

IEEE IEEM **VIRTUAL**

**2020 IEEE International Conference on
Industrial Engineering and Engineering
Management (IEEM)**

14 – 17 December 2020

www.IEEM.org

Organizers

IEEE Singapore Section
IEEE TEMS Singapore Chapter
IEEE TEMS Hong Kong Chapter

IEEM Secretariat



Supporting Organizations



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WELCOME FROM THE ORGANIZERS

It is not an overstatement that 2020 has proven to be one of the most challenging years of our lives. The COVID-19 pandemic situation has led to profound changes in the ways we live, work, and in the ways we exchange information.

IEEM2020 was scheduled to take place from 14 to 17 December 2020 in Singapore at the Marina Bay Sands Convention Centre. However, it was clear by July that it would not be possible to have the in-person conference, and the most appropriate course of action is to conduct the IEEM2020 virtually.

We therefore warmly welcome you to this online conference. From handshakes to headsets, the engagement will be different, but no less valuable. All papers have gone through the same review process as in the past. We are grateful for the many authors who submitted their papers, and the many more reviewers who reviewed the papers at this difficult time. Between presenting and watching the presentations, we hope you will make time to join the quizzes and win prizes that you can use in next IEEM 2021 in Singapore!



HO Teck Hua,
General Chair
National University
of Singapore



Kah Hin CHAI,
Organizing Chair
National University
of Singapore



Roger JIAO,
Program Chair
Georgia Institute
of Technology



Min XIE,
Program Chair
City University
of Hong Kong

COMMITTEES

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National Kaohsiung University of Science and Technology

Jun YANG
Beihang University

Linda ZHANG
IESEG School of Management (LEM-CNRS 922)

COMMUNITY ENGAGEMENTS

Attend These Events Free of Charge – Need to Pre-Register!

The 14-Dec 2020 Opening Ceremony, Keynote and the 17-Dec 2020 Keynote Panel, Best Paper Award & Closing Ceremony will be conducted live on ZOOM Webinar. We welcome all!

- All fee paying attendees will be auto-approved
Be sure to click on the registration URL arriving by email from IEEM Secretariat
- Special Invites to IEEM Subscribers ONLY
[New to IEEM? Subscribe here](#)
- Full details on the 14-Dec and 17-Dec 2020 program will be posted on the conference website here: <https://www.ieem.org/public.asp?page=index.asp>

COMMUNITY ENGAGEMENT 1

14-Dec 2020 Conversation Forum: Opening & Keynote
6:45PM-8:30PM (GMT +8, Singapore Standard Time)

Presents the chance for conversation and a chance to find out more about the topic

[Join Now](#)



Professor HO Teck Hua

*Senior Deputy President
and Provost*

*Tan Chin Tuan
Centennial Professor*

*National University
of Singapore*

Official Opening by IEEM2020 General Chair

Professor HO Teck Hua is the senior deputy president and provost of the National University of Singapore (NUS), where he is a Tan Chin Tuan Centennial Professor. He is also the executive chairman of AI Singapore, a national research and development programme, and chairman of the Singapore Data Science Consortium.

Teck is a prominent behavioural scientist with a PhD and a master's degree in decision sciences from the Wharton School of the University of Pennsylvania. He also has a master's degree in computer and information sciences and a bachelor's degree in electrical engineering with first class honours from NUS.

In 2011, he took a part-time appointment at NUS as vice president of research strategy and became director of the NUS Centre for Behavioural Economics. In 2015, he became deputy president of research and technology at NUS. Prior to his role as deputy president, Teck was the William Halford Jr Family Professor of Marketing at the University of California, Berkeley's Haas School of Business. In 1999, he earned tenure in the marketing department at the Wharton School of the University of Pennsylvania. Prior to that, he was assistant professor of operations and technology management at the University of California, Los Angeles's Anderson School of Management.

At the Haas School of Business, Teck received the Earl F Cheit Award for Excellence in MBA Teaching, three years in a row (2004, 2005, and 2006) as well as the Williamson Award (2015). The latter is the School's highest faculty award, named in honour of Oliver Williamson, the recipient of the 2009 Nobel Memorial Prize in Economic Sciences. It celebrates honourees who best reflect the character and integrity associated with Williamson's scholarly work and legacy. In 2010, Teck received the Distinguished Teaching Award, the University of California, Berkeley's highest university-level award for teaching.

Teck has had many significant works published in refereed journals in the areas of behavioural economics, management science, and marketing. He was the first non-US citizen to be editor-in-chief of Management Science, the venerable flagship journal of the Institute for Operations Research and the Management Sciences, and one of the top journals for research in management.

In Singapore, Teck is a member of the boards of the National University Health System, the National Environment Agency, the Government Technology Agency, and the Defence Science and Technology Agency. He is also a fellow of the Singapore Civil Service College and the Academy of Engineering, Singapore.



Andy CHEN

*Founding Managing Partner,
REDDS Capital*

*President & CEO,
Catronic Enterprise*

*President, IEEE Technology and
Engineering Management Society
(IEEE TEMS)*

Message from President IEEE Technology and Engineering Management Society

Andy Chen is a partner of REDDS Venture Investment partners which empower disruptive start-ups that scale worldwide and have billion dollars plus potential through team building, global business development, financing, mentoring, and strategy.

Andy is the President & CEO of a global consulting firm. The firm's principle business is to provide consulting services for utility industry worldwide. Andy is a senior business advisor for several leading global consulting firms and enterprise software vendors. Andy held the position of the Chief Technology Officer and Vice President, Enterprise Strategy and Architecture of the largest Canadian-based electricity generator. He also served as the chair of ABB International User Board of Directors.

Andy is the President, IEEE Technology and Engineering Management Society (TEMS) a member of Board of Governors 2018-2020 for IEEE Computer Society (CS). IEEE and its members inspire a global community to innovate for a better tomorrow through its more than 423,000 members in over 160 countries, and its highly cited publications, conferences, technology standards, and professional and educational activities. IEEE is the trusted "voice" for engineering, computing, and technology information around the globe.

Andy participates in the United Nations Global Pulse's Data Privacy Advisory Group. He is also a director for the Federation of Enterprise Architecture Professional Organizations' board and a member of the Technical Advisory Council for the FinTech Ideas Festival. He also served as the Chair of the Technical Advisory Council for YinTech Investment Holding Ltd. As an internationally recognized speaker, Andy was a keynote speaker at the UN ITU Telecom World and AI for Good Global Summit, the World Computer Congress, the World CIO Forum, and the Digital Africa Conference.

*We are excited to
announce our
Opening Keynote Speaker*



Professor Tim MINSHALL
University of Cambridge

Opening Keynote

The Future of Manufacturing: How to ensure we really do 'Build Back Better'

Tim Minshall is the head of the Institute for Manufacturing (IfM) at Cambridge University Engineering Department and head of IfM's Centre for Technology Management. He is the inaugural Dr John C. Taylor Professor of Innovation, a member of the boards of St John's Innovation Centre Ltd and IfM-ECS Ltd, a Visiting Research Fellow at the Institute of Technology, Enterprise and Competitiveness (ITEC) at Doshisha University, and a member of the IET's Innovation and Emerging Technologies Policy Panel. He is a member of advisory/steering committees for groups including ideaSpace, Cambridge University Entrepreneurs, Cambridge i-Teams and 100% Open.

His research interests include open/collaborative approaches to innovation, the commercialisation of new production technologies, and the development of engineering and manufacturing skills.

He is a recipient of a University of Cambridge Pilkington Prize for Teaching Excellence and a Royal Academy of Engineering/ExxonMobil Excellence in Teaching Award.

COMMUNITY ENGAGEMENT 2

17-Dec 2020 Keynote Panel, Best Paper Award & Closing Ceremony

9:00AM-11:00AM (GMT +8, Singapore Standard Time)

Attend to show your approval and gratitude for each person's good job and outstanding work

[Join Now](#)

Join us for this thought-provoking session.

Keynote Panel – Management of Intelligent Transportation Systems

Organized by: Kwok TSUI, Virginia Polytechnic University | Min Xie, City University of Hong Kong

Partially supported by a grant from Research Grants Council of the Hong Kong SAR [T32-101/15-R]

INVITED PANELISTS:



S.K. Jason CHANG

Professor, National Taiwan University

Director, Advanced Public Transport Research Center

Prof Chang is Director of Advanced Public Transport Research Center and a Professor of Civil Engineering at National Taiwan University. He is Vice President of ITS Taiwan and member of Board of Directors for ITS World Congress. He is also the first Vice President of Eastern Asia Society for Transport Studies (EASTS). His research areas include transit oriented development, active mobility, public transport, transport economics and smart mobility. Since 1999, He has also been invited as an advisor for many international NGOs, the World Bank, Asia Development Bank, and various ministries as well as city governments on sustainable urban development, smart cities and sustainable mobility.



