deterioration of the parts. As multiple uncertainties such as individual product demand, volume of recovered parts and the recovery timing are present in this system, stochastic programming is applied in this study. A lithium-ion battery (LIB, hereafter) originally developed for automotive applications is taken as an example. Since LIB is composed of multiple modules and each module is composed of a set of cells, the objective of optimal common design is to determine the number of cells that should be included in each module. The objective function of common parts design is defined as the "contribution degree", which is calculated by dividing the total electrical energy supplied until disposal by the operating cost. The effectiveness of the proposed optimal common design on environmental factors such as new production volume and disposed quantity, is evaluated using discrete event simulation.

Method for Expanding the Capacity of a U-Shaped Processing Line by Considering the Utilization of Existing Transfer Robots**Yuan Jialiang, Akasaka Shingo and Weng Jiahua**

This study addresses the augmentation of processing line capacity, transitioning from a U-shaped configuration to an O-shaped layout. To facilitate this transformation, a method grounded in Tabu search principles is devised for the judicious allocation of transport tasks, distributing responsibilities among both the incumbent and newly integrated transfer robots.

Resilient and Responsive Production Systems**Yong Yin**

The escalating global uncertainties necessitate the evolution of Resilient and Responsive Production Systems (RRPS) to adeptly navigate demand fluctuations and supply disruptions. This paper delves into the conceptual framework and operational strategies underpinning RRPS, aiming at fortifying production systems against unforeseen adversities. Through a meticulous review of existing literature and analysis of contemporary supply chain models, core principles of resilience and responsiveness within production domains are delineated. The discourse further explores the potential of data-driven methodologies in discerning and mitigating supply chain risks, underscoring the role of public policies in fostering resilience. Additionally, the necessity for a structured framework to appraise and augment supply chain resilience is highlighted, providing actionable insights for practitioners and policymakers. This paper aims to amalgamate theoretical insights with practical applications, contributing to a nuanced understanding and a systematic approach towards cultivating Resilient and Responsive Production Systems, thereby fostering a more reliable, efficient, and sustainable industrial ecosystem in the face of evolving global challenges.

Decision support system for hospital bed management**Yuka Matsubayashi, Mari Ito, Ryuta Takashima, Takamori Ukai, Masaki Koizumi, Akemi Yano, Shunsuke Matsushima and Sadaaki Inokuchi**

In recent years, the demand for medical care has increased owing to the rising average life expectancy. Accordingly, some hospitals are still managing hospital beds manually to ensure their efficient use. Moreover, the workload on nurses is becoming increasingly serious. Therefore, a system aimed at reducing the workload in hospital bed management is being developed to manage all aspects of hospital beds, from capturing patient data to creating hospital bed schedules, all in a single Excel file. The system creates schedules using 0-1 integer programming and is employed in python 3.8. The personnel in charge of bed management are not necessarily well versed in programming. Therefore, we construct a system that allows the creation of schedules with the push of a button. Consequently, we obtained a schedule that could be solved in less than one minute, from data capture to output, and that satisfied all of the patient's wishes. Additionally, the volume of medical care provided and hospital profits increased. By doing everything on the developed system, the system contributed to reducing the workload.

Session 3A: General Session

Business & Economic Decision-making

Prediction Model for Opta Index Using Football Player Performance Data

Motoi Shinji, Makoto Shimoshimizu, Makoto Goto, Martyn Williams, Naoto Noguchi, Shohei Sasaki and Akihiro Takai

Visualizing player performance is a challenging task for football teams. To address this issue, we propose a linear prediction model by employing the Opta Index as the dependent variable and player performance statistics as independent variables. The procedure includes the least absolute shrinkage and selection operator (LASSO) and Ridge regression techniques to select essential variables for predicting the Opta Index. Our findings reveal that, within our dataset, linear regression with variables selected through LASSO outperforms that with variables selected through Ridge regression in terms of predictive accuracy. Further, by extending our analysis of individual players to a position-wise dataset, we identify the variables that capture distinct positional features. These analyses potentially contribute to the enhancement of player training strategies and team tactics.

Study on Effective Brand Strategies Focusing on Technology Brand

Hiroki Ishii and Masaru Ishioka

In recent years, the market environment has been changing such as increasing commoditization and intensifying global competition. These changes have become challenges for sustainability management. One solution to these problems is the usage of brands. On the other hand, brands face challenges such as the recent decline in the brand value of Japanese companies and the increasing complexity of the brand system. This study focuses on the concepts of technology brand and related brands. Then, organizing the brand system and how to construct and manage the technology brand are discussed. Based on this discussion, the new model is developed and discussed.

Revenue Prediction Model for Movie Box Office Considering Emotion Values Related to Hedonic Consumption

Ruikang Deng, Kotomichi Matsuno, Yoshikuni Edagawa, Takaaki Kawanaka and Takahiro Ohno

In recent years, sentiment analysis has been incorporated into movie box office revenue predictions, leading to numerous attempts to improve prediction accuracy. However, there has been little discussion about from which perspective emotions in the text should be extracted. This study aims to construct a prediction model from the perspective of hedonic consumption and attempts to achieve highly accuracy box office revenue predictions using text analysis and machine learning.

A New Price Prediction Method for Financial Instruments Based on Similarity

Wei Jiang, Chunhui Xu and Masakazu Ando

This study proposes a new method for predicting the price trends of financial commodities over a certain period, utilizing data similarity.

We first propose a new definition of similarity. Then, we identify historical data from the past that is most similar to the current data based on this definition. We use the trend (upward, downward, or fluctuating) of this selected historical data as a prediction for the future trend. By comparing this prediction with th

A Method for Forecasting Export Tendency

Yanli Huo and Chunhui Xu

In this paper, we present a method to predict the sales tendency type in a future period. We classify sales tendencies into three categories: rising, falling, and range types, and propose a direct approach to predict the sales tendency type by utilizing historical sales data. Our method leverages linear regression to transform the historical sales data into tendency type data, and then proceeds to calculate the type change probabilities for each type. The sales tendency type for the next period is then forecasted using the maximum likelihood principle. To validate our approach, we tested it on export data of a cleaning robot vacuum cleaner from China.

Session 3B: Industry-Academia Collaboration (I)
Underground Logistics

Research on the Layout of Metro Logistics Distribution Center Based on SLP

Xuegui Wang, Yong Yin, Cheng Liang and Jinqiu Chen

In recent years, metro logistics has gradually become one of the choices of urban logistics terminal distribution, scientific and reasonable layout of metro logistics distribution center is an important guarantee for the development of metro logistics. To reasonably design the metro logistics distribution center layout plan, this paper firstly introduces the general steps of Systematic Layout Planning (SLP) method. And then by using this method completes the functional area division of the distribution center according to the operation characteristics of metro logistics and gives the distribution center operation flow based on the functional area division. Finally, taking Xiong'an New Area as an example, the correlation between the functional areas of the distribution center is analyzed to get the functional area operation relationship diagram and complete the layout of the distribution center.

The Analysis Method of the Comprehensive Benefit of Subway Logistics

Siyu Tao, Rao Pei, Hanbing Yang and Yong Yin

Subway logistics can effectively relieve the pressure of urban traffic and realize the green and efficient development of urban logistics. In order to analyze the comprehensive benefits of subway logistics, this paper studies the comprehensive benefits of subway logistics from two aspects: economic benefits and social benefits. In terms of economic benefit, it analyzes the economic cost, the trend freight yield, the induced freight yield and the transfer freight yield. In terms of social benefits, the benefits of saving transportation time, reducing traffic accidents, reducing cargo damage and reducing carbon emissions are analyzed. Finally, a calculation method of the comprehensive benefit of subway logistics is proposed, which can conveniently calculate the comprehensive benefit of subway logistics.

Research on the Development of the Urban Functions of the Integrated Passenger Transport Hub in Railway

Siyu Tao, Yue Zhao, Hanbing Yang, Tao Feng and Ximei Chen

With the continuous renewal of China's urbanization process, the comprehensive development of integrated passenger transport hub in railway has become a major trend in the development of the transportation industry. To ensure the comprehensive development of the hub to achieve the optimal effect of Pareto, it is necessary to develop the urban function reasonably and efficiently on the premise of realizing the traffic function. Based on the concept of economy and sustainability, three objectives are considered: maximizing economic benefit; maximizing social benefit; and minimizing the carbon emissions of hub operation. The trade-off among urban floor plot ratio, traffic surplus capacity and the upper limit of the development volume of different urban function types is incorporated in the model. A case study of the Shapingba Railway Integrated Passenger Transport Hub is also conducted for model illustration. Moreover the rationality and feasibility of the model are tested by comparing the calculated development volume scale of hub city function and its actual development situation.

Research on utilizing urban rail transit in the fresh e-commerce front warehouse model

Yineng Lv, Qunzhi Wang, Yue Bai and Bin Zheng

The continuous growth of e-commerce and the escalating need for fresh products have prompted a focus on leveraging urban rail transit with surplus capacity for fresh logistics. Therefore, this study proposes a new model that combines urban rail transit with the fresh e-commerce front warehouse system. We focus on the feasibility of utilizing urban rail transit for replenishing goods from urban distribution centers to the front warehouse and conclude that this new model has the potential to enhance the efficiency of fresh product delivery and meet the sustainable development requirements of our resource-saving society.

Feasibility Analysis of Urban Rail Transit in Fruit and Vegetable Logistics

Dan Shan, Qunzhi Wang, Bin Zheng and Xiaobo Liu

This paper focuses on the feasibility of the application of urban rail transportation in fruit and vegetable logistics. It analyzes the challenges currently faced by fruit and vegetable distribution, explores the advantages of using urban rail transit to develop fruit and vegetable logistics, and discusses solutions to the application possibilities of urban rail transit in fruit and vegetable logistics. It provides a theoretical basis for the application of urban rail transportation in fruit and vegetable logistics. And its feasibility is further analyzed. The article concludes that the application of urban rail transit in fruit and vegetable logistics provides innovative ideas that are expected to improve efficiency, reduce costs, minimize environmental impacts and ensure freshness of goods.

Session 3C: General Session

Business Environment & Management

Study on Feature Analysis of the Patent Strategy at EUVL equipment manufacturer "ASML"

Dongjian Wu and Manabu Sawaguchi

When it comes to the topic of why ASML (a Dutch semiconductor equipment manufacturer) could succeed on the R&D of EUV Lithography equipment, it is figured out that ASML, relied on its development partners for technical resources and shared technical issues with outside organizations during R&D activities. Previous studies regarding to this topic are mainly implemented as a comparative analysis, using the information and data of ASML and its competitors Canon and Nikon, the two Japanese semiconductor equipment manufacturers, from the perspective of co-authoring activities and outsourcing situation of these three companies. Therefore, it is obvious that the patent analysis has not been attempted to make discussion on the characteristics of EUVL machine R&D activities of ASML. Thus, in this study, the patent information of ASML and the two Japanese companies will be extracted from J-PlatPat (Japan Platform for Patent Information), to create a patent map using KH Coder, then the characteristics of the patent strategy that led to the ASML's success on EUVL equipment R&D will be discussed.