Hong Kam LO

Head and Chair Professor, Department of Civil and Environmental Engineering

Director of GREAT Smart Cities Institute

Associate Director of HKUST-DiDi Joint Research Lab

The Hong Kong University of Science & Technology

Professor Hong K. LO is Department Head and Chair Professor of Civil and Environmental Engineering and Director of GREAT Smart Cities Institute of the Hong Kong University of Science and Technology. He serves as Founding Editor-in-Chief of Transportmetrica B: Transport Dynamics, Managing Editor of Journal of Intelligent Transportation Systems, and on the editorial boards of many international journals. He served on the Transport Advisory Committee advising the Chief Executive in Council of the Hong Kong government, Hong Kong-Zhuhai-Macau Bridge Feasibility Study Expert Panel, Vice-President of the Hong Kong Society for Transportation Studies, Convener of Railway Objections Hearing Panel, etc.



Norio TOMII

Professor, Chiba Institute of Technology

President, IAROR (International Association of Railway Operations Research)

Professor TOMII started his career in ex Japanese National Railways (JNR) and then joined Railway Technical Research Institute (RTRI). He was serving as a board member of Japan Transport Safety Board (JTSB) for about ten years, which is a national organization to conduct investigation to determine the causes of aircraft, railway and marine accidents. He is currently with College of Industrial Technology, Nihon University, and also serves as the President of IAROR (International Association of Railway Operations Research).



Zijiang James YANG

Professor, Western Michigan University

Zijiang James Yang is a professor of Computer Science at Western Michigan University. His research focuses on tools to support the debugging, analysis and verification of complex systems. He was a recipient of various awards, including 2018 ACM SIGSOFT Distinguished Paper Award, 2015 2010 PADTAD best paper award, 2008 ACM TODAES best paper award. He is the general chair of the 12th IEEE Conference on Software Testing, Validation and Verification (ICST). He is also an inventor of ten United States patents. Prof Yang recently formed IEEE Reliability Society Technical Committee on Electric and Autonomous Vehicles.

IEEM2020 will offer these Best Paper Awards

Best Paper Awards – Winner Receives a Certificate and Prize

[Best Conference Paper Award](#)

[Outstanding Conference Paper Award](#)

IEEM2020 papers that earned Honorable Mention

[Honorable Mention](#)

Overall IEEM Online Quiz Competition Top Scorer Wins Grand Prize

Closing Ceremony

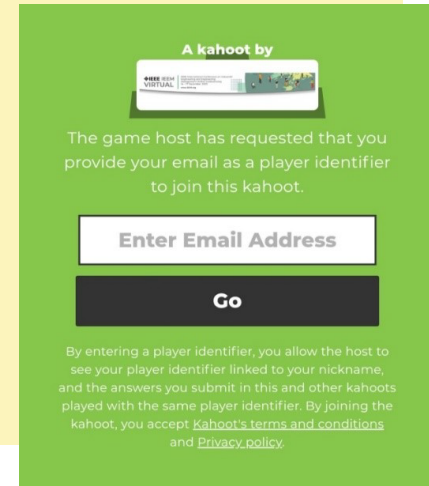
[IEEM Online Quiz Competition](#)

COMMUNITY ENGAGEMENT 3

**Win Prizes! Participate in the IEEM Online Quiz Competition!
14 to 17 Dec 2020 – Overall Top Scorer Wins Grand Prize**

RULES & REGULATIONS

1. This competition will be conducted on Kahoot!
2. You will require an active internet connection to participate.
3. There will be 4 rounds of online quizzes in this competition:
 - o 1st Round: Mon-14 Dec, 6:45PM to 7PM (GMT+8)
 - o 2nd Round: Tue-15 Dec, 2:15PM to 2:30PM (GMT+8)
 - o 3rd Round: Wed-16 Dec, 2:15PM to 2:30PM (GMT+8)
 - o 4th Round: Thu-17 Dec, 11AM to 11:15AM (GMT+8)
4. The sooner the player answers, the more points the player gets
5. Prizes will be presented to the Top Scorer(s) at every round
6. Each player's Final Score is the sum of points earned at every round of competition.
7. Use the same email address so all earned points are added to your final score
8. Grand Prize to the Overall Top Scorer (i.e. must play all 4 rounds)
9. Winners will be notified by email about their prizes
10. Prizes are not transferable



**Click to enter the IEEM Online Quiz
Competition-Zoom Room**

*Use the same email address so all earned points
are added to your final score*

[14-Dec 2020, 6:45PM](#)

[15-Dec 2020, 2:15PM](#)

[16-Dec 2020, 2:15PM](#)

[17-Dec 2020, 11AM](#)

PRESENTER INFO

15 & 16 Dec 2020 Presenter Schedules

To view presenter schedules, simply go to the [Presentation Schedule](#) on the conference website.

To present/attend/join the conference, click on **"IEEM Virtual"** on the left panel under "Author Options" in the portal.

Live Support During Conference

Click this link to visit the [Zoom Room Help Desk](#)

How to Find E-Posters, Papers & Conference Proceedings





Auto-access will be enabled for fee paying attendees only.
Only accepted papers that are IEEE compliant are included.

To download - Click on "Conference Proceedings" on the left panel under "Author Options" in the portal

Submission to IEEE Xplore - Condition

The paper has been presented at the conference

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Conference

Announcement
Topic List

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My Abstract/Paper
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E-Poster
Conference Proceedings
Proof of Attendance

RESOURCE 1 - ATTENDEE GUIDE

Language

English is the official language throughout the meeting.

Platform

We will use the Zoom Conference Webinar Platform

Please note that several security features are being utilized to prevent unauthorized access.

Attendee Access to Sessions

Sessions will be presented live at the scheduled time. Though available, the recordings will not be available for public viewing.

Fee Paying Attendee Privileges

- ✓ Presenter Rights
- ✓ Session Charing Rights
- ✓ The Whole Works Participation Rights
- ✓ Conference Proceedings
- ✓ Proof of Attendance (Condition Applies)



RESOURCE 1 - ATTENDEE GUIDE

Accepted Paper Presentations on 15 & 16 Dec 2020

The two-day virtual presenter event will be conducted via Zoom Meetings and requires a paid registration to attend.

Presenter functions (via ZOOM) are auto-enabled in the IEEM online submission portal (see "Author Options") once paid registration fee is received.

Fee paying participants who are non-presenters, please click on "IEEM Virtual" in the author panel to join the meeting.

Presentation Format

Presenters pre-record their individual presentations.
Only the Q&A is conducted live during the scheduled session time.

Each presentation will consist of two parts:

- A pre-recorded presentation of the accepted paper
- Live Q&A for attendees to meet virtually with presenters and ask questions or give feedback





Attend These Events Free of Charge

The 14 Dec 2020 Opening Day and 17 Dec 2020 Closing Day programs will be conducted live on ZOOM Webinar. We welcome all!

Attendance requires pre-registration. Look out for the registration links included in Special Invites to all our IEEM e-news subscribers. Sign up for a user account to subscribe to e-news here:

<https://www.meetmatt-svr3.net/ieem2020/createUser0.asp>

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RESOURCE 2 - PRESENTER GUIDE

Get Ready!

All presenters will require a PC or Laptop with

- Camera & Microphone
- Webcam Specifications: Minimum 0.5 Megapixel
- Compatible Browsers

Make sure that your browsers are updated to their latest versions.

- Internet Explorer
- Edge
- Firefox
- Chrome
- Safari



Lighting/Camera

Diffused light in front of you will usually work best to avoid shadows. Try to position your camera so that it is just above your eye level.

Presentation/Clothing

Darker colour shirts/blouses appear better on camera. Try to avoid busy plaid or patterned outfits.

Audio/Sound

Avoid or minimize sounds in your background. Ensure that your voice can be heard loud and clear.

RESOURCE 2 - PRESENTER GUIDE

IEEE Policy on No Show

Each accepted paper to IEEM2020 must be presented by the registered author/co-author during the online conference.

Accepted Paper Presentations on 15 & 16 Dec 2020

The two-day virtual presenter event will be conducted via Zoom Meetings and requires a paid registration to attend.

Presenter functions (via ZOOM) are auto-enabled in the IEEM online submission portal (see "Author Options"). To present/attend/join the conference, simply click on "IEEM Virtual".

Presentation Format

Presenters **pre-record** their individual presentations. Only the Q&A is conducted **live** during the scheduled session Time. Each presentation will consist of two parts.





If Oral

- 10-min pre-recorded video of the presentation
- 5-min live Q&A for attendees to meet virtually with presenters and ask questions or give feedback

If Poster

- Pre-uploaded poster on public display from 14 – 17 Dec 2020
- 2-min live presentation and 5-min (also live) Q&A for attendees to meet virtually with presenters and ask questions or give feedback

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Author Options

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- [My Abstract/Paper](#)
- [IEEM Virtual](#)
- [E-Poster](#)
- [Conference Proceedings](#)
- [Proof of Attendance](#)

RESOURCE 2 - PRESENTER GUIDE

Rehearse Your Presentation

Purpose is for Presenters and Session Chairs to familiarize themselves with the virtual platform and its features. The IEEM Virtual Meeting team will schedule practice sessions with presenters in the week of 30 Nov to 04 Dec 2020. All Presenters will be invited to participate.

Let's test your connections well in advance and check pre-recordings for:



Quality sound & video



Quality connectivity



Quality presentation

Testing Your Presentation in Advance

If during the conference you have questions or you want to test your presentation on Zoom, you can visit the Help Desk any time even if your presentation is on a later day. See Singapore Time (SGT) Help Desk Hours below.

Help Desk Hours (SGT)

Mon-14 Dec, 9am-1pm, 4.30pm – 7pm SGT
Tue-15 Dec, 7.30am – 6.30pm SGT
Wed-16 Dec, 7.30am – 6.30pm SGT
Thu-17 Dec, 8.30am – 11.30am SGT

RESOURCE 2 - PRESENTER GUIDE

Oral Presentations

Preparing Your Video

- Speakers are required to submit a 10-min pre-recording of their paper presentation.
- Though not compulsory, it is preferred that you use the standard IEEEM [PowerPoint template](#).
- The acceptable file format is MPEG-4 video (*.mp4), and the file size must not exceed 800mb.
- See also "[How to](#)" [Guide for Pre-Recording a Video](#)
- The deadline for submitting the pre-recording is 25 November 2020.

Submit Your Pre-Recording to IEEEM Submission Portal (opens by 6 November 2020)


1. Log-in with your email & password to the IEEEM portal
<https://www.meetmatt-svr3.net/ieem2020/login.asp>
2. On the left menu click on "My Papers" → "Paper ID" to view paper details.
3. Scroll the page until you see the upload link as shown in the figure below. This function is auto-enabled for individuals delivering oral presentations.

ORAL Presenters **NEW**

Please upload your pre-recorded presentation by 25 Nov 2020

[Download Template](#)

(.MP4 Only, Max file size: 800MB)

Not uploaded  [upload](#)

Deliver Your Presentation

Please [connect to your session room in Zoom](#) at least 15 minutes before the start of your session

- The session host will play your **10-minute pre-recording** at the scheduled time.
- The speaker is required to participate in the live **5-minute Q&A** session to be held immediately after the presentation.
- Questions from the audience will be asked through the **Zoom Chat**

Poster Presentations

Upload Your Poster

- Presenters must upload a PNG poster of their paper presentation.
- Poster size is A0 in landscape format.
- Though not compulsory, it is preferred that you use the standard IEEM [Poster template](#).
- Please see also [“How to” Guide for Preparing Your Poster](#).
- The deadline for submitting the digital poster is 25 November 2020.

Public Display

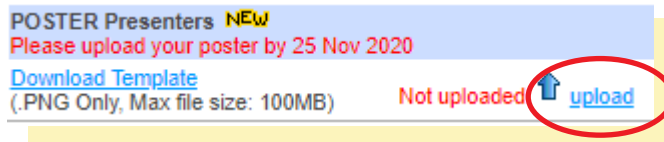
All Posters will be posted publicly for viewing throughout the conference period from Mon-14 Dec to Thu-17 Dec 2020.

During the Live Chat – See Check Final Program for Your Timeslot

- Presenter delivers a 2-min walkthrough of their poster presentation followed by a 5-min Q&A session.
- Questions from the audience will be asked through the Zoom Chat

Submit Poster to IEEM Submission Portal

1. Log-in with your email & password <https://www.meetmatt-svr3.net/ieem2020/login.asp>
2. On the left menu click on “My Papers” → “Paper ID” to view paper details.
3. Scroll the page until you see the upload link as shown in the figure below. This option is auto-enabled for individuals delivering poster presentations.



RESOURCE 3 – CHAIRING GUIDE

You are charged with ensuring presenters stay on time and maintaining a professional and insightful dialog among the participants of the session. You will introduce each presenter (name, affiliation, maybe an additional piece of insight, co-authors) along with their paper. A session assistant will be assigned to support you as necessary.

Please connect to your session room in Zoom at least 15 minutes before the start of your session.

Session Assistant Roles

1. Oversee presenter check-in
2. Keep track of no-shows & report it to session chairs
3. Provide live technical support during the conference
4. Handling of presentation materials
5. Click on the attendance link to make a record of who has presented at the session

Session Chair Roles

- Introduce presenters in your session
- Ask questions to the presenter based on their presentation
- Keep track of time allocated for each presenter

Before the Session

- Set up Zoom using [the guide](#) given to all participants.
- Before chairing the session you should test your set-up.
- If you have not presented or moderated via Zoom, we strongly recommend doing a rehearsal. Details on the rehearsal will be sent later.
- The [virtual meeting program](#) includes session information, links to presentation materials and, presenter attendance register etc.

RESOURCE 3 – CHAIRING GUIDE

Chairing the Session

1. Audio Mute/Unmute - Participants will be muted when they join the meeting.
2. Remind presenters to unmute themselves to speak when called on in the queue; and then mute themselves when done.
3. Zoom 'Chat' – Remind participants to send you questions using this feature.
Be sure to check the 'Chat' regularly.
4. Introduce yourself, the presentation and authors; mute yourself when done.
5. Session assistant will present the pre-recorded materials. Each presenter has to make their presentation in 15 minutes, including 5 minutes of Q & A.
6. Unmute yourself. Ask questions to the presenter if there is still time left after the presentation.

Rehearsal

Purpose is for Presenters and Session Chairs to familiarize themselves with the virtual platform and its features. Secretariat will be in touch to arrange a rehearsal. Please confirm which of these time slots works best for you

YR 2020	SGT Time	SGT Time
Daily, on 09 Dec, 10 Dec & 11 Dec	9 – 11AM	3 – 5PM

RESOURCE 4 – LIVE ATTENDEE SUPPORT

Call at the Help Desk Zoom Room which will be kept open for the duration of the conference.
Click this link to visit the [Zoom Room Help Desk](#)

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Wed-16 Dec, 7.30am – 6.30pm SGT
Thu-17 Dec, 8.30am – 11.30am SGT



IEEE

2021 IEEE International Conference on
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IEEM 2021

13 - 16 Dec 2021
Marina Bay Sands,
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Big Data and Analytics 1

15/12/2020 10:00 - 11:30

Chairs: Carman Ka Man LEE *The Hong Kong Polytechnic University*
Arnesh TELUKDARIE
University of Johannesburg

[Abstracts: see page 49](#)

IEEM20-P-0039/The Prediction of Flight Delay: Big Data-driven Machine Learning Approach

Jiage Huo, Kin Lok Keung, Carman Ka Man Lee, Kam K.H. Ng, K.C. Li
The Hong Kong Polytechnic University, China

IEEM20-P-1055/TV Series Adaptations: An AI Toolkit For Success

Anjal Amin¹, Landry Digeon²
¹*The Mobius Trip, United States*
²*University of Maryland, Baltimore County, United States*

IEEM20-P-0366/Business Applications for Current Developments in Big Data Clustering: An Overview

Glendon Hass¹, Parker Simon¹, Rasha Kashef²
¹*Western University, Canada*
²*Ryerson University, Canada*

IEEM20-P-0398/Visual-based People Counting and Profiling System for Use in Retail Data Analytics

Meygen Cruz, Jefferson James Keh, Ramiel Deticio, Carl Vincent Tan, John Anthony Jose, EDWIN SYBINGCO, Elmer Dadios
De La Salle University, Philippines

IEEM20-P-539/Detecting Bursts in Water Distribution System via Penalized Functional Decomposition

Yinwei Zhang, Kevin Lansey, Jian Liu
University of Arizona, United States

IEEM20-P-0500/SARIMA and Artificial Neural Network Models for Forecasting Electricity Consumption of a Microgrid Based Educational Building

Meditya Wasesa, Adhya Rare Tiara, Mochammad Agus Afrianto, Fakhri Ihsan Ramadhan, Irsyad Nashirul Haq, Justin Pradipta
Institut Teknologi Bandung, Indonesia

Big Data and Analytics 2

15/12/2020 19:00 - 20:30

Chairs: Philipp BAUMANN *University of Bern*
Oliver STRUB *University of Bern*

[Abstracts: see page 53](#)

IEEM20-P-0115/A Dynamic Feedback System Analysis on the Mechanism of Shipping Freight

Xiwen Bai¹, Ming Qi Xu¹, Haiying Jia²
¹*Tsinghua University, China*
²*Norwegian School of Economics, Norway*

IEEM20-P-0234/Optimal Feature Selection for Support Vector Machine Classifiers

Oliver Strub
University of Bern, Switzerland

IEEM20-P-0256/News Media Sentiments and Stock Markets: The Indian Perspective

Shweta Agarwal, Utkarsh Goel, Shailendra Kumar
Indian Institute of Information Technology, Allahabad, India