Proposal of set-items considering the accuracy of demand forecasting

Kaoru Kuramoto and Satoshi Kumagai

It is important for convenience store to display and sell items that contribute to income in a limited area. In this study we propose a new approach to design new item-sets and the prices of them in order to increase profit of convenience store considering the accuracy of demand forecasting, and validate it by using POS-data (the data includes three different type stores' 1 year purchasing data). Firstly, classify products by evaluation index using a random forest demand forecasting model we proposed. For each classification, classify the items in view of simultaneous purchase with ABC analysis and association analysis into three time zones (breakfast time zone, lunch time zone and dinner time zone). Secondly, calculate the benefit of each item-set in view of simultaneous purchase and raking them for each time zone. Then, pick up the top 5 goods of each class and propose new set for each time zone. Then design a questionnaire survey to gather the expected price information of each item-set. Decision of item-set' price is based on the survey data. By comparison with POS data, to verify the contribution potential to profit increase due to item-sets.

The effects of our proposal are as follows.

- (1) By classifying items, items with poor forecasting accuracy can be detected in advance, contributing to the improvement of overall forecasting accuracy.
- (2) Sensitivity analysis can show the effectiveness of profit-enhancing promotion plans that take demand and price fluctuations into account.

The Employment Method of the Temporary Workers for Seasonal Products under the Working Population Decrease

Yoshihiko Suzuki and Sadami Suzuki

The demand of seasonal products is uncertain and concentrates on a short period. The manufacturer makes production plan to demand to minimize inventory and employs temporary workers during the peak period. However, upward change of demand causes shortage, and downward change causes excess inventory. As a result, it decreases profit. For this problem, it is clarified in a previous study that the profit is improved by early employing temporary workers. However, recently the working population of Japan decreases, and the number of temporary workers decreases. In addition, by the external factors such as climate change and governmental economic measures, the demand structural change that total demand increase and demand differences between peak and bottom becomes narrower. In this study, we suggest the employment method of the temporary worker of the seasonal products under the business environment changes.

Industry Entry Strategies by Friendly M&A: Big Leap or Serial Merger

Motoki Suzuki, Makoto Shimoshimizu and Makoto Goto

This study examines the optimal strategy for firms planning to enter an oligopolistic industry through friendly mergers. We construct the model for strategies using the real options approach. Specifically, we analyze the strategies adopted by a firm that aims to enter an industry through mergers with existing large firms. We construct a new analytical model that considers the characteristics and equilibrium of the target industry. We discover that the optimal merger strategy changes according to changes in the synergy of mergers. Increasing synergy leads to a lower merger threshold and earlier merger timing.

Session 4A: General Session
Sustainable Production & Operation

Consumer Purchase Intentions for Assorted Sets of Non-Standard Vegetables through E-Commerce

Mitsuki Nakano, Kotomichi Matsuno, Takahiro Ohno, Yoshikuni Edakawa and Takaaki Kawanaka

In Japan, the number of new farmers is declining in recent years due to unstable farm income. One of the reasons for unstable earnings is thought to be that non-standard vegetables account for 40% of the vegetables produced. Non-standard vegetables are vegetables produced by farmers that do not meet the standards set by agricultural cooperatives due to damage, size, or shape, and are generally not marketed. In order to reduce losses, some farmers sell the non-standard vegetables through D2C such as e-commerce. However, as a result of interviews with EC operators who actually sell set of non-standard vegetables, it was found that there was an insufficient understanding of consumer needs.

Therefore, this study analyzes the types and levels of risk that consumers perceive for the assortment sales of non-standard vegetables based on the perceived risk theory, and examines their impact on purchase intention. In addition, the study also investigates the impact of consumer characteristics such as interest in sustainability on purchase intention. By clarifying the factors that are barriers for consumers when purchasing non-standard vegetable sets, this study propose information that reduces the risk of consumers purchasing non-standard vegetable sets and encourages them to purchase them.

A Multi-Period Dynamic Pricing Model for Fresh Foods Considering Customer Perceptions

Kento Komae, Kotomichi Matsuno, Ruriko Watanabe and Yoshitaka Tanimizu

In recent years, off-market distribution has been increasing in Japan. Most of these constitutes producer-driven supply chains, with direct sales outlets be-ing the main example, and pricing is mainly based on producer's rules of thumb and intuition. Pricing is not based on systematic evaluations, and may not ensure sufficient profits that should be obtained. In this study, we pro-pose a dynamic pricing method that combines fuzzy inference and interac-tive genetic algorithms considering the customer's product perception and evaluate its effectiveness.

Pinduoduo and the Transformation of Agriculture: Tackling Rural Area Dilemmas through Supply Chain Management

Lu Qian and Dongyu Dai

China has been grappling with substantial issues pertaining to the 'Three Ru-ral Issues', which involve rural regions, agriculture, and farmers, for a con-siderable period. Notwithstanding persistent endeavors, these complex social, economic, and political concerns persist without resolution. Considering these difficulties, the Pinduoduo Group was established in 2015, employing the strategies of group purchasing and social e-commerce. The main aim of this research is to provide a comprehensive understanding of how Pinduoduo, with its specific focus on agricultural products, utilizes supply chain management strategies to tackle these challenges. By conducting a thorough examination of their operational framework, we have identified a close part-nership between Pinduoduo and farmers, resulting in the efficient facilita-tion of agricultural product sales. The findings demonstrate a significant boost in rural development, agricultural sales, and the augmentation of farmers' income. This study highlights the innovative contribution of Pindu-oduo towards addressing the persistent challenges known as the 'Three Rural Issues', so presenting a novel approach to integrating e-commerce with rural rejuvenation.

Simulation for Decision Support of Shipment Strategy in Prawn Aquaculture Using System Dynamics

Kenji Yasuda, Reiko Fuseya, Shingen Yamamoto, Jun Miyoshi, Ryuzo Takahashi and Yutaka Takahashi

In the aquaculture industry, the quantity and timing of seed input, as well as the shipping strategy, are crucial decision support factors that affect profitability. However, stock management and growth prediction, which are key to decision support, are technically difficult to understand in real-time. Therefore, decision-making is often dictated by the experience of the aquaculturist. This study aimed to determine the relationship between inventory and growth through numerical simulations to assist in decision support regarding seed input, timing, and shipping strategies. Using a system dynamics approach, a simulation model was constructed to replicate an aquaculture pond and its rearing environment, with prawn as the study organisms. A comparison of the simulation results with historical data revealed that growth was inhibited by water temperature and prawn occupancy in the ponds. Furthermore, the relationship between seed input and profit was not proportional, and no significant effect of the timing of shipments on the final profit emerged, regardless of seed input. Future work should include building a simulation model that allows for more complex decision support by increasing the number of aquaculture ponds in the simulation.

Session 4B: Special Session

Theories and Techniques for Circular Economy

A Case Study of Sustainable Development Goals and Circular Economy Methodology

Yoshiki Nakamura, Nozomi Oomiya, Hiroki Kozu and Kinya Tamaki

The circular economy is an economic model that emphasizes effective use of resources and minimization of waste. Since 2022, we begin research regarding SDGs and CE. Circular economy defines five business models. Especially, the sharing platforms are advanced and important field. This research, therefore, focus on the educational program in platform development. It can teach a management strategy, marketing, and so on. Finally, we show the case and effectivity to study the platform.

A preliminary consideration of software development process in a circular and sustainable society

Hiroyuki Kameda

This paper overviews the software development process and points out virtualization, docker container, microservices, measurement etc. are the key technology to build a circular economy society. As software is now a SoS (System of systems), we pay much amounts of cost in software development process. In other words, software is now as if a kind of architecture which is as large and complicated as pyramid in ancient time. In this paper, paying attention for these situations, software development process is divided into 6 parts, and considered from various aspects in some details, i.e., what problems there are and how to solve the problems. The point is that in software development process, much amounts of paper is consumed, development processes are constantly repeated according to user's requests or social needs changing on time, and recently Open AI software is frequently applied to software development process which consumes huge amounts of energy. This paper describes results of tackling to solve such problems.

Development of a Method for Service Creation and Product Design to Realize a Circular Economy

Masahiro Arakawa, Won Young Park, Takeshi Abe, Kazuhiro Tazaki and Kinya Tamaki

This study develops a method for creating services and products for a circular economy. The method consists of creating services to provide additional value for customers and the design method of products considering environmental friendli-ness. In this paper, we show the characteristics of the proposed method to create valuable services using a function deployment process and the procedure of creating an IoT/DX system to enhance the value of services by using a sample problem.

Development of Service and Product Design Processes Considering Product Life Cycle Management for a Circular Economy

Masahiro Arakawa, Won Young Park, Takeshi Abe, Kazuhiro Tasaki and Kinya Tamaki

One of the purposes of a circular economy is not to generate waste in the process of usage and manufacture of products. In particular, there is expected for prod-ucts to be reused repeatedly to extend their useful life and ultimately to be re-turned to nature. Therefore, following the concept of the circular economy, we must design new products by repeatedly reusing the products. In this research, we develop a service and product design process considering product lifecycle management in the circular economy. We inspect the characteristics of product design to realize the circular economy with reference to papers discussing the cir-cular economy. Then, we develop a service and product design process using IoT/DX systems that considering these characteristics into consideration, and ex-plain the effectiveness of the developed method.

Session 4C: General Session

Optimization in Production Operations

Mass data analysis of the relationship between workers' assembly performance and their Five Factor Personality

Yanwen Dong and Noriki Ogura

In many manufacturing companies, where manual tasks such as assembly are still performed by hand, it is as important as ever to improve worker performance. Since the early 1900s, thousands of studies have examined the relationship between personality traits and job performance. In particular, the widespread adoption of the Five Factor Model has increased the frequency of these studies and provided a useful framework for interpreting worker aptitude for assembly tasks. We have conducted a number of experimental studies to investigate the impact of worker aptitude. It was found that two thirds of the variance in assembly times was determined by the workers, with the workers' aptitude or ability having a stronger influence than experience. It is very important to measure the aptitude of the workers and to put the right workers in the right place.

In our previous studies, we examined the relationship between the five super traits of the FFPQ-50, which is an abbreviation of the Five Factor Personality Questionnaire, and the performance of production cells. Since the previous studies were based on the experimental data of only 79 workers, this study collected data from 249 workers and conducted a mass data analysis to confirm how workers' aptitudes significantly affect their performance. We aim to make several new contributions through the following investigations:

- (1) This study designs and conducts an experiment of assembly operations and uses assembly time to quantitatively measure a worker's performance. This is different from most previous research, which used questionnaire survey or case study methods to subjectively assess work performance.
- (2) As most studies have paid attention to the relationship between workers' five-factor personality and job performance, this study is the first attempt to consider how workers' five super traits: extraversion, affiliation, control, emotionality, and playfulness, significantly affect their performance in assembly operations.
- (3) We used partial correlation analysis and regression analysis to examine the relationship between workers' scores on the FFPQ-50 and their assembly time. Based on the result, we intend to provide some key points for practitioners to conduct assembly operations more effectively.

On Searching Optimal Worker Assignment in Multi-Stage Production Lines

Xiaowen Zhao, Ryuji Ogawa and Shao-Chin Sung

We are concerned with worker assignment problem in multi-stage production lines, in which workers may have different skill levels. The model called the restricted-cycle model with multiple periods is under consideration. The objective is to minimize the expected cost of assignments, which is defined based on the expected idle cost and the expected delay cost at all stages. We propose a new branch and bound algorithm for finding an optimal worker assignment, and the proposed algorithm can also be applied when parallel production line environments are under consideration. Based on numerical experiments, we show that our proposed algorithm is more effective than previously proposed algorithms.

Optimizing Facilities by Adjusting Node and Server Numbers in a Closed BCMP Queueing Network

Momona Tamagawa, Haruka Ohba and Shinya Mizuno

Queueing theory is a mathematically sophisticated discipline, and there is currently an expectation to apply it to optimization problems using computational results. To achieve the overall optimization of facilities, it is essential to consider selects in the number of service nodes, the availability of nodes, and the relationships with neighboring nodes. In this research, we construct a model to perform simultaneous optimization of the number of service nodes and the number of service points at each node, given the number of people classes and the number of people within the system, in a closed network constructed using closed BCMP. The theoretical calculation of closed BCMP utilizes the mean value analysis method. We employ a genetic algorithm for optimization, where the objective function considers both the standard deviation of the mean number of people within the system and the cost of installing servers at nodes, aiming to distribute congestion effectively within the network. Constraints are implemented to ensure that the mean number of people at each node does not exceed its maximum allowable capacity. Additionally, if a specific node is not used, the number of servers at that node becomes zero. The total maximum allowable capacity of all nodes is subject to specified conditions. This approach allows for the effective dispersion of congestion within the network, prevents excessive increases in the number of people at each node, and minimizes the cost of servers installation.

Bundle Sales in Nested Demand Structure

Yosuke Yamamoto, Yu Ogasawara and Kimitoshi Sato

In recent years, there has been a growing trend among companies to increase revenue by offering two or more products or services combined into a single package, with the aim of stimulating demand. This marketing approach is commonly referred to as bundle sales. This study focuses on bundle sales targeting services with a nested demand structure. Nested demand structure implies that when two services are provided, one service (the main service) must be utilized to access the other service (the sub service). For instance, in the context of tourism in island regions accessible exclusively by ferry, the ferry service serves as the main service, while activities and transportation within the islands constitute the sub services. In this research, we formulate a revenue management model for such nested demand structures, aiming to maximize total revenue, and we validate the effects of bundle sales using the proposed model.

Session 5A: Organized Session

Optimal Integration Model for Production System

Hierarchical production planning for a plastic container manufacturer - Basic research for scheduling optimization in a combined flow shop of processing-assembly and hybrid types -

Chihiro Hayashi and Hisashi Yamamoto

The purpose of this study is to optimize the hierarchical production planning system used in a plastic container manufacturer with a combined flow shop of processing-assembly and hybrid types. As a basic study for this purpose, we formulate the relationship between production capacity, which is set by safety inventory setting parameters and demand forecast priority parameters, and evaluation indicators, such as inventory and stock-outs. We study optimization using a mathematical approach targeting production planning in the decoration and assembly processes of a processing-assembly flow shop. In particular, it differs from previous studies in that it addresses a three-stage hierarchical production planning and target models that vary in production capacity rather than inventory levels or ordering points.

Visualization of Worker Behavior for Process Improvement

Mitsuyoshi Horikawa

Improvement activities in factories are a source of competitiveness in the Japanese manufacturing industry and are designated as industrial engineering (IE). However, the introduction of many visualization technologies using IoT/AI often does not engender "visual control" that leads to improvement activities. One reason is that the methods and knowledge cultivated in the IE field and visualization technologies are not integrated. They therefore do not lead to the "discovery of waste," which is important for IE.

This study examines how visualization technology is applicable to IE methods. Findings are expected to help small and medium-sized manufacturing companies to activate their improvement activities using easy and inexpensive IoT/AI.

Applied Research on Workers Assignment Optimization using the InQross System

Xiaowen Zhao, Jing Sun, Hisashi Yamamoto and Mitsuyoshi Horikawa

In the field of production control, solving production scheduling and line balancing problems is extremely important for improving productivity, reducing production costs, and meeting delivery dates. If a delay occurs in one stage on the production line, it will affect the next stage, causing a delay in delivery and an increase in costs. However, human error of the worker, appearing or failure can lead to such delay of the whole production line. This study takes a parallel production line as an example and considers the problem of how to optimally assign workers to each stage when the total expected cost is minimized by having a different number of stages in each production line. We propose a method to verify the above sufficient conditions based on the actual measurement data by measuring the actual operating time of each worker in real-time using the 'InQross Kaizen Maker' (hereinafter referred to as 'InQross System').

Optimal Allocation Rule in Limited-Cycle Multiple Periods Considering Quality and Worker Levels

Kazuma Noda, Sun Jing and Hisashi Yamamoto

In recent years, corporate quality irregularities have been covered in various media, shaking the trust of companies and affecting sales and stock prices. Furthermore, worker abilities differ due to the increase of foreign workers and differences in length of service. Therefore, the objective is to find the optimal worker assignment rule that takes into account quality and worker levels to produce efficiently. To solve this problem, we have built a mathematical model by introducing quality cost into the concept of a multi-period constraint cycle model. We also use programming to vary the parameters of worker level and number of processes. And we conduct numerical experiments assuming various process situations. As a specific example, if there are two workers who work quickly, we are studying the optimal placement of these two workers to minimize cost. Based on these numerical results, we propose optimal placement for different worker levels and provide proofs to generalize the law.

Session 5B: General Session

Logistics and Operations Management

Supply chain coordination with production, transportation, and demand uncertainties considering subsidies

Masatoshi Tanaka

In the vaccine supply chain, there are many uncertainties in vaccine design, manufacture, delivery, and demand, especially with the need to update vaccine components on time as viruses continually mutate. This can result in significant losses to vaccine manufacturers and retailers. Therefore, governments provide subsidies to the production and purchase sides in the vaccine supply chain, respectively, to increase the sustainability of the supply chain. Li et al [1] considered a vaccine supply chain consisting of vaccine manufacturers and sales retailers, and considered uncertainties in the manufacturing, transportation, and sales processes. The model was constructed to account for uncertainty in the manufacturing, transportation, and distribution processes, as well as government subsidies. In their analysis, they used a uniform function for the distribution function, which is the uncertainty part.

In this study, we discuss the generality of the model extended from the model of Li et al.

Development of a Vehicle Routing Model for School Lunch Centers in Japan

Haruka Ohba, Koji Ishizuka and Shinya Mizuno

School lunches in Japan play a crucial role in the growth, food education, and overall education of children. The environment for preparing school lunches is centralized at centers rather than cooking within each school's lunch preparation room, due to factors such as declining birthrates and the need to reduce costs. It is necessary to establish distribution routes that comply with standards. Therefore, we conducted a study focusing on the optimization of distribution plans specialized for lunch centers, targeting a lunch center in Fukuroi City, Shizuoka Prefecture, Japan. We formulated the distribution planning optimization problem and achieved optimization within a feasible time frame. Calculating routes within feasible time frames using linear programming proved to be challenging, so we adopted a genetic algorithm to determine the routes. As a result, we were able to derive a route that reduces the distance by 52.3 km/day compared to the current route scheduling, enabling an annual fuel cost reduction of approximately 210,000 yen. This model can also be applied to other regions. With the ongoing decline in birthrates leading to the merging or abolition of schools and changes in lunch preparation methods, the need for optimized route scheduling plans is expected to increase. Additionally, considering costs for the potential introduction of Electric Vehicles (EVs) is crucial from a sustainability perspective.

Standby Location Determination System for Food Delivery Personnel

Xuyang Chen, Kotomachi Matsuno, Yoshikuni Edagawa, Takaaki Kawanaka and Takahiro Ohno

The food delivery market has continued to expand in recent years due to the coronavirus pandemic. There is an increasing amount of research on food delivery, especially on delivery efficiency. However, there is little research on the standby time of delivery workers. In addition, the standby time is highly dependent on individual experience, which leads to large differences in earnings among delivery staff, making it difficult to increase the number of new delivery staff. With the aim of creating a fairer delivery environment, this study proposes a standby location recommendation system that can reduce the waiting time of delivery staff using pygame and verifies its effectiveness.

Effectiveness of Different Pricing Strategies at Reducing the Workload of Home Delivery Services

Hisashi Kurata

Owing to a declining birthrate, aging population, and labor shortage, the Japanese logistics industry is at risk of collapse. In particular, coming restrictions on overtime hours for truck drivers are expected to have a major effect on home delivery services. Japan's delivery companies generally charge the same delivery fee for both face-to-face attended delivery, which may include redelivery, and unattended delivery, where the item may just be placed in front of door. In this study, we investigated whether differentiating the delivery fee by charging a premium for attended delivery or offering a discount for unattended delivery of a delivery company. We formulated a game theoretic model to consider a delivery company and users with different service preference. We then determined the conditions under which price differentiation can achieve separating equilibrium where users choose attended or unattended delivery according to their service preference. We also consider the conditions under which both the company and user select the same price differentiation strategy.

**Session 5C: General Session
Information Technology and Management**

Reduction of Hotel Reservation Plans Using the Clustering Method and Its Profit Effects

Wataru Nugata and Kimitoshi Sato

Many hotels in Japan sell the same guest room as a product with various added values (e.g., types of meals, amenities, hot springs, etc.). These products are called plans. While hotels can meet various customer needs by offering a large number of plans, there is concern that customers will avoid purchasing due to the large number of choices. In addition, the management of a large number of plans is complicated and places a heavy burden on employees, especially in hotels in regional cities where there is a serious shortage of labor. In this study, we use actual hotel reservation data to aggregate the number of plans based on plan characteristics and customer attributes. The simulation results show that the aggregation of plans improves the hotel's profit by reducing the risk of customers' non-purchase behavior due to choice aversion and the cost of operating the plans.

Multi-Task Learning for Estimating Consumer Impressions of Product Images

Ayako Yamagiwa and Masayuki Goto

The impact of product images on consumers' willingness to purchase is significant, and their analysis is an important issue for companies. Product mapping is one possible analysis method, but conventional methods are difficult to apply when the number of products is large due to the high cost. The authors have proposed a method to create impression maps for thousands of products at a feasible cost by introducing a deep neural network (DNN) to estimate the pair-wise comparison results for a product image pair. The authors' method creates maps based on customers' impressions by setting arbitrary evaluation axes, and the possible "impressions" may be opposite, similar, or have a common denominator. Hence, more complex relationships are expected to be captured by learning different evaluation axes at once, i.e., by introducing multi-task learning. However, analyzing under what conditions multi-task learning is important, because it has been reported that, in some cases, simultaneous learning can lead to a deterioration of accuracy. This study, therefore, first shows the difference in accuracy between learning each indicator alone and with multitask learning in a DNN model. Furthermore, based on experimental results and psychological findings, we discuss the conditions under which multi-task learning is effective.

Analysis of corporate value factors by cluster considering non-financial information

Ryota Hasegawa, Kaoru Kuramoto and Satoshi Kumagai

In recent years, non-financial information has attracted attention as one of the factors influencing corporate value, and the relationship between corporate value and non-financial information, such as R&D investment and greenhouse gas emissions, has been clarified. In addition, there exists a time lag between corporate value and both financial and non-financial information, and some information may be delayed for a long period of time, affecting corporate value. However, the factors that influence corporate value are arbitrarily selected and the corporate value analysis targets a specific industry or encompass all sectors, resulting in a lower explanatory power of corporate value. Therefore, we define clusters of companies to be analyzed and propose a corporate value factor analysis model that takes non-financial information into account. The objective is to clarify the corporate value factors for each cluster and to improve the explanatory power of the corporate value factor analysis model. We also consider the time lag between corporate value and information.