IEEM20-P-0281/Feature Engineering for Supply Analysis in Ocean Transportation

Roar Adland, Vit Prochazka
NHH Norwegian School of Economics, Norway

IEEM20-P-0329/Using of Social Media Data Analytics for Applying Digital Twins in Product Development

Abdiladif Ahmed Olad, Omid Fatahi Valilai
Jacobs University Bremen gGmbH, Germany

IEEM20-P-0333/A Binary Linear Programming-Based K-Means Algorithm For Clustering with Must-Link and Cannot-Link Constraints

Philipp Baumann
University of Bern, Switzerland

Big Data and Analytics 3

16/12/2020 12:00 - 13:30

Chairs: Min XIE *City University of Hong Kong*
Omid Fatahi VALILAI *Jacobs University Bremen gGmbH*

[Abstracts: see page 74](#)

IEEM20-P-0534/Monitoring and Control of Unstructured Manufacturing Big Data

Yesheng Cui¹, Sami Kara¹, Ka C. Chan²
¹*The University of New South Wales, Australia*
²*University of Southern Queensland, Australia*

IEEM20-P-0492/Topological Data Analysis for Identifying Critical Transitions in Cryptocurrency Time Series

Patipol Saengduean, Sutthipong Noisagoon, Farida Chamchod
Mahidol University, Thailand

IEEM20-P-0536/GPS-Derived Measures of Freight Trucks for Rest Areas: A Case-Study Based Analysis

Ahmed Karam, T. Illemann, Kristian Reinau
Aalborg University, Denmark

IEEM20-P-0569/User Aggregation Models for a Video-on-Demand (VoD) System

Subrato Mondal, Goutam Sen
Indian Institute of Technology Kharagpur, India

IEEM20-P-0369/Data Quality Issues When Quantifying Costs of Complexity

Aleksandra Staskiewicz¹, Lars Hvam¹, Anders Haug²
¹*Technical University of Denmark, Denmark*
²*University of Southern Denmark, Denmark*

IEEM20-P-0562/A User Segmentation Approach for UGC Platform Based on a New Lead User Identification Index System and K-means Clustering

Danni Chang¹, Jing Zhao¹, Fanxing Zou¹, Gangyan Xu²
¹*Shanghai Jiao Tong University, China*
²*Harbin Institute of Technology, China*

Decision Analysis and Methods 1

15/12/2020 08:00 - 09:30

Chairs: Carman Ka Man LEE *The Hong Kong Polytechnic University*
Vinay SINGH ABV-IITM
Gwalior

[Abstracts: see page 48](#)

IEEM20-P-1145/Stress-based Lattice Structure Design for Additive Manufacturing

Adrian Chung Baek, Namhun Kim
Ulsan National Institute of Science and Technology, South Korea

IEEM20-P-0160/Launch Strategies for Upgraded Products with Consideration of Self-cannibalization

Chao Nan Li, Yan Chen, Hai Jiao Luan, Li Shan Wang, Le Xin Sun, Tong Xin Wang, Xin Li
Macau University of Science and Technology, China

IEEM20-P-0168/Using Classification with K-means Clustering to Investigate Transaction Anomaly

Xing Scott Tan¹, Zijiang Yang¹, Younes Benlimane¹, Eric Liu²
¹*York University, Canada*
²*Bayview Secondary School, Canada*

IEEM20-P-0238/Two-Stage Newsvendor Problem with Loss Aversion and Probability Weighting Effects

Cunwu Sun¹, Hongqing Ye¹, Wei Weng², Qingwei Wang¹
¹*Shanghai Jiao Tong University, China*
²*Kanazawa University, Japan*

IEEM20-P-0348/A Multiple Layer DEA Model for Evaluating Corporate Sustainable Performance Using Lean Manufacturing Practices

Willy Zalatar, Eppie Clark
De La Salle University, Philippines

IEEM20-P-0422/Application of Lean Six Sigma Methodology and Queueing Theory to Minimize Systemic Variability: A Case Study from Public Services

Felix Santhipillai, R. M. Chandima Ratnayake
University of Stavanger, Norway

Decision Analysis and Methods 2

15/12/2020 12:00 - 13:30

Chairs: Yaqiong LV *Wuhan University of Technology*
Vinay SINGH ABV-IITM
Gwalior

[Abstracts: see page 50](#)

IEEM20-P-0446/An Analysis of Decision to Retrofit Coal Based Power Plant with Carbon Capture Technology Having Uncertain Parameters

Shalini Kumari, Sasadhar Bera
Indian Institute of Management Ranchi, India

IEEM20-P-0501/Prediction of Raw Material Price Using Autoregressive Integrated Moving Average

Nutthaya Hankla, Ganda Boonsothonsatit
King Mongkut's University of Technology Thonburi, Thailand

IEEM20-P-0533/Energy Efficiency Measures and Production Resources: Towards an Integrative Classification Framework for Decision Makers

Mile Katic, Andrea Trianni
University of Technology Sydney, Australia

IEEM20-P-0557/A Game-theory Based Parking Pricing Policy

Shijin Wang, Ting Hu
Tongji University, China

IEEM20-P-0465/Least-distance Data Envelopment Analysis Model for Bankruptcy-based Performance Assessment

Xu Wang, Takashi Hasuike
Waseda University, Japan

IEEM20-P-0459/Experimental Study on Visual Variables Influencing Icon Similarity

Shiyuan Ding, Haiyan Wang, Chengqi Xue
Southeast University, China

Decision Analysis and Methods 3

16/12/2020 16:30 - 18:00

Chairs: Ramakrushna PADHY *IIM Kashipur*
Xin WANG *City University of Hong Kong*

[Abstracts: see page 75](#)

IEEM20-P-0450/On-Chip Democracy: A Study on the Use of Voting Systems for Computer Cache Memory Management

Nguyen Anh Vu Doan, Akshay Srivatsa, Nael Fafous, Sebastian Nagel, Thomas Wild, Andreas Herkersdorf
Technical University of Munich, Germany

IEEM20-P-0464/Blockchain Adoption Time of Shipowners: A Game Theoretic Analysis

Shuyi Pu, Jasmine Siu Lee Lam
Nanyang Technological University, Singapore

IEEM20-P-1187/Drivers for Lithium-ion Battery Recycling Industry: A Delphi Study

Asit Tripathy¹, Atanu Bhuyan¹, Amitosh Gautam², Ramakrushna Padhy¹
¹*Indian Institute of Management Kashipur, India*
²*National Productivity Council, India*

IEEM20-P-0561/The Implementation of the Lean Thinking Concept for Reducing Waste: A Study Case in the Leather Tanning Process

Mohammad Chaeron¹, Rakhmadi Sentosa², Apriani Soepardi¹
¹*Universitas Pembangunan Nasional Veteran Yogyakarta, Indonesia*
²*PT Halejora Power, Barabai Branch Office, Indonesia*

IEEM20-P-0455/Data Model for Managing Product Complexity

Michael Riesener, Christian Dölle, Jan Koch, G. Schuh
RWTH Aachen University, Germany

IEEM20-P-0217/Evolutionary Analysis of Vaccination Strategies for Infectious Diseases Considering Neutral Strategy

Xueyu Meng, Huiying Cao, Muhammad Rashid Bhatti, Zhiqiang Cai
Northwestern Polytechnical University, China

Decision Analysis and Methods 4

16/12/2020 19:00 - 20:30

Chairs: Nizar CHATTI *Université d'Angers*
Ramakrushna PADHY *IIM Kashipur*

[Abstracts: see page 76](#)

IEEM20-P-0145/Dynamic Bayesian Network Decision Model for Improving Fault Detection Procedure

Nizar Chatti¹, Khaoula Tidiriri², Tarun Kumar Bera³

¹University of Angers, France

²University of Grenoble Alpes, France

³Thapar Institute of Engineering and Technology, India

IEEM20-P-0139/Digitizing Company Analytics – Digitalization Concept for Valuable Insights

Janne Harkonen, Erno Mustonen, Joni Koskinen, Hannu Hannila
University of Oulu, Finland

IEEM20-P-0347/Creating Transparency in the Finished Vehicles Transportation Process Through the Implementation of a Real-Time Decision Support System

Angelina Schenk, Uwe Clausen
TU Dortmund University, Germany

IEEM20-P-0359/Use of Analytical Hierarchy Process in Selecting the Optimum Equipment for Execution at a Construction Project

Kumar Gaurav Thakur¹, Arvind Keprate²

¹Project Management Institute, India

²Oslo Metropolitan University, Norway

IEEM20-P-0405/The Influence of Macroeconomic Variables on Philippine Stock Market Indices: A Structural Equation Model Approach