The objective variable is corporate value, and we have selected 11 factors related to environmental, financial, and working environment aspects as explanatory variables for corporate value factors, using a stepwise method. Then multiple regression models are proposed. Since the number of cluster combinations is computationally huge, we use a local search method to define the appropriate cluster as the combination of corporates with the largest sum of degree-of-freedom-adjusted decision coefficients.

As a result, the explanatory power of the corporate value factor analysis model is higher for each of the proposed clusters compared to each of the incumbent industries.

The choice of explanatory variables varies by cluster, with the result that there were clusters with greater influence of environmental items and clusters with greater influence of financial items.

In this study, we objectively selected explanatory variables and identified corporate value factors by cluster. This method is also expected to serve as one criterion for investment diversification for investors.

A Clustering Method Using Embedded Representations Based on User Ratings

Miho Mizutani, Ayako Yamagiwa and Masayuki Goto

To implement efficient marketing measures that increase the repeat usage rate of users and improve user satisfaction on e-commerce sites or content distribution services. It is effective to cluster users and items based on the information related to their preferences and to develop marketing measures for each class based on this clustering. As a conventional method for clustering users and items based on their preferences, there is an analysis that applies Non-negative Matrix Factorization to user ratings. This method assumes that user rating is an interval scale. However, user rating is determined by each user's feelings and is not necessarily on an interval scale. To address this issue, this research utilizes TransR and proposes a method to estimate embedded representations of users and items based on user ratings by each user. In the proposed method, user rating values can be treated as independent relations rather than interval scales, so it is expected that it will be possible to cluster users and items more clearly than conventional methods. We also confirmed the effectiveness of the proposed method by applying it to a movie-related dataset.

An Option Pricing Framework for Valuation of Football Players: Transfer Offers and Sellouts

Yuta Kudo, Makoto Shimoshimizu, Makoto Goto, Martyn Williams, Naoto Noguchi, Shohei Sasaki and Akihiro Takai

This study formulates the contract values for professional football players using an option-pricing framework. Unlike the existing models, our model is designed to reflect real contracts. We consider player sellout choices and transfer-related uncertainties in actual contracts. Our formulation deals with the player's contract-pricing problem as a dynamic decision-making issue and applies the real options method. Moreover, we conduct numerical computations based on an actual club's sales and players' performance data. As a result, we gain insights into the profit and loss incurred by transfers and sellouts. Furthermore, our framework provides quantitative contract values for real players at each time point. The framework developed in this study can serve as a quantitative criterion for football clubs when making investment decisions concerning players.

Session 6A: Industry-Academia Collaboration (II)

Logistics Planning and Optimization

Operation Planning of Electric Buses Considering Uncertainty of Power Consumption

Takuma Ohzeki, Tetsuya Sato, Yoshitaka Tanimizu and Ryunosuke Hamada

The introduction of electric vehicles (EVs) has been considered as a significant step toward establishing a low-carbon society. However, a shorter travel range is often exhibited by EVs when compared to traditional gasoline or diesel vehicles, and longer charging durations are required. Hence, large-scale introductions of electric buses in Japan have been limited. Battery recharging is required by electric buses during a single day's operation. This in turn leads to challenges in adhering to the traditional schedules of diesel buses. Given these challenges, a model that considers variability in power consumption has been proposed to develop an operational strategy for electric buses. Based on numerical experiments, the restructuring of the operational plan, which integrates bus routes with charging schedules, has been demonstrated using the proposed model.

Solution Method of Stochastic Integer Programming for Planning the Introduction of Electric Buses

Yusuke Ishitani, Hiroaki Ueno, Tetsuya Sato, Yoshitaka Tanimizu and Ryunosuke Hamada

The introduction of electric vehicles as route buses is expected to play a major role in reducing CO2 emissions. Nevertheless, fluctuation of the energy consumption by electric bus operations renders it difficult to optimize the operations. Therefore, developing an optimal planning model for introducing electric buses with probabilistic constraints and improving its calculation efficiency are important. In this study, we proposed a planning model and its solutions using the cutting plane or quantile-based approximation method.

Application of tabu-search-based method to order batching and routing problems in logistics warehouses

Rune Noguchi, Takashi Irohara, Takashi Tanaka and Naomi Sugiyama

The order batching problem and the picker routing problem are methods for improving the efficiency of order picking operations in logistics warehouses. The former is a problem to optimize the combination of multiple orders for efficient picking, and the latter is a problem to optimize the route for picking batches, which are a sets of combined orders. Both problems have been formulated as mathematical optimization problems to minimize the total travel distance, and have been the subject of numerous previous studies. However, when the scale of the problem is large, it is often impossible to obtain an exact solution in a practical time, and even a feasible approximate solution cannot be obtained. In this study, we propose a new optimization algorithm based on the tabu-search method, a meta-heuristic, for the batching and routing problems in logistics warehouses, where the order batching and picker routing problems are considered simultaneously. The effectiveness of the proposed method is verified through a large number of numerical experiments using large-scale problem data prepared with reference to real data.

Teaching logistics optimization through a real-world project-based learning

Shunichi Ohmori and Toru Kajino

In this work, we present a project-based learning approach to teach logistics optimization to undergraduate students. Logistics optimization has been widely taught in business and engineering schools. However, when students encounter a real-world problem, there are several key challenges. First and most, modeling the optimization problem based off of real-world business needs is much different from classroom examples. The optimization modeling is a fundamental activity of creating a simplified representation of real-world decision-making. However, since most undergraduate students have no industrial experience, they have limited understanding of what element should (and should not) be incorporated into the problem. Second, unlike the classroom examples, there are overwhelming and large amount of data, which includes hundreds of SKUs transaction data. Many optimization problems with such large amount of data are difficult to solve, and thus, modeling often need some compromise to be computationally tractable. Finding the right level of aggregation to balance between reality and simplicity is often challenging. Third, to present the key results and insights in a way that business professionals can understand and discuss with is often challenging for students. While students usually focus on details of analytical process, business professionals are interested in influencing an organization and having an impact on business outcomes. We developed a project in which students learn by actively engaging in real-world problem. The company we worked with is a well-known restaurant chain. The logistics network involves factories, warehouses, and restaurant stores. Recent trends of increased demand and truck driver shortages have made the company reconsider the logistics network design. We present how students develop optimization model and use it to help the decision-making of company we worked with.

Session 6B: Organized Session

Mathematical and Information Technology for Plant Product Supply Chain Management

VEGETOMO, a Chat System that Connects Agricultural Producers and Consumers

Tomoko Kashima, Shimpei Matsumoto and Takashi Hasuike

Producers who supply products to agricultural direct sales outlets don't have the means to know the consumers who pick up the products. Knowing what kind of products consumers want and the level of interest and concern consumers have for the products is important to boost the motivation of the producers. Therefore, this study develops an information-sharing system, named VEGETOMO, targeting housewives that enables information sharing between producers and consumers. Through VEGETOMO, we propose a mechanism where both producers and consumers can more actively share information. This study utilizes LINE Bot, which makes use of LINE Messaging API, allowing consumers to easily use the system with a familiar design and view product information and recipe information. Additionally, along with LINE Bot, we are placing tablet devices in stores to display videos introducing LINE Bot. By this, we guide consumers from the tablet devices in the store to LINE Bot, and from LINE Bot to Facebook, functioning as a tool to connect producers and consumers in this process. With VEGETOMO, we aim to convey the producers' production processes and thoughts up to the point the products are lined up in stores. Such information can form trust and assurance in agricultural products and is considered effective in improving the added value of agricultural products. Therefore, it can be said that VEGETOMO is effective for a sustainable agricultural system.

Forecasting Regional Order Quantities in E-commerce Websites Using Time Series Models

Takaki Kawamoto and Takashi Hasuike

The rapid adoption of electronic commerce (EC) services has led to the establishment of numerous online sales platforms. Forecasting the order quantity is crucial for effective inventory management at EC-affiliated stores and meeting demand in EC services. In this study, we explored time series modeling, focusing on ARIMA-derived models, namely SARIMA and SARIMAX, considering the limited features in the dataset for forecasting.

The dataset was obtained from an EC platform specializing in floral products with peak demand during Japanese Mother's Day.

In the SARIMAX models, we proposed exogenous variables such as binary indicators for Mother's Day and holidays and a variable denoting the week of May.

The SARIMAX model with the "Mother's Day" variable yielded the best performance.

However, forecasting accuracy was inadequate due to date variability.

To improve forecasting accuracy, we propose a data-formatting approach that expresses dates based on Mother's Day.

This approach aims to eliminate the influence of date variability.

By adopting the proposed approach, we achieved more accurate forecasts compared to our previous results.

In conclusion, our proposed exogenous variables and data-formatting approach allowed for order quantity forecasts with optimal accuracy.

Despite the promising results, our study has limitations, such as the reliance on a specific dataset and need for further validation in diverse EC contexts.

Future research could explore the integration of additional exogenous variables and investigate the scalability of our forecasting approach.

Two-step Optimization Method for Multi-objective Crop Planning Problem in Contract Farming System

Takashi Hasuike and Yameng Huang

This study examines a contract farmer system between a public institution and farmers from the perspective of mathematical optimization, with local production for local consumption of agricultural products in mind. Specifically, it is considered to stabilize the profits of local farmers by maximizing their agricultural out-put, while at the same time maximizing the profits (or minimizing the costs) of the public agency. The proposed problem is formalized as a multi-objective optimization problem, and the optimal solution cannot be obtained directly. Therefore, in this study, the proposed mathematical programming problem is solved in two steps to obtain the optimal solution, taking into account the importance of the objective function.

Session 6C: Special Session**Sustainable Manufacturing and Service (I)****An Enhanced Bucket Brigade Order Picking System with a Conveyor****Xin Zhou, Keisuke Nagasawa, Katsumi Morikawa, Katsuhiko Takahashi and Daisuke Hirotsu**

Bucket brigade order picking systems (OPSs) exhibit high operational productivity due to their self-adjusting characteristic without requiring management intervention. However, the unproductive travel behaviors of pickers can impact productivity, particularly when the OPS handles a large number of small-sized orders that lead pickers to walk long distances to pick a few items. This study proposes an OPS to mitigate unnecessary walking behaviors of pickers in bucket brigade OPSs. The proposed OPS incorporates a conveyor system to assist pickers in transporting totes that have completed order picking to the unloading station and to introduce new empty totes. By doing so, the proposed OPS reduces the average total walking time cost by 36.64% and increases productivity by 9.65% in the designed simulation experiments.

Real Estate Property Image Classification Based on Optimal Transport Costs**Hiroya Ichihara, Kazushi Okamoto and Atsushi Shibata**

There is a growing need for image information in the real estate industry. While previous studies on the quality of real estate property images and their labels have reported that real estate property images contain data on the relationships among labels, conventional methods do not train classification models for real estate property images to account for the relationships among labels. In this study, we validate the effectiveness of a classification model that uses optimal transport costs as a loss function to account for the relationship between labels. In the experiment, the relationship between labels in real estate property images is formulated using a cost matrix based on language and image, and the optimal transport costs with entropy regularization obtained using the Sinkhorn algorithm are used as the loss function. The experimental results demonstrated that accuracy improves by 0.018 points for the cost matrix by language and 0.017 points for the cost matrix by image, compared with the conventional loss function, categorical cross entropy. The results also indicated that the optimal transport costs may be robust to highly ambiguous data.

Mix and Single Carbon Policy Evaluations for Cost-Effectiveness of GHG Reduction in Global Supply Chain Network**Miyu Kotegawa, Yuki Kinoshita and Tetsuo Yamada**

Global warming caused by Greenhouse Gas (GHG) has been recognized as one of the most serious environmental issues. To reduce GHG emissions in the global supply chain, various carbon policies such as emission trading have been introduced in each country. Each carbon policy has its own characteristics, and it is important to introduce appropriate carbon policies depending on the goal. Carbon tax is relatively easy to implement because it can be incorporated into existing systems. Emission trading is a mechanism that allows companies to buy and sell differences between actual GHG emissions and emission allowances. As each country introduces carbon policies, their effects influence each other. This study models global supply chain with emissions trade based on Nagao et al. (2022) and analyzes the GHG emissions and costs in the supply chain under different carbon prices with carbon tax and cap-and-trade and obtained from the model policy mix and single policy are compared and discussed.

Effect of Risk Aversion and Experiential Learning on Domain Knowledge Acquisition Using the Beer Game**Daiya Watanabe, Jundai Koketsu, Aya Ishigaki, Ryuta Takashima and Hajime Nishida**

This study determines the effects of risk aversion and experiential learning on decision making regarding inventory management in supply chain (SC) management. A total of 33 subjects, including students and inventory control experts in the

Department of Industrial Engineering at the Tokyo University of Science, participated in the experiment, which replicated the replenishment decision model in a beer game. The decision-making results tended to differ depending on the degree of risk aversion after a number of experiments. Future research on the impact of the factors identified in this study on SC performance is needed.

Session 7A: Industry-Academia Collaboration (III)

Smart Production Planning and Management

Scheduling of Design Engineers in an Engineer-to-Order Production System

Nirmala Liyanarachchi, Shingo Akasaka and Jiahua Weng

Lead time reduction is a major challenge facing Engineer-to-Order manufacturing. Rapid skill improvement of the workforce will positively impact the processing time of work. For Engineer-to-Order production systems, the product design activity significantly affects product lead time. In this research, a scheduling system for design engineers in such a production environment is investigated as a combinatorial optimization problem. A tabu-search based algorithm is proposed, and neighbourhood structures are explored.

Delay Risk Assessment for Job Shop Scheduling Considering Uncertain Processing Times

Masaki Sano, Yoshitaka Tanimizu, Kotomichi Matsuno and Ruriko Watanabe

This study expresses the uncertainty of manufacturing processing time as a random variable and proposes a new production schedule evaluation method based on the probability distribution. We obtained results by using this proposed method. The results were compared with simulation results in order to clarify the effectiveness of the proposed method.

Analysis of Takt Time Extension in Assembly Lines with Multiple Elemental Works Allocated to a Process

Kagehisa Nakayama and Hisashi Onari

In recent years, in response to the diversification of customer needs and the shortening of product life cycles, there has been a shift towards establishing multiple production lines for each product, similar to cell production. Such production lines generally consist of multi-elemental work process, which multiple elemental works are allocated to a process. However, in production lines constructed with such multi-elemental work processes, it is often observed that operations cannot be carried out at the targeted takt time, resulting in a failure to meet production goals. In the production line under investigation in this study, the discrepancy between planned takt time and actual execution takt time also has been a problem.

Therefore, in this study, we conducted an analysis of the factors causing an extension of process work time in multi-elemental work processes through the analysis of a manual assembly line for white goods appliances and assembly work experiments. The study clarified that, when estimating multi-elemental work process work time, it is necessary to consider not only the execution time of component elemental work but also the time for interruptions in operation and cognitive processes.

An Investigation into Refining Accuracy of Business Quote Estimation by Digitalization in Small and Medium Manufacturing Enterprises in Japan

Yuri Nagase and Testu Saito

Many of Japan's small and medium manufacturing enterprises (SMMEs) are referred to as "subcontractors", meaning that they are contracted by certain prime contractors to process parts or manufacture a portion of their output. These SMMEs are in a difficult business situation because they have little bargaining power with prime contractors and unable to raise the fees charged to them. Under these circumstances, Digital Transformation (DX) for business sustainability is attracting attention. In this paper, we analyzed each of process leading to the creation of new value, focusing on factors such as human resources, data, business functions, and inter-business information linkage in four companies that are advanced in the use of DX. As a result, we found that all the cases had one thing in common: they were all working to improve the accuracy of their estimates. Based on these results, we will discuss how the DX process should be implemented for many SMMEs with weak price negotiation capabilities.

Session 7B: Special Session

Optimization for Sustainable Management

A Mathematical Model of the Multi-objective Flexible Job-shop Scheduling Considering Human Factors

Mingjuan Zhao, Jing Sun and Koichi Nakade

The Flexible Job Shop Scheduling Problem (FJSP) is crucial in adapting to varying market demands and production contexts, yet existing approaches tend to prioritize machine efficiency, often sidelining worker needs. This re-search advocates for a holistic approach to FJSP that concurrently considers machinery and worker allocation, focusing not just on operational efficiency, but also on the physiological and psychological wellness of workers. A mathematical model addressing these facets within a multi-objective FJSP framework is proposed and validated through numerical experiments, providing a balanced and human-centric perspective to scheduling solutions.

A Heuristic Algorithm for the Vehicle Routing Problem with Stochastic Travel and Service Times

Yusuke Honda and Koichi Nakade

In this paper, we consider the vehicle routing problem with stochastic travel and service times. We determine the delivery routes that meet customer's time window when the arrival time of the vehicle at customers is uncertain. We propose the algorithm that iteratively generates efficient routes and adds them as candidates. The algorithm adds multiple routes in one iteration to the possible routes, to improve computation time. The computational experiments show that the computation time can be significantly improved for the problem with many customers.

An Optimization Model of a Retailer and a Manufacturer in a Green Supply Chain

Wataru Sakurai and Koichi Nakade

In recent years, the development of a green supply chain model that takes sustainability into consideration has become an urgent issue in corporate management and policy operation. For example, in the fashion industry, the proper circulation of not only used items purchased by consumers, but also unsold items generated in retail stores is one of the most important issues. In this study, we examine a supply chain model for the appropriate circulation of unsold new products from retail outlets. Specifically, we considered a supply chain model in which a retailer's inventory is divided into two states under stochastic demand fluctuations: new and old items, and the unsold old items are collected and reproduced by a manufacturer. By formulating this model as a Markov decision process, the optimal decisions regarding the retailer's ordering policy and the retail price and the manufacturer's wholesale price are obtained. Optimal investment and appropriate institutional design to reduce CO2 emissions generated in a supply chain are also considered. Specifically, we examine the decision of green investment in manufacturing technology to reduce CO2 emissions when a manufacturer produce items. And we examine the design of a carbon tax system to control CO2 emissions. Sensitivity analysis on the carbon tax system shows that raising the carbon tax rate increases the optimal retail price, the optimal wholesale price, and the optimal green investment.

An Integrated Model for Power Demand Forecasting and Power Procurement Using Economic Indicators

Risako Yamauchi and Jing Sun

This paper aims to derive optimal combination of electric powers for electric power market network considering environmental evaluation. Currently, attention is being paid to increasing the ratio of renewable energy generation in the electric power market which called Green Energy Coefficient (GEC). Many studies have analyzed different purposes for power market, such as configuration problem of electric power price, customer's electric power purchase distribution problem, power consumption problem, the development problem of the power generating system and so on. In this research, we propose the optimization stochastic programming models for electricity supply chain under renewable integration. We explicitly consider intermittency of renewable energy by developing a scenario decision tree, and further formulate and solve a multistage stochastic supply balance model to meet the aggregate demand in each period. The case study application is used to illustrate the model and how it supports the electricity marketing strategy.

**Session 7C: Special Session
Sustainable Manufacturing and Service (II)**

Comparison of Different Procurement Options and Influence on Greenhouse Gas Emissions: Case of Bochum City

Seigo Takahashi, Yuki Kinoshita, Nora Schelte, Thomas Spelten, Semih Severengiz and Tetsuo Yamada

The electric moped scooter (e-moped) sharing service has attracted attention because of less greenhouse gas (GHG) emissions in a usage phase. This study examines reduction of GHG emissions and total costs including equipment cost of charging stations for the e-moped sharing service simultaneously. First, a bill of materials (BOM) for the e-moped is created, and Bochum city data are surveyed to set 2 different cases of equipment charging stations in the city. Next, supplier selection is formulated and conducted to balance GHG emissions and procurement costs based on the cases. Finally, GHG emissions and total costs including the equipment costs of charging stations are evaluated. It is found that 1 ton GHG emissions of material procurement for e-mopeds can be reduced within additional 10,000 yen at both cases.

Motion Capture Analysis of Learning Effect for Assembly Tasks

Koki Karube, Ryuto Kawane, Taku Hayashi, Masao Sugi and Tetsuo Yamada

The aging population has recently led to a labor shortage. Developing re-sources and transmitting skills to workers in the manufacturing industry is crucial to address these challenges. However, these skills must be conveyed through verbal instructions or on-the-job training from experienced workers to inexperienced ones. A quantitative analysis is required to understand their learning progress effectively. This study, used motion capture technology to visualize nut-tightening operations to gain insights into the efficiency of workers and their proficiency levels. We assessed the skill development overtime by analyzing the time series data.

Maintenance Policy for Multi-unit Redundant Systems with Two Types of Opportunities

Zirui Wang, Lu Jin and Watalu Yamamoto

Opportunistic maintenance is an effective way to reduce maintenance costs. However, the existing models for opportunistic maintenance are developed mainly on series systems or single types of maintenance opportunities such as system shutdown caused by failure of units. This paper proposes a maintenance policy with opportunistic maintenance for multi-unit redundant systems. Both internal maintenance opportunities, caused by unit maintenance, and external maintenance opportunities, caused by external factors affecting system operation and maintenance costs, are considered. The deterioration of the system unit follows a semi-Markov process, and the occurrence of external maintenance opportunities follows a homogeneous Poisson process. The proposed policy is optimized to minimize the total expected discounted cost over an infinite horizon based on a semi-Markov decision process. An example of a three-unit redundant system demonstrates the effectiveness of opportunistic maintenance.

Revised Mode Switching Policy for a Hybrid Closed-Loop Supply Chain

Leanne Russell and Daisuke Hirotani

This research paper investigates the advantages of implementing a closed-loop supply chain (CLSC) and underscores the potential enhancements in efficiency, productivity, and sustainability it offers. Additionally, it explores the integration of a hybrid CLSC to bolster a business's resilience in the face of disruptions and fluctuations in demand, particularly in mitigating the notorious bullwhip effects. Existing studies on hybrid CLSC have primarily focused on control strategies, mainly the development of a push-pull model, emphasizing the necessity for proactive bullwhip effect mitigation. However, these studies have overlooked a critical aspect—comprehending the implications of these strategies on the total cost while considering each mode in detail. The primary objective of our research is to propose the revised switching policy and calculate the total cost within a hybrid CLSC framework utilizing a Markov chain approach. We achieve this by constructing a revised hybrid push-pull model, subjecting it to analysis within a Markov chain framework, and assessing its cost-effectiveness, particularly in the context of bullwhip effect mitigation.