Noime Fernandez¹, Richard Li²

¹Adamson University, Philippines

²De La Salle University - Manila, Philippines

IEEM20-P-0443/A Methodology for Value-oriented Strategic Release Planning to Provide Continuous Product Upgrading

Tarik Sahin, Tobias Huth, Joachim Axmann, Thomas Vietor
Technische Universität Braunschweig, Germany

IEEM20-P-0418/An Approach for Systematic Planning of Project Management Methods and Project Processes in Product Development

Julian Baschin, Tobias Huth, Thomas Vietor
TU Braunschweig, Germany

E-Business and E-Commerce 1

15/12/2020 16:30 - 18:00

Chairs: Krishna KOTTAKKI *Bundl Technologies*
Linda ZHANG *IESEG School of Management (LEM-CNRS 9221)*

[Abstracts: see page 58](#)

IEEM20-P-0167/Digital Transformations in the Apparel Value Chain for Mass Personalization

Wasana Uduwela¹, R. K. J. De Silva², T. D. Rupasinghe³

¹Wasana Uduwela, Sri Lanka

²University of Moratuwa, Sri Lanka

³University of Kelaniya, Sri Lanka

IEEM20-P-0384/A Constrained Clustering Algorithm for the Location of Express Shops

Xilin Zhang, Xiao Liu, Jing Jiang
Shanghai Jiao Tong University, China

IEEM20-P-0468/Efficient Detection of Shilling's Attacks in Collaborative Filtering Recommendation Systems Using Deep Learning Models

Mahsa Ebrahimian, Rasha Kashef
Ryerson University, Canada

IEEM20-P-0486/Relative Importance of Determinants Towards Users' Privacy Disclosure on Social Network Sites by Privacy Invasion Experience Based on Construal Level Theory

Li-Ting Huang¹, Jun-Der Leu²

¹Chang Gung University, Taiwan

²National Central University, Taiwan

IEEM20-P-0330/An Integrated Scheme for Robot E-procurement

Yafei Nie, Shurong Tong
Northwestern Polytechnical University, China

IEEM20-P-0355/Customer Satisfaction with Order Fulfillment in E-Retail Supply Chains in China: An Empirical Study

Yilin Xie¹, Linda L. Zhang²

¹IESEG School of Management, France

²IESEG School of Management (LEM-CNRS 9221), France

E-Business and E-Commerce 2

16/12/2020 16:30 - 18:00

Chairs: Krishna KOTTAKKI *Bundl Technologies*
Linda ZHANG *IESEG School of Management (LEM-CNRS 9221)*

[Abstracts: see page 70](#)

IEEM20-P-0080/The Influence to Customer Engagement Behavior by Different Strategy for Different Objective in Online Marketing

Dongying Yang, Shuzo Fujimura
Tokyo Institute of Technology, Japan

IEEM20-P-0267/Customer Stickiness to "Internet +" Environmental Protection Public Welfare Platforms

Guanghui He, Yali Zhang, Xingqiao Jiang, Jie Zhang
Northwestern Polytechnical University, China

IEEM20-P-0298/An Optimization Framework for On-Demand Meal Delivery System

Siddhartha Paul¹, Sunil Rathee², Jose Matthew¹, Kranthi Adusumilli²

¹Swiggy, Bundl Technologies, India

²BUNDL Technologies, India

IEEM20-P-0299/Customer Experience Driven Assignment Logic for Online Food Delivery

Krishna Kottakki, Sunil Rathee, Kranthi Adusumilli, Bharat Nayak, Jose Mathew, Saket Ahuja
BUNDL Technologies, India

IEEM20-P-0320/Equal Pricing or Free Pricing? The Pricing Strategies of B2C Platform

Houping Tian¹, Shuang Zheng¹, Chunfang Jiang¹, Changxian Liu²

¹Nanjing University of Science & Technology, China

²Nanjing University of Posts and Telecommunications, China

IEEM20-P-0321/Consistent Pricing or Inconsistent Pricing: A Tool to Deal with Dominant E-tailers

Houping Tian¹, Chunfang Jiang¹, Shuang Zheng¹, Changxian Liu²

¹Nanjing University of Science & Technology, China

²Nanjing University of Posts and Telecommunications, China

Engineering Economy and Cost Analysis

16/12/2020 14:30 - 16:00

Chairs: Kah Hin CHAI *National University of Singapore*
Leif OLSSON *Mid Sweden University*

[Abstracts: see page 85](#)

IEEM20-P-0009/Operating Expense Budgeting Using Standard Activity Measurement Plan

Romeo G. Manalo¹, Marivic V. Manalo²

¹*Manila Electric Company, Philippines*

²*De La Salle University, Philippines*

IEEM20-P-0146/Time-related Differentiation of Complexity Costs Using Process Data Mining

G. Schuh, Christian Dölle, Maximilian Kuhn, Jan Koch, Alexander Menges, Christina Ruschitzka
RWTH Aachen University, Germany

IEEM20-P-0363/The Effect of Geographical Factor on the Use of Combinable Containers

Haruki Ogawa¹, A. Imai², K. Shintani³, E. Nishimura²

¹*National Institute of Technology, Japan*

²*Kobe University, Japan*

³*Tokai University, Japan*

IEEM20-P-1083/EV Diffusion Model Considering Differences in Network Externality Structure

SangWoo Yun, Deok-Joo Lee
Seoul National University, South Korea

Engineering Education and Training 1

16/12/2020 10:00 - 11:30

Chairs: Zied HAJEJ *LGIPM/Lorraine University*
Fitra LESTARI
Faculty of Science and Technology Sultan Syarif Kasim State Islamic University

[Abstracts: see page 78](#)

IEEM20-P-0071/A Research on the Training Status of EECs Students' Core Competency in University of Science and Technology

Jen-Chia Chang, Hsiao-Fang Shih, Kuang-Ling Chang
National Taipei University of Technology, Taiwan

IEEM20-P-0356/Gamification in Assembly Training: A Systematic Review

Niko Uletika, Budi Hartono, Titis Wijayanto
Gadjah Mada University, Indonesia

IEEM20-P-0412/Simulation Paper Planes a Way to Teach Lean Production

Luis A. Salazar¹, Maria Del Pilar Revuelta Mendoza²

¹*Pontificia Universidad Católica de Chile, Chile*

²*Universidad de los Andes, Colombia*

IEEM20-P-0541/Independent Campus on Industrial Engineering Undergraduate Program in Indonesia: A Delphi Method

Fitra Lestari¹, Ismu Kusumanto², Salfen Hasri², Akmalulhadi³

¹*Sultan Syarif Kasim State Islamic University, Indonesia*

²*UIN Sultan Syarif Kasim Riau, Indonesia*

³*Citraciti Pasific, Indonesia*

Engineering Education and Training 2

16/12/2020 16:30 - 18:00

Chairs: Leif OLSSON *Mid Sweden University*
Yogi Tri PRASETYO *School of Industrial Engineering and Engineering Management, Mapua University*

[Abstracts: see page 85](#)

IEEM20-P-0122/The Impact of SARS-CoV-2 on Engineering Education: Student Perceptions from Three Countries

Per Ahag¹, Ying Jui Hsu², Leif Olsson³, Leif Sundberg³

¹*Umeå University, Sweden*

²*Nanyang Technological University, Singapore*

³*Mid Sweden University, Sweden*

IEEM20-P-0331/Blackboard E-learning System Acceptance and Satisfaction Among Filipino High School Students: An Extended Technology Acceptance Model (TAM) Approach

Yogi Tri Prasetyo, Simeon Arnold R. Tumanan, Lance Allen F. Yarte, Mhel Cris C. Ogoy, Ardivin Kester S. Ong
Mapua University, Philippines

IEEM20-P-0420/Checklist as an Effective Means of Information Delivery in On-Demand Learning

Anand Konjengbam, Sanetake Nagayoshi
Shizuoka University, Japan

Healthcare Systems and Management

16/12/2020 08:00 - 09:30

Chairs: Arnesh TELUKDARIE
University of Johannesburg
Tingyao XIONG Radford
University

[Abstracts: see page 77](#)

IEEM20-P-0037/Community Operational Research (OR) and Design Thinking for the Health and Social Services: A Comparative Analysis

Desmond Wong¹, Yee Lin Hiew²
¹University of Hull, United Kingdom
²National University of Singapore, Singapore

IEEM20-P-0154/Healthcare Energy Management: A Digital Approach

Megashnee Munsamy, Arnesh Telukdarie
University of Johannesburg, South Africa

IEEM20-P-0367/A Systems Approach to a Sector Productivity Intervention in the Social Services: Report on Methodology

Desmond Wong¹, Yee Lin Hiew²
¹University of Hull, United Kingdom
²National University of Singapore, Singapore

IEEM20-P-0378/Evolutionary Game Analysis of the Quality of Elderly-care Services Based on Public-private Partnership Supply Pattern

Qiang Mu, Ding Wang, Xiaonan Wang
Northwestern Polytechnical University, China

IEEM20-P-0521/The Impact of Social Media on the Quality of Doctor-Patient Interaction

Yasaman Asayesh, Keivan Sadeghzadeh
University of Massachusetts Dartmouth, United States

IEEM20-P-1099/Binary Sequences with Large SRS Contrast Ratios

Tingyao Xiong¹, Jonathan Hall²
¹Radford University, United States
²Michigan State University, United States

Human Factors

15/12/2020 19:00 - 20:30

Chairs: Michel ALDANONDO
Toulouse University / IMT-Mines
Albi
Linda ZHANG IESEG School of
Management (LEM-CNRS 9221)

[Abstracts: see page 59](#)

IEEM20-P-0028/The Effect of Gender, Hand Anthropometry, Hand Dominance, and High School Grade on Hand Grip Strength in Filipino Teenagers Aged 15-18: A Structural Equation Modeling Approach

Yogi Tri Prasetyo, Rod Vincent L. Cortes, Franklin S. Bautista, Kenneth C.E. Piguing, Aaron Josh A. Bermudez, Charlotte N. Monteiro
Mapúa University, Philippines

IEEM20-P-0075/Influence of Presentation Mode on User's Mental Map in Temporal Sequence Data Visualization

Wenlu Wang, Ningyue Peng, Haiyan Wang, Chengqi Xue
Southeast University, China

IEEM20-P-0178/The Importance of Including Qualitative Data in Technology Evaluation - Investigating the Technology Implementation Evaluation Score (TIES)

Annika Hasselblad, Leif Olsson
Mid Sweden University, Sweden

IEEM20-P-0220/Young Consumers' Perception Towards Downstream Green Supply Chain Practices

Vaishnavy Perinparajah¹, H. Niles Perera¹, Jayani Ishara Sudusinghe², Uthpalee Hewage¹
¹University of Moratuwa, Sri Lanka
²University of Kassel, Germany

IEEM20-P-0306/What Makes a Robot Robotic? Application of Speed, Fluidity and Animation Principles to Define Human Versus Robotic Movement

Andrew Prah, Bernhard Schmitt
Nanyang Technological University, Singapore

IEEM20-P-0434/Comparing Design Preference of Guide Road Signs by Native Arabic Speakers and International Speakers in the State of Qatar

Asma Mahgoub, Pilsung Choe
Qatar University, Qatar

Information Processing and Engineering 1

15/12/2020 14:30 - 16:00

Chairs: Gabriel FUENTES Centre for
Applied Research at NHH
Seung Ki MOON Nanyang
Technological University

[Abstracts: see page 62](#)

IEEM20-P-0161/Research on Layout Design of Situation Interface Based on Comprehensive Importance Evaluation of Nodes

Hao Wu, Haiyan Wang, Xiaojiao Chen, Chengqi Xue
Southeast University, China

IEEM20-P-0164/Exploring AI-Driven Business Models: Conceptualization and Expectations in the Machinery Industry

Carsten Hahn¹, Tim Traunecker², Manuel Niever¹, Gustav Basedow³
¹Karlsruhe University of Applied Sciences, Germany
²Technical University of Munich, Germany
³esentri AG, Germany

IEEM20-P-0171/A Pilot Study of Industry 4.0 Asset Interoperability Challenges in an Industry 4.0 Laboratory

Sune Chung Jepsen, Thomas Ingemann Mørk, Jakob Hviid, Torben Worm
University of Southern Denmark, Denmark

IEEM20-P-0279/Addressing Supply Chain Vulnerability by Supporting Emerging IT: An Analysis Based on SCOR Framework

Mengdi Wu¹, Zhaojun Yang¹, Jun Sun², Xueping Gong¹
¹Xidian University, China
²University of Texas Rio Grande Valley, United States

IEEM20-P-0402/A Customized Smart Medical Mask For Healthcare Personnel

Noori Kim¹, Joslyn Jun Wei Lim², John Jie Ming Ying², Haining Zhang³, Seung Ki Moon³, Joonphil Choi³
¹Newcastle University in Singapore, Singapore
²Singapore Institute of Technology and Newcastle University in Singapore, Singapore
³Nanyang Technological University, Singapore

IEEM20-P-0419/A Spatial Framework for Extracting Suez Canal Transit Information from AIS

Gabriel Fuentes¹, Roar Adland²
¹Centre for Applied Research at NHH, Norway
²NHH Norwegian School of Economics, Norway

Information Processing and Engineering 2

16/12/2020 10:00 - 11:30

Chairs: Vinay SINGH *ABV-IIITM Gwalior*
Tingyao XIONG *Radford University*

[Abstracts: see page 73](#)

IEEM20-P-0025/Relating Environmental and Structural Uncertainty to Management Decision Making Style and Behavior During Information System Planning and Implementation

R.R.K. Sharma¹, Vinay Singh², K.K. Lai³
¹Indian Institute of Technology Kanpur, India
²ABV-Indian Institute of Information Technology and Management Gwalior, India
³Chaoyang University of Technology, Taiwan

IEEM20-P-0211/A Feasible Schema Design Strategy for Amazon DynamoDB: A Nested Normal Form Approach

Wai Yin Mok
The University of Alabama in Huntsville, United States

IEEM20-P-0218/Intelligent Maintenance of Complex Equipment Based on Blockchain and Digital Twin Technologies

Qiuan Chen¹, Zhenwei Zhu², Shubin Si¹, Zhiqiang Cai¹
¹Northwestern Polytechnical University, China
²Shanghai Enfon Robotics Co., Ltd, China

IEEM20-P-0463/Reinforcement Learning-Based Differential Evolution for Solving Economic Dispatch Problems

Thammarsat Visutarrom¹, Tsung-Che Chiang¹, Abdullah Konak², Sadan Kulturel-Konak²
¹National Taiwan Normal University, Taiwan
²Penn State Berks, United States

IEEM20-P-0058/A Statistical Comparison of Novel Coronavirus Cases between the Philippines and South Korea

Kianna Denise C. Villapando, Maria Angelica D. Bare, Francee Mae F. Castro, Angelo Luis S. Doctora, William Davin D. Perez, Michael N. Young
Mapúa University, Philippines

IEEM20-P-0436/Evaluation of Chinese Sentiment Analysis APIs Based on Online Reviews

Tianwei Tang, Liang Huang, Yan Chen
Macau University of Science and Technology, China

Intelligent Systems

16/12/2020 14:30 - 16:00

Chairs: Ramakrushna PADHY *IIM Kashipur*
Annapoornima M SUBRAMANIAN
National University of Singapore

[Abstracts: see page 74](#)

IEEM20-P-0336/Enablers and Barriers to the Implementation of Digital Twins in the Process Industry: A Systematic Literature Review

Matteo Perno¹, Lars Hvam¹, Anders Haug²
¹Technical University of Denmark, Denmark
²University of Southern Denmark, Denmark

IEEM20-P-0403/Neural Network Control of Optical Tweezers System for Manipulation of Microscopic Objects

Gulam Dastagir Khan, Chien Chern Cheah
Nanyang Technological University, Singapore

IEEM20-P-0485/Optimization of Multilayer Design for FTTH Networks Based on Geographical Information

Kaltham Al Romaiithi¹, Anis Ouaili², Kin Poon², Peng-Yong Kong², Beum-Seuk Lee³
¹Abu Dhabi Police, United Arab Emirates
²Khalifa University, United Arab Emirates
³British Telecom, United Kingdom

IEEM20-P-0559/Development of a Novel Control Approach for Collaborative Robotics in I4 Intelligent Flexible Assembling Cells

Aleksandar Protic¹, Ziyue Jin², Romeo Marian², Khalid Abd², Duncan Campbell³, Javaan Chahl⁴
¹HSR Hochschule für Technik Rapperswil, Switzerland
²University of South Australia, Australia
³Member IEEE, Australia
⁴University of South Australia/Defence Science and Technology Organisation, Australia

IEEM20-P-0560/Implementation of a Bi-directional Digital Twin for Industry 4 Labs in Academia: A Solution Based on OPC UA

Aleksandar Protic¹, Ziyue Jin², Romeo Marian², Khalid Abd², Duncan Campbell³, Javaan Chahl⁴
¹HSR Hochschule für Technik Rapperswil, Switzerland
²University of South Australia, Australia
³Member IEEE, Australia
⁴University of South Australia/Defence Science and Technology Organisation, Australia

Manufacturing Systems 1

15/12/2020 12:00 - 13:30

Chairs: Hyeong Suk NA *South Dakota School of Mines and Technology*
Wen WANG *Shanghai Jiao Tong University*

[Abstracts: see page 61](#)

IEEM20-P-0197/Energy Management: Sustainable Approach Towards Industry 4.0

A. S. M. Monjurul Hasan, Andrea Trianni
University of Technology Sydney, Australia

IEEM20-P-1133/Critical Success Factors for Internet of Things (IoT) Implementation in Manufacturing Companies in Indonesia: Literature Review and Future Research