**Session 8A: Special Session
Sustainable Supply Chain Management**

Simulation Analysis of Inventory System Considering Advance Demand Information and Production Capacity

Xiaohua Wang

In this study, we dynamically adjusted the production capacity and inventory replenishment level of the supply chain inventory system using advanced demand information to respond to uncertain demand. We evaluated the system's performance using a simulation method, specifically focusing on four factors: the ratio of demand with advance demand information, the coefficient for adjusting production capacity, the period for adjusting production capacity, and the coefficient for determining inventory replenishment levels. We analyzed their effects on average inventories, average backorders, and average production capacity shortages. In conclusion, the following key points were identified. A higher ratio of demand with advance demand information led to a more pronounced reduction in inventory and backorders. Insufficient capacity is affected by the capacity coefficient. A low setting of this coefficient, combined with a short dynamic adjustment period of capacity, improves the shortage situation. While the coefficient for inventory replenishment level significantly affected inventory and backorders, it was not correlated with insufficient production capacity. Based on these conclusions, effectively utilizing advance demand information in determining production capacity and inventory replenishment levels is meaningful.

Supply contracts with capacity investment and bargaining powers for a two-stage supply chain

Pyunghoi Koo and Sung-Moon Jung

In a supply chain (SC) comprising an upstream component supplier and a downstream manufacturer, the channel coordination is a critical challenge with significant implications for the overall efficiency and profitability of the chain. When introducing a new product, both the supplier and manufacturer must invest in production capacity, involving significant capital outlays. The investment risks could be critical for the supplier, especially when a single downstream manufacturer exclusively uses the component, as an excessive capacity investment can result in a permanent loss. Consequently, suppliers often make conservative capacity investment decisions, exacerbating the double marginalization problem. Various coordinated supply contracts considering capacity procurement have been studied extensively where capacity investment risks are shared between the supplier and manufacturer. Capacity reservation, capacity cost sharing, and commitment contracts are among the coordinated contract types dealing with capacity building. However, previous studies on supply contracts often overlook the bargaining structures of the parties involved, resulting in limited applicability. Our study aims to present a supply contract scheme that enables manufacturers to design and select supply contracts to achieve channel coordination under arbitrary bargaining power. Our contract scheme consists of two supply contracts, capacity cost sharing (CCS) and surplus capacity compensation (SCC) contracts. Revenue sharing is a building block for both contracts. In the CCS contract, the supplier's capacity investment costs are shared with the manufacturer, while in the SCC contract, the manufacturer compensates the supplier for investment in unused capacity. Each contract encourages the supplier to invest in production capacity in alignment with the overall supply chain capacity under different bargaining power scenarios. Our work contributes to the literature in three ways: First, we show that any bargaining power structure can be satisfied with one of these contract policies. Specifically, the SCC contract can lead to the channel coordination under a higher supplier's bargaining power, and the CCS contract under a lower supplier's bargaining power. Second, we explore the interrelation between contract parameters of each contract type and establish them for channel coordination. Finally, we derive the relationship between bargaining power and optimal supply contracts and present a mechanism for selecting the appropriate contract policy under different bargaining power structures.

Optimal Strategies of Electricity Plans Using Latent Class Analysis Considering Renewable Energy

Kirana Horie and Jing Sun

Demand for renewable energy is increasing. Along with this, the burden of electricity charges as levies is also increasing. There are many complaints about this levy. However, future levy prices are also expected to rise. Among these, what can be said to be important is how to get people to choose a renewable energy plan, even if there is a burden. In the research so far, there is no research that presents additional information on global environmental risk information, measures the impact of the information effect, or creates a new power plan that suits consumers. Therefore, in this study, in order to evaluate the influence of global environmental risk information on consumer perception, we extract stated preference data by selective conjoint survey and estimate consumer preference by latent class model. We decided to verify the extent to which the presentation of global environmental risk information is effective in improving consumer receptivity and increasing awareness of renewable energy plan selection. In addition to that, the purpose of this research is to derive optimal strategies of electricity plans using latent class analysis considering renewable energy for the optimization of power generation in virtual power plant environment.

Session 8B: General Session

Business and Economic Decision-making

A multi-agent-model considering green energy coefficient and the entry /exit to electricity trading market

Motodamari Koki and Sun Jing

JEPX Japan Wholesale Electric Power Exchange currently has a spot market (one-day market) that takes place one day before power supply and a pre-hour market (same-day market) that is subsequently adjusted. In addition, the operation of multiple markets such as the capacity market and the adjustment power market procured by local transmission and distribution companies is expanding. It is necessary to analyze market trades in order to respond to the market.

To analyze the price formation process in the electricity trading market under the constraint of the future renewable energy ratio in electricity, we will conduct an electricity trading simulation in which each bidder sets the bidding price between the two parties, the seller (power producer) and the buyer (retailer). Two markets, a one-day-ahead market, and a day-ahead market, will be established, and the transaction method will be the same as that used in the actual market.

Optimizing Pricing Strategies in Dual-Channel Closed-Loop Supply Chains: An Analysis of Manufacturer's Corporate Social Responsibility Investment

Yang Xiao and Hisashi Kurata

The advent of dual-channel closed-loop supply chains further complicates the incorporation of corporate social responsibility (CSR) initiatives in a business environment where CSR and sustainability are crucial. Our study examines the unexplored complexities of integrating CSR practices into this complex system, considering the growing focus on supply chains and societal expectations. Using equilibrium analysis and numerical simulations, the study intends to investigate how different recycling channel structures affect optimal CSR investments, the resulting impact on pricing and recycling rates, and the interaction with consumer channel preferences. Our findings indicate that increased consumer sensitivity to CSR correlates with increased profitability and recycling rates, providing a strategic advantage to the manufacturer. This analysis provides a novel contribution by revealing the operational and ethical complexities of CSR integration in dual-channel closed-loop supply chains. It encourages firms to incorporate CSR efforts with consumer education and to synchronize pricing and recycling strategies for mutual benefit, thereby providing manufacturers and retailers with actionable strategies for achieving sustainable and profitable operations.

Biofuels supply chain network equilibrium model in the aviation industry

Yasushi Narushima and Shoma Uda

Increases in carbon dioxide (CO₂) emissions are having a major impact on climate change in modern society. The transportation sector accounts for a large portion of this, and airplanes, in particular, emit more CO₂ per ton-kilometer than other ways of transportation. Therefore, Sustainable Aviation Fuel (SAF), which is made from plants and waste, is attracting attention as a next-generation aviation fuel for reducing CO₂ emissions. Though airlines can be exempted from part of their emissions trading obligations by using SAF, the amount of SAF that can be supplied is not sufficient and thus the price of SAF is higher than the fossil aviation fuel. Therefore, in this study, we focused on the use of SAF in the airline industry, and we propose a Supply Chain Network Equilibrium (SCNE) model between raw material procurers, fuel manufacturers, airlines, and emissions markets. In the proposed model, there are two types of raw material procurers. The first ones procure the raw materials for fossil aviation fuel and the second ones for SAF. Same as raw material procurers, there are two types of fuel manufacturers. We assume that the raw material supplier and the fuel manufacturer make decisions to maximize their respective profits and that the airline company makes decisions to minimize its costs. We also assume that some equilibrium conditions in emissions markets. We reformulate the proposed SCNE model to a variational inequality problem. Finally, we present some numerical results and analyze the impact on trading volume and trading price of fuels when supply chains for SAF are established.

Session 8C: Special Session**Sustainable Manufacturing and Service (III)****Scheduling Vinegar Production and Filling Processes using a Mixed-Integer Programming Model: A Case Study****Katsumi Morikawa, Yasutoshi Yajima, Mana Kanda, Baku Takahashi, Kimiko Okamoto, Youichirou Hirohata and Kenta Kasaishi**

The scheduling problem for vinegar production and filling operations of a target factory is investigated. The processes include mixing, sterilization, and filling with several tanks. In the mixing process, it is essential to consider the mixing time and tank capacity constraint, and in the sterilization and filling processes, the filling speed is the critical factor in generating feasible schedules. When multiple batches are necessary for a semi-finished product, it is necessary to mix them promptly, and feed them to the sterilization plate without a break. Given the quantity of the products to be filled in a single day, the problem of determining the schedule of when to start and finish each process is formulated as a mixed-integer programming model. The solutions obtained by using actual production schedule data were recognized as acceptable, as the model includes the key features of the processes.

A Note on Reliability Computation for Linear Consecutive-k-out-of-n:G Systems Using Domination**Lei Zhou, Shoichiro Miyamoto, Yoshinobu Tamura and Hisashi Yamamoto**

A linear consecutive-k-out-of-n: G system consists of n components which are arranged in a line and the system works if exists k or more working components continuously arranged. In this paper, we first summarize the several proposed methods of system reliability evaluation of the consecutive-k-out-of-n:G systems. However, these methods based on the assumption that all components are independent and identical. We then consider the system reliability of the linear consecutive-k-out-of-n: G system when components lifetime not need to be identical, and a method of domination is introduced.

Sugarcane Supply Chain Network Design with Greenhouse Gases and Disposal**Keisuke Nagasawa, Katsumi Morikawa and Katsuhiko Takahashi**

The sugarcane supply chain is rapidly gaining attention. Especially in Japan, the expansion and utilization of sugarcane cultivation is being explored from the perspective of biofuel supply and SAF. In the sugarcane supply chain, the cost and CO₂ vary depending on how the residue is handled besides the sugar mill. It is necessary to develop a quantitative model to determine whether and how to dispose of the residue. The sugarcane supply chain network (SSCN), treated in this study, is a supply chain in which disposal is added to the conventional SSCN, and the total cost and environmental impact of the by-products flowing to the disposal plant are considered.

Session 9A: General Session

Management Science and Technology

Follow-up survey on the effect of the educational program applying the concept of active learning in the field of Nepal

Haruka Yamashita, Manita Shrestha, Masaaki Sugihara and Masayuki Goto

The Nepal-Japan Project is a cooperative field program involving faculty members and their students from several Japanese universities and faculty members and their students from Nepalese universities. Since its inception in 2002, this program, which involves travel to Nepal, has employed active learning educational methods and has accumulated a track record of more than 15 years. However, while there have been studies on the short-term learning effects of the program, there have been no studies on the effects after graduation. In this study, we report the results of a follow-up survey and analysis of the program's effects on past participants.

Online Flipped Conference Based Data Science Education Program and Its Educational Effectiveness in Multi-University Collaboration

Masayuki Goto, Manabu Kobayashi, Takeshi Moriguchi, Yoichi Seki, Hideo Suzuki, Takashi Namatame, Kazuhide Nakata, Aya Ishigaki, Masao Ueda, Kimitoshi Sato, Kenta Mikawa, Haruka Yamashita, Tomoaki Tabata, Tianxiang Yang, Ayako Yamagiwa and Yutaka Tajiri

In recent years, with the development of information and communication technology (ICT), a class format called "flipped classroom" has been attracting attention and has been introduced in many educational settings. Some studies have analyzed the relationship between flipped classrooms and active learning. However, the flipped classroom style has mostly been discussed as a method to enhance the effectiveness of teaching students the subject content designed by the instructors, and there have been few reports on the use of this style in seminars and study groups where students present the results of their own investigations and discuss from the research view point. In response to this background, the authors have proposed an educational model of a flipped online research conference meeting in collaboration with multiple universities, and have empirically verified its effectiveness as part of the data science education program implemented by Center for Data Science at Waseda University, and are continuing to improve it. This initiative is designed and implemented by the Data Science Center of Waseda University as a part of the Development of Data Analysis Talents (D-DATa) program. In this paper, we discussed to clarify the essential framework in the design of this multi-university collaborative online research exchange and examined its educational effects. An empirical evaluation of the program was conducted through the actual implementation of a multi-university collaborative program, and an analysis was made based on a questionnaire survey of the participants.

Consumer Preferences and Willingness to Pay for Energy-Efficient Housing

Takuma Gocho, Kazuya Ito, Ryuta Takashima and Makoto Tanaka

This study examines consumer preferences and consumers' willingness to pay (WTP) for energy-efficient housing, a critical domain in the context of evolving energy policies targeting carbon neutrality and reductions in energy-efficient housing gas. Employing a two-part experimental design, a discrete choice experiment is conducted to assess consumer choices related to housing, and a comparative analysis of the preferences and WTP of those who plan to purchase detached housing within five years (homebuyers) and the rest of the population (general population) is performed. Key findings reveal that consumers express a positive WTP for all housing attributes considered, indicating a significant valuation of these attributes in the home-purchasing process. Notably, prospective homebuyers exhibit lower WTP values across all attributes compared to the general population. This discrepancy suggests that prospective buyers prefer cost reduction in home acquisition over energy-efficient systems and energy consumption reduction, possibly due to the limited information they possess on the benefits of energy savings. These findings underscore that actively considering home purchase tends to diminish the utility that consumers assign to energy-efficient housing. Future research can continue to explore consumer preferences for different attributes by further analyzing the collected data.

Application Procedures and Challenges of Reinforcement Learning Using Discrete System Simulation

Aoi Mineta, Masaki Miura and Yoshiyuki Higuchi

Recently, more and more people have been using reinforcement learning (RL) to solve industrial issues. RL requires long-term trial and error. So, when dealing with large-scaled or complex systems where it's hard to apply RL directly, discrete system simulation is used as an instead of the real system. This report explained RL using simulation. First, we used a simple logistics model and described the linking simulation and RL. Then, we looked at a more complex industrial case, where we explained the application of RL in the pit crane operation at a waste incineration facility. This study explained the linkage process of simulation and RL in more detail and identified the issues.

Session 9B: General Session

Organization & Innovation Management

On similarities between the processes of innovation and psychological healing

Terumasa Matsuyuki

We find similarities between the structural processes of value creation in innovation and human healing in the process of psychological counseling. The common structure is 1) one finds a paradox 2) one formulates a problem based on the paradox 3) one solves the problem 4) one changes himself/herself as a person. Design thinking represents a process of innovation and in that one is supposed to follow the 5 steps of "empathize", "define", "ideate", "prototype" and "test". The first three steps of "empathize", "define", "ideate" roughly correspond to the structure of 1), 2) and 3) above. Someone who innovates something faces a serious problem and feels uneasy but by overcoming this difficulty one may feel he/she has changed. On the other hand, in psychological healing, some researchers formulate the process of healing as follows: a client faces difficulty, contradiction or paradox such as traumatic experience one is hard to accept. Then in the process of psychological counseling, one externalizes the experience and reinterprets it and gives it a new interpretation and that way one overcomes the traumatic experience and heals himself/herself. As a result, a client "changes" himself/herself. Psychologists formulate this process as a structural process 1) to 5) above. We explore the details of these similarities and show the possibilities that one can change himself/herself through the process of innovating things.

Research on Organizational Structure and Innovation Models to Promote Innovation through Ambidexterity

Shotaro Kamata and Masaru Ishioka

Various factors, such as shortening product life cycles, commoditization, and changing and diversifying needs due to ICT, are forcing companies to create even more innovations. The theory of ambidexterity is important in this context. And today, innovation creation is required in both exploration and exploitation activities. This paper discusses organizational structures and innovation models to promote innovation creation through ambidexterity.

Study on Open Innovation characteristics of Air conditioner manufacturing companies

Shinichiro Fujimoto and Manabu Sawaguchi

Open innovation between large and start-up companies in Japan has room for activation. In order to activate it, it is essential to create a sustainable mechanism to quantitatively evaluate the initiatives and to lead to the next challenge. We aim to propose an evaluation method for open innovation activities of Japanese large companies based on the case studies of three Japanese air conditioner manufacturing companies. In this study, we focused on joint applications as one of the indicators of the evaluation method. We surveyed the three aforementioned companies to determine the relationship between their open innovation efforts and joint applications.

Not all directors have the same roles: The roles of inside and outside directors in alliance portfolio capability and performance

Yiwei Zheng and Yu Deng

Data on 101 newly-listed Chinese firms from information technology and Internet industry were used to explore the roles of the firms' inside and outside directors in shaping and managing the firms' alliance portfolio. Structural equation modelling and bootstrap regression were used to test the study's hypotheses. The results show that inside directors' directorships in other firms was positively associated with alliance portfolio performance, but multiple directorships among a firm's outside directors was negatively associated with alliance portfolio performance. Further, the three dimensions of alliance portfolio capability play the different roles of mediation in the relationship of multiple directorships of directors and alliance portfolio performance.

Session 9C: General Session

Business Environment

From Japan to China: Unpacking the Live Commerce Strategies of Brand Marketing in the Cross-Border E-commerce

Yatong Xiao and Motoi Ihara

This study examines the function of KOL and KOL marketing within the context of Chinese live commerce. Companies rely on KOL to engage potential consumers and promote their brands due to the rise of social media. Japanese companies have also adopted this strategy, collaborating with Chinese KOLs to boost sales and brand awareness. However, Chinese consumers' skepticism can influence how they perceive these marketing efforts. The framework for this investigation is the Stimulus-Organism-Response (SOR) model, with KOL characteristics serving as external stimuli. Perceived value functions as the mediating variable, whereas purchase intent is the dependent variable. The research seeks to address two important questions: a) How do characteristics of KOLs in live distribution channels affect the propensity of Chinese consumers to purchase Japanese products? b) Which KOL characteristics have the greatest effect on purchase intent and brand awareness? This study offers valuable insights for companies seeking to increase their presence on the Chinese market by utilizing live streaming for product promotion. It discusses the difficulties and opportunities associated with KOL marketing in the dynamic environment of Chinese e-commerce and social media platforms.

Cultural Dynamics and Luxury Acceptance among Chi-na's Middle Class: Implications for Value Co-Creation in Novel Markets

Dongyu Dai and Shika Sone

Despite the backdrop of China's robust economic growth, there has been a notable diversification in consumer dynamics, particularly due to the emergence of a financially empowered middle class. The increase in purchasing power has greatly intensified interest in the luxury industry. Driven by this transformation and a simultaneous revival of traditional Chinese culture, this research acknowledges a converging fascination between long-standing cultural principles and the appeal of Western opulence. The objective of our study is to explore the integration of Western luxury values with China's longstanding jewelry culture, with a particular focus on the adaptive techniques employed by the luxury sector. Using a qualitative methodology, this study examines the relationship between customer cultural values and the strategies employed by luxury brands. The results indicate that there is a mutually beneficial relationship known as "value co-creation" between customers and luxury firms. This relationship is influenced by the process of cultural assimilation and the implementation of market strategies. This study highlights the importance of comprehending intricate cultural tendencies when it comes to influencing the trajectory of luxury brand marketing in China.

Enhancing Financial Inclusion for the Elderly Population through Digital Banks and Digital Payments

Nalini Nathasha Thenuwara and Motonari Tanabu

The global population is experiencing a profound demographic shift, with developed nations witnessing a significant increase in the elderly population. This trend of population aging is posing challenges and opportunities in various domains, including financial inclusion and technological innovation. In the realm of financial services, the rise of Fintech has revolutionized the landscape, offering digital payment solutions and digital banking services.

Using data from 2012-2021 this study employs panel regression analysis to investigate the influence of the elderly demographic on the adoption of digital payment systems in 28 developed countries. Then drawing upon the Technology Acceptance Model (TAM) as a foundational framework, this study proposes a novel conceptual model to analyze digital banks and digital payments through the lens of various influencing factors that consider the unique characteristics and challenges faced by the elderly population. These factors include Perceived Usefulness (PU), Perceived Ease of Use (PEU), Aptitude for Learning (AFL), Self-Efficacy (SE), Uncertainty Avoidance (UA), Social Influence (SI), Data Security and Privacy Risk (DS), Promotions and Incentives (P&I), Brand Image (BI), and Intention to Use (I). These factors collectively shape the elderly's willingness to adopt and utilize FinTech payment methods as part of their financial routines. The findings from this research not only contribute to a deeper understanding of the factors shaping technology adoption among the elderly in developed nations but also have significant implications for policymakers and financial service providers aiming to enhance financial inclusion and promote the use of digital payment and banking solutions among this demographic.

Navigating the Complexity of Bottom-of-the-Pyramid Markets: A Comprehensive Case Study on ZTE Corporation's Strategies in Emerging Economies

He Zhang and Yang Xiao

The concept of the Bottom of the Pyramid (BOP) was first developed by Prahalad and Hart in 2002. This concept draws attention to a market sector consisting of around 4 billion individuals, which has historically been over-looked by the global business community. The authors emphasize the significant opportunities that exist within this category. In the 21st century, emerging markets, notably the BRICS (Brazil, Russia, India, China, and South Africa) nations, have gained significant global recognition. Chinese multinational businesses have specifically directed their international expansion efforts towards BOP segment. This analysis focuses on ZTE as a case study to examine their "retrospective" strategy in BOP markets, as well as the techniques implemented by multinational firms in emerging economies. This case study offers further understanding of the overall traits and difficulties encountered by Chinese multinational corporations (MNCs) in BOP business segment. The paper's conclusion offers a comprehensive analysis of the commercial implications of BOP concept on global market dynamics and potential future developments. This study examines the strategic approach of the Chinese multinational, ZTE, in the Bottom of the Pyramid (BOP) market. The objective is to elucidate the current position of Chinese multinationals in the BOP segment and the challenges they encounter. Through this analysis, the strengths and weaknesses of Chinese MNEs operating in the BOP market are identified. Building on these findings, the study offers insights into how emerging MNEs can achieve a competitive advantage in the BOP market.

Session 10A: General Session

Management Science and Technology

Cleaning and Metal Corrosion Prevention Technology Using Ultrafine Bubbles (UFB)

Yukiko Nakahara

Metal has the property of corroding and deteriorating with continuous exposure to water. Water pipes that are normally exposed to water have a limited lifespan and must be replaced. In this study, the metal was treated with ultrafine bubbles (UFB) and the corrosion effect of the metal was investigated. Iron plates, copper plates and nickel-plated water pipes were treated with UFB water for several days at room temperature. The results were obtained that suppressed the occurrence of rust. As an inhibitory mechanism, the ultrafine bubbles acted as a surface coating agent for the metal, or the ultrafine bubbles induced the precipitation of silica particles contained in the UFB water, contributing to the formation of an ultrathin silica coating on the metal surface. Therefore, UFB water has the effect of inhibiting corrosion as a coating agent for metals, and is expected to be used to improve the durability of water pipes.

Target-awared Source Data Selection Strategy for Transfer Learning

Kanyu Miyoshi, Ryotaro Shimizu, Linxin Song and Masayuki Goto

Transfer learning is well known as a potent training method across various fields, including natural language processing and computer vision. However, in the field of transfer learning, domain adaptation poses specific challenges that have garnered significant attention. One prominent issue in domain adaptation is the presence of extraneous information in the source dataset, which can hinder accurate inferences on the target dataset and degrade overall performance. Another well-explored challenge is catastrophic forgetting, which occurs when a neural network, initially optimized for the source domain, struggles to adapt to the objectives of the target domain, potentially erasing valuable shared knowledge.