Inaki M. Hakim, Moses L. Singgih, I. Ketut Gunarta
Institut Teknologi Sepuluh Nopember, Indonesia

IEEM20-P-0120/Digital Twin Application for Production Optimization

Sumin Jeon¹, Sebastian Schuesslbauer²
¹Siemens Pte Ltd, Singapore
²Siemens AG, Germany

IEEM20-P-0123/Adaptive Task Sharing in Human-Robot Interaction in Assembly

Christina Schmidbauer, Sebastian Schlund, Tudor B. Ionescu, Bernd Hader
TU Wien, Austria

IEEM20-P-0134/Enterprise-wide Value Stream Mapping: From Dysfunctional Organization to Cross-Functional, Collaborative Learning and Improvement

Daryl Powell¹, Cristina Bartolome²
¹SINTEF Manufacturing AS, Norway
²Norwegian University of Science and Technology, Norway

IEEM20-P-0054/Design and Development of a Hydrothermal Reactor for Bio Coal Production for Application in Solid Waste Management Technologies

Michelle Mugoronji¹, Mercy Manyuchi², C. Mbohwa², Edison Muzenda², W. Stinner³, Nita Sukdeo²
¹Harare Institute of Technology, Zimbabwe
²University of Johannesburg, South Africa
³Germany Biomass Research Center, Germany

Manufacturing Systems 2

15/12/2020 19:00 - 20:30

Chairs: Hichem Haddou BENDERBAL
IMT Atlantique
Junfeng WANG Huazhong
University of Science and
Technology

[Abstracts: see page 47](#)

IEEM20-P-0155/Diagnosis on Energy and Sustainability of Reconfigurable Manufacturing System (RMS) Design: A Bi-level Decomposition Approach

Amirhossein Khezri¹, Hichem Haddou Benderbal², Lyes Benyoucef³, Alexandre Dolgui²

¹Arts et Métiers ParisTech, France

²IMT Atlantique, France

³Aix-Marseille University, France

IEEM20-P-0170/Industrial Wastewater Treatment Configuration: Insights from a Northern Italy Textile Manufacturing District

Marta Negri¹, Enrico Cagno¹, Caterina Salemm², Andrea Trianni³

¹Politecnico di Milano, Italy

²Confindustria Como, Italy

³University of Technology Sydney, Australia

IEEM20-P-0213/A Data Model to Apply Process Mining in End-to-End Order Processing Processes of Manufacturing Companies

G. Schuh, Andreas Güttzlaff, Sven Cremer, Seth Schmitz, Arian Ayati
RWTH Aachen University, Germany

IEEM20-P-0338/Small Series Production and Geometric Analysis of Sheet Metal Car Body Parts Using Forming Tools Made of Fused Filament Fabricated PLA

G. Schuh, Georg Bergweiler, Falko Fiedler, Philipp Bickendorf, Philipp Schumacher
RWTH Aachen University, Germany

IEEM20-P-0343/Exploring Reconfigurability in Manufacturing Through IIoT Connected MES/MOM

Soujanya Mantravadi¹, Jagjit Srai², Thomas Ditlev Brunoe¹, Charles Møller¹

¹Aalborg University, Denmark

²University of Cambridge, United Kingdom

Manufacturing Systems 3

16/12/2020 14:30 - 16:00

Chairs: Hichem Haddou BENDERBAL
IMT Atlantique
Junfeng WANG Huazhong
University of Science and
Technology

[Abstracts: see page 80](#)

IEEM20-P-0350/Digital Twin-based Production Simulation of Discrete Manufacturing Shop-floor for Onsite Performance Analysis

Yufan Zhang, Yaoqi Shao, Junfeng Wang, Shiqi Li
Huazhong University of Science and Technology, China

IEEM20-P-0357/Development of a Lean Manufacturing and SLP-based System for a Footwear Company

Victor Paucar¹, Sergio Munive¹, Victor Nuñez¹, Eloy Marcelo Lastra², Jose C. Alvarez-Merino³, S. Nallusamy³

¹Universidad Peruana de Ciencias Aplicadas, Peru

²Peruvian University of Applied Sciences, Peru

³Dr. M.G.R. Educational and Research Institute, India

IEEM20-P-0358/ Improving the Cutting Process Through Lean Manufacturing in a Peruvian Textile SME

Beckin Alanya, Emily Dextre, Victor Nuñez, Eloy Marcelo Lastra, Jose C. Alvarez-Merino

Peruvian University of Applied Sciences, Peru

IEEM20-P-0372/Manufacturing Cloud Service Composition Based on the Non-Cooperative and Cooperative Game Theory

Ehsan Vaziri Goodarzi¹, Mahmoud Houshmand², Omid Fatahi Valilai³, Vahidreza Ghezavati¹, Shahrouz Bamdad¹

¹Islamic Azad University, Iran

²Sharif University of Technology, Iran

³Jacobs University Bremen gGmbH, Germany

IEEM20-P-0376/Reengineering Workflow for Planned Reuse of IEC 61131-3 Legacy Software

Juliane Fischer¹, Birgit Vogel-Heuser¹, Fabian Haben¹, Ina Schaefer²

¹Technical University of Munich, Germany

²Technical University of Braunschweig, Germany

IEEM20-P-0495/Goal-Lever-Indicator-Principle to Derive Recommendations for Improving IEC 61131-3 Control Software

Birgit Vogel-Heuser, Juliane Fischer, Eva-Maria Neumann
Technical University of Munich, Germany

Operations Research 1

15/12/2020 08:00 - 09:30

Chairs: Hyeong Suk NA South Dakota
School of Mines and Technology
Kuo-Wei WU National Taiwan
University

[Abstracts: see page 60](#)

IEEM20-P-0532/A Robust Optimisation Formulation for Post-departure Rerouting Problem

Miriam Bongo, Charlle Sy
De La Salle University, Philippines

IEEM20-P-1061/Behavioral Model to Understand Hurricane Evacuation Decision Making Affected by Social Influence

Hyeong Suk Na
South Dakota School of Mines and Technology, United States

IEEM20-P-0290/Job Shop Scheduling Problem Neural Network Solver with Dispatching Rules

Mun Hon Sim¹, Malcolm Yoke Hean Low², Chin Soon Chong³, Mojtaba Shakeri³

¹University of Glasgow Singapore, Singapore

²Singapore Institute of Technology, Singapore

³Singapore Institute of Manufacturing Technology, Singapore

IEEM20-P-0300/Portfolio Selection Utilizing Electronic Company Stocks During the Enhance Community Quarantine Period in the Philippines

Michael N. Young, Godfrey Arevalo, Ezekiel Mallari
Mapúa University, Philippines

IEEM20-P-0438/Performance Analysis of an Open Cycle Gas Turbine Power Plant in Grid Electricity Generation

Moses Kabeyi, Oludolapo Olanrewaju
Durban University of Technology, South Africa

IEEM20-P-0406/Managing Sustainability in Electricity Generation

Moses Kabeyi, Oludolapo Olanrewaju
Durban University of Technology, South Africa

Operations Research 2

15/12/2020 16:30 - 18:00

Chairs: Ripon CHAKRABORTTY
UNSW Canberra at ADFA
Gitae KIM Hanbat National
University

[Abstracts: see page 63](#)

IEEM20-P-0030/Performance Analysis of Greedy-based Construction Heuristics on Classical Vehicle Routing Problem

Yandong He¹, Mingyao Qi¹, Fuli Zhou², Huilin Li³

¹Tsinghua University, China

²Zhengzhou University of Light Industry, China

³Shenzhen Yantian District People's Hospital, China

IEEM20-P-0042/Optimization of Capacitated Vehicle Routing Problem for Recyclable Solid Waste Collection Using Genetic and Seed Genetic Algorithms Hybridized With Greedy Algorithm

Gevorg Guloyan, Ridvan Aydin
American University of the Middle East,
Kuwait

IEEM20-P-0045/A Large Neighbourhood Search Approach to Airline Schedule Disruption Recovery Problem

Kam K.H. Ng, Kin Lok Keung, Carman Ka Man Lee, Yuk Ting Hester Chow
The Hong Kong Polytechnic University, China

IEEM20-P-0162/Model for Hazardous Material Transportation Problem via Lane Reservation Under Considering Environmental Risk

Zhen Zhou, Haoyan Zhao
Northwestern Polytechnical University, China

IEEM20-P-0189/A Multi-objective Emergency Scheduling Model for Forest Fires with Priority Areas

Lubing Wang, Peng Wu, Feng Chu
Fuzhou University, China

IEEM20-P-0242/An Order-First Split-Second Approach to a Novel Variant of the Cardinality-Constrained Covering Traveling Salesperson Problem

Chantal Schöni, Philipp Baumann, Norbert Trautmann
University of Bern, Switzerland