One approach to tackle these challenges is to train the model on both source and target domain data using a weighted loss, a strategy known as multi-task learning. Unfortunately, this method demands substantial computational resources and is less suited for large-scale tasks. An alternative approach involves reinforcing the model's memory of prior knowledge by incorporating a limited amount of source domain data. However, this method is with the risk of including irrelevant information that could harm performance on the target domain. In this research, we introduce Domain Adaptation Loss (DA-Loss), a specialized method designed to guide the model in learning from relevant source domain data during training. Specifically, we construct a transition matrix that aids the model in selecting data related to the target domain. To compute this transition matrix, we initially warm up our model on the target domain, allowing it to develop a rudimentary understanding or "rough prior." This rough prior then informs the calculation of conditional probabilities for both the source and target domains, aligning with the fundamental concept of transfer learning, where the model learns to transfer knowledge when presented with source domain data. With the introduction of DA-Loss, we aim to improve the accuracy in the target domain. Notably, our proposed method is computationally efficient, as data selection occurs without requiring additional model inference.

We compare DA-Loss with two baselines: (a) training exclusively on the source domain and (b) a traditional fine-tuning approach. We conduct experiments using various settings, with CIFAR-100 or ImageNet as the source dataset and CIFAR-10 or CIFAR-100 as the target dataset. The results demonstrate that DA-Loss outperforms all baselines, achieving an accuracy improvement of over 4.78%. This highlights the capability of our method to extract target-related knowledge from the source domain.

Average TSP tour length approximations for territory design

Daisuke Hasegawa and Naoshi Shiono

In vehicle routing, estimating route lengths using continuous approximation models can be valuable for delivery planning, especially for tour cost estimation and territory design because it avoids the computational cost associated with solving TSP and VRP directly. In this study, we propose a route length estimation formula based on rectilinear distances by considering the shape of the area. We calibrated the parameters through numerical experiments. Thus, our proposed formula can estimate the average tour length in rectilinear distance with high accuracy and as the number of points increases, the influence of the shape decreases.

A study on regional revitalization using parking lot usage history -An approach using a store recommendation system based on Bayesian networks-

Haruse Takizawa, Ruriko Watanabe, Shunsuke Watanabe, Nobutada Fujii, Daisuke Kokuryo, Toshiya Kaihara, Yoshimi Fujioka and Takahiro Imafuku

In recent years, the decline of central city areas has become an issue due to motorization and the suburbanization of urban functions. The loss of amenity is one of the problems caused by the decline of central city areas, and there is an urgent need to revitalize central city areas. In this study, the circulation history of parking lot users was investigated using questionnaires and receipts at parking lots, which are relay points between people and automobiles, and analyzed together with the history of parking lot use to visualize the status of parking lot use. In addition, since more than 70% of parking lot users visited only one store, a store recommendation system was created to encourage an increase in the number of stores visited using a Bayesian network. Finally, the performance of the model was evaluated by comparing the recommendation results from the created store recommendation system with simulated correct data from real data.

Session 10B: General Session

Management Science and Technology

Fundamental Study of Lifecycle Management for Secure System

Tomoyuki Kato and Seiko Shirasaka

Designing and managing a secure system is a critical issue. In order to respond to ever-evolving attacks, the system must constantly change. In order to design and manage a system that can always change, a secure system must be built and enhanced in an agile manner. However, not everything can be done well by executing everything in an agile manner. In this study, we identify a problem space to consider how to ensure security while being agile by considering the lifecycle of secure systems. It also provides a policy for solutions to the problems identified.

Research on cyber security investment for realising social value

Yuko Iwasaki

The digitalisation of the economy has increased the potential for cyber-attack damage to businesses as the cyber attack surface area expands. Global losses from cybercrime are estimated at USD 6 trillion in 2021. In light of this situation, cyber security has become an important management issue for companies. Enterprises play a role in the healthy and harmonious development of society. As such, companies are recognised as social entities and there has been much discussion on the role they should play. However, it is difficult to securitise the value created and the activities themselves if the organic relationship between value-creating activities and cybersecurity investment is not clear for companies to sustainably continue. In this study, a framework was developed to visualise the realisation of social value (intangibles) and economic value at the same time, considering cybersecurity investment as an integral part of the management strategy.

Quantifying the Impact of Physical Internet Systems under Decentralized Control

Sadami Suzuki and Ornida Kraiwuttianant

The logistics crisis spread worldwide due to the imbalance between the supply shortage and the rise of fluctuating demands. Physical Internet (PI), the analogous of digital internet described as an open logistics network sharing assets and flow consolidation, is introduced to solve the inefficiency of transportation by providing high interconnectivity, standardization protocol, and decentralized management. This research comparatively investigates the performance of a supply chain under different network frameworks, namely, traditional supply network (TR) and PI system by using multi-agent simulation approach. Regarding to PI in particular, assuming the initial phase of PI implementation, decentralized control system has been adopted in which each PI participant pursues their own profitability like TR even though PIS participants share the resources such as warehouses and trucks in a supply chain. Simulation results showed that PI maintain significantly lower number of opportunity losses than TR, even in the system under decentralized control that are assumed to be in the initial phase of PI implementation.

A Study on Sensibility Evaluation of Salon Shampoo

Hiroki Kozu, Yukio Maruyama and Yasuyuki Kourogi

This study aimed to investigate the impact of different types of salon shampoo on user sensibility evaluation. Fifty healthy university students participated in this experiment, which required four conditions to be completed, corresponding to the four different types of salon shampoo. The participants' sensibility evaluation was measured before going to bed and after waking up. One of the results demonstrated that the difference in the efficacy of salon shampoo affects the user's sensibility evaluation. Additionally, it was observed that these effects continued until after going to bed.

Cross-Lingual Analysis Based on Natural Language Model to Explore Nationality Differences in Traveler Value

Tianxiang Yang, Hideo Suzuki and Masayuki Goto

In the aftermath of the COVID-19 pandemic, the global tourism industry is on the path to recovery, with Japan standing as a particularly enticing destination for travelers worldwide. Ensuring the provision of top-tier services within the tourism sector has emerged as an imperative concern. Simultaneously, the advent of advanced language models in 2023 offers new opportunities for natural language processing (NLP), making it an effective tool for the tourism industry. Therefore, this study focuses on analyzing tourist feedback data based on NLP model, specifically examining cultural and behavioral disparities between Japanese and international tourists. The purpose of this study is two-fold, (1) To clarify the benefits of the different values and behaviors that Japanese and foreign tourists seek in tourism. (2) To make the relationship of cross-lingual analysis understandable to general readers. In the experiment, we employ real user-generated text evaluations to identify distinctions between languages and validate our approach's effectiveness. In conclusion, this study contributes to Japan's tourism industry by addressing the importance of accommodating cultural differences. The findings are valuable for tour operators, hospitality professionals, and policymakers aiming to create a more personalized and welcoming tourism experience in Japan, ensuring its enduring appeal as a global destination.

Session 10C: General Session
Sustainable Operations and Productivity Management

Results of Literature Search on the Effects of Menopausal Symptoms on Labor Productivity

Makiko Arima, Yoshikuni Edagawa, Chikako Kawahara, Kohta Suzuki, Koichi Sinohara, Nahoko Shirato, Yoshie Miwa and Yasuki Kishi

Currently, the employment rate of Japanese women over the age of 50 years is high, and they play an important role in social economy. Women of this generation often experience menopausal symptoms owing to estrogen deficiency. Therefore, it is assumed that menopausal symptoms have a large impact on labor productivity. To improve this situation, it is necessary to clarify the impact that menopausal symptoms have on labor productivity and to accumulate evidence on this issue. In this study, we report the results of a literature search on the effects of menopausal symptoms on labor productivity. The research question for the literature search was set as "Do menopausal symptoms affect labor productivity?" The literature search selection criteria were working women, including part-timers. The indexing database searched was PubMed, and English articles published up to 2008 were targeted. As a result of the literature search, 98 related English articles were included. In particular, it was inferred that sleep symptoms that occur during menopause affect labor productivity, and that there are reports in the literature showing that the more menopausal symptoms develop, the more negative impact on labor productivity. It is suggested that creating a workplace environment that is comfortable for women in the menopausal generation improves labor productivity and prevents job turnover, which will lead to activation of the organization. We plan to continue reviewing the literature and accumulating more evidence.

Relationship between Accident Risk in Construction Machinery Maintenance and Eye-Tracking Data

Sana Ito, Yoshiyuki Higuchi, Kiyoma Maeda, Tadayuki Kawamoto and Naoko Kanazawa

The domain of construction machinery maintenance involves high-risk tasks, such as replacing substantial components and working at elevated heights. As a result, the occurrence of work-related accidents in this field exceeds that in comparable sectors like automobile maintenance. In our effort to gain an understanding of these accidents, our study focused workers eye tracking. To begin with, we leveraged eye-tracking technology to the tracking data of approximately 500 individuals engaged in the maintenance of construction Machinery. In this eye-tracking test, subjects viewed five videos demonstrating various maintenance tasks, and we recorded their visual engagement after each video. Simultaneously, we employed a questionnaire to gain insights into predictive safety measures and strategies for preventing accidents for each of the five videos. Subsequently, we analyzed the accumulated eye-tracking data using both hierarchical and non-hierarchical clustering techniques to classify and interpret trends in gaze conditions. Additionally, we assessed the occupational accident history of the subjects and predicted their accident risks through questionnaires, considering occupational accident risks for each category of gaze status. Through these analyses, we elucidated the relationship between gaze conditions, work-related accidents, and associated risks.

Verification of changes in service operations and effectiveness of on-site maintenance in an EV shift environment

Satoru Kaneko and Masahiro Arakawa

In recent years, in efforts toward a decarbonized society, there has been a shift from vehicles equipped with internal combustion engines (ICVs) to electric vehicles (EVs). The EV shift has affected various industries, and the automotive after-sales service industry is no exception. Since maintenance work for EVs and ICVs differs depending on their component parts, it is conceivable that the expanding share of EVs will change how service engineers work and the required job skills. Additionally, there is a need for more auto mechanics in Japan, and efficient business operations are required in an environment where EVs and ICVs coexist. In this study, we clarify the problems of maintenance work operations due to EV shift through information from various literature and interviews with maintenance shops. We also consider ways to solve the problems through simulation.

Stress-Reducing Effects of the Sounds of Musical Instruments

Yoshiki Fujita, Yating Yu, Seiko Taki and Ryu Yamamura

Psychological stress is a major social problem in Japan today. According to a report released by the Ministry of Health, Labor and Welfare in 2022, Japan has the highest suicide mortality rate among the Group of Seven industrialized nations. Japan is also the only country in which suicide is the leading cause of death among 10- to 29-year-olds. Therefore, it is important to provide stress care to young people. Many studies regarding the use of music as a means of reducing stress have been conducted. However, the relationship between the sounds of musical instruments and stress reduction is yet to be clarified. Hence, this study examined the stress-reducing effects of the sounds of musical instruments based on two physiological indicators: salivary amylase activity and heart rate. The study targeted 60 young people, and the changes in their stress level before and after they listened to music were observed.

-Thank you-



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