Operations Research 3

16/12/2020 16:30 - 18:00

Chairs: Philipp BAUMANN University
of Bern
Ripon CHAKRABORTTY
UNSW Canberra at ADFA

[Abstracts: see page 81](#)

IEEM20-P-0254/A Multi-Round Auction for Staff to Job Assignment Under Myopic Best Response Dynamics

Felix Merz, Christoph Schwindt, Stephan Westphal, Juergen Zimmermann
Clausthal University of Technology, Germany

IEEM20-P-0289/Simulated Annealing Algorithm Performance on Two-Echelon Vehicle Routing Problem-Mapping Operation with Drones

Rahmad Inca Liperda¹, A. A. N. Perwira Redi², Nandini Niramaya Sekaringtyas¹, Handina Boedhy Astiana¹, Bertha Maya Sopha³, Anna Maria Sri Asih³

¹Universitas Pertamina, Indonesia

²Bina Nusantara University, Indonesia

³Universitas Gadjah Mada, Indonesia

IEEM20-P-0414/A Relax-and-Solve Algorithm for the Ordered Flow-Shop Scheduling Problem

Mostafa Khatami, Amir Salehipour
University of Technology Sydney, Australia

IEEM20-P-0441/A Stochastic Programming Approach for Configuration Optimization of Reconfigurable Manufacturing Systems

Feng Cui, Na Geng, Zhibin Jiang, Xin Zhou
Shanghai Jiao Tong University, China

IEEM20-P-1129/Estimation of Weights for Multi-objective Production Scheduling Problems - An Inverse Optimization Approach

Kohei Asanuma¹, Tatsushi Nishi²

¹Osaka University, Japan

²Okayama University, Japan

IEEM20-P-0457/Robust Optimization Based Heuristic Approach for Solving Stochastic Multi-Mode Resource Constrained Project Scheduling Problem

Ripon Chakraborty, Michael Ryan
University of New South Wales, Canberra, Australia

Operations Research 4

16/12/2020 19:00 - 20:30

Chairs: Ripon CHAKRABORTTY
UNSW Canberra at ADFA
Oliver STRUB University of Bern

[Abstracts: see page 82](#)

IEEM20-P-0460/A Matheuristic for Practical Flights Arrival and Departure Scheduling

Mohammad Mahdi Ahmadian, Amir Salehipour
University of Technology Sydney, Australia

IEEM20-P-0497/Flying Sidekick Traveling Salesman Problem with Pick-Up and Delivery and Drone Energy Optimization

John Francis Gacal, Marco Lorenzo Utera, Dennis Cruz
De La Salle University, Philippines

IEEM20-P-0502/Multi-objective Optimization for Mixed-model Assembly Line Sequencing and Balancing in the Context of Industry 4.0

Mehran Majidian-Eidgahi¹, Armand Baboli¹, Reza Tavakkoli-Moghaddam²

¹University of Lyon, France

²University of Tehran, Iran

IEEM20-P-0540/An Immune Genetic Algorithm for Resource Constrained Project Scheduling Problem with Discounted Cash Flows

Md Asadujjaman, Mohammad Humyun Fuad Rahman, Ripon Chakraborty, Michael Ryan
University of New South Wales, Canberra, Australia

IEEM20-P-0546/A Hybrid Community-based Simulated Annealing Approach for Influence Maximization in Social Networks

Tarun K. Biswas, Alireza Abbasi, Ripon Chakraborty
University of New South Wales, Canberra, Australia

IEEM20-P-0430/Application of Fault Tree Analysis and Petri Net Modeling in Perishable Product Supply Chain

Manisha Bhardwaj, Rajat Agrawal
Indian Institute of Technology Roorkee, India

Poster Session 1

15/12/2020 10:00 - 11:30

Chairs: Ai Chin THOO *Universiti Teknologi Malaysia*
Roger JIAO *Georgia Institute of Technology*

[Abstracts: see page 64](#)

IEEM20-P-1073/The Key Success Factor for Attracting Foreign Investment After the Popularity of COVID-19

San-Weng Huang¹, James Liou¹, Gwo-Hshiung Tzeng²
¹National Taipei University of Technology, Taiwan
²National Taipei University, Taiwan

IEEM20-P-0364/Productivity Evaluation of Asia Textile Industry

H. T. Tsai¹, T. H. Ho², Chia-Nan Wang²
¹Jinn Her Enterprise Co., Ltd., Taiwan
²National Kaohsiung University of Science and Technology, Taiwan

IEEM20-P-0158/Advance Selling Decision for Perishable Products in the Presence of Strategic Consumers

Yanli Fang¹, Zhuoyi Ren², Zhaobin Wei¹
¹Huizhou University, China
²Guizhou University, China

IEEM20-P-0172/Resource Allocation of Internet Display Advertising Considering Multiple Metric Constraints

Hanmin Wang, Xinglu Liu, Wai Kin (Victor) Chan
Tsinghua University, China

IEEM20-P-1112/Perceived Sustainability Performance of Eco-Industrial Park Through Environmental Consciousness and Strategic Intention

Ai Chin Thoo¹, Jin Ming Ngang¹, Zuraidah Sulaiman¹, Norhayati Zakuan¹, Hon Tat Huam²
¹Universiti Teknologi Malaysia, Malaysia
²Universiti Putra Malaysia, Malaysia

IEEM20-P-0224/Applying K-Means Technique and Decision Tree Analysis to Predict Taiwan ETF Performance

Keng-Chieh Yang, Wen-Ping Chao
National Kaohsiung University of Science and Technology, Taiwan

IEEM20-P-0207/What Core Competence Can Students Learn from Off-Campus Internship?

Feng-Ming Sui¹, Jen-Chia Chang², Hsi-Chi Hsiao³
¹Hwa Hsia University of Technology/National Taipei University of Technology, Taiwan
²National Taipei University of Technology, Taiwan
³Cheng Shiu University, Taiwan

IEEM20-P-0216/Internet-based Collaborative Design, Manufacturing, and Supply Chain for Manufacturing Companies

Xin Yuan¹, Yiwen Chen², Qibo Zhang², Xinguo Ming¹
¹Shanghai Jiao Tong University, China
²National University of Singapore, Singapore

IEEM20-P-0132/Personal Health Mention Identification from Tweets Using Convolutional Neural Network

Yue Wang¹, Xiang Li², Daniel Y. Mo¹
¹The Hong Kong University of Science and Technology, Hong Kong SAR
²City University of Hong Kong, Hong Kong SAR

IEEM20-P-0439/Optimized Layout of Emergency Monitoring for Sudden Marine Pollution Accidents

Xiaotian Liang, Yu Guo, Weitao Xiong, Qingqing Yang, Jiang Jiang
National University of Defense Technology, China

Poster Session 2

15/12/2020 19:00 - 20:30

Chairs: Seung Ki MOON *Nanyang Technological University*
Omid Fatahi VALILAI *Jacobs University Bremen gGmbH*

[Abstracts: see page 65](#)

IEEM20-P-0292/What Makes Consumers More Strategic? Evidence from an Experimental Study

Yi Liu, Qiyuan Li, Yan Chen
Macau University of Science and Technology, China

IEEM20-P-0295/Classification and Weighting of Strategic Projects in Organizations Under Multi-Criteria Decision-Making Situations

Fernanda Souza, Thais Rodrigues, Rodolfo Cardoso, Edwin Meza, Carlos Frederico Barros
Federal Fluminense University, Brazil

IEEM20-P-0537/Trade-terms Based Pricing Method for Export Commodity

Shijin Wang, Jiaolong Wang
Tongji University, China

IEEM20-P-0360/Research on the Relationship Between Self-identity and Organizational Citizenship Behavior of the New Generation Knowledge Workers - The Mediating Effects of Organizational Identification

Shuyan Gong
Northwestern Polytechnical University, China

IEEM20-P-0553/Research on Key Factors of Total Social Welfare System of Car Hailing Industry-Based on DEMATEL Method

Huafeng Cong, Rui Miao
Shanghai Jiao Tong University, China

IEEM20-P-0437/A Procedure for Product Variety Reduction that Considers Linked Revenue

Tobias Kondrup Andersen¹, Anders Haug², Lars Hvam¹
¹Technical University of Denmark, Denmark
²University of Southern Denmark, Denmark

IEEM20-P-0027/Using Online Big Data for Determining the Importance of Product Attributes

Hanan Yakubu, C.K. Kwong
The Hong Kong Polytechnic University, China

IEEM20-P-0549/An Application on Building Information Model to Procurement Strategy of Copper Raw Material with Big Data Analytics

Sheng-Tun Li¹, Kuei-Chen Chiu², Tsung-He Chiu¹
¹National Cheng Kung University, Taiwan
²Shih Chien University, Taiwan

IEEM20-P-1134/Aerosol Jet Printed Temperature Sensor for Wireless Monitoring

Joslyn Jun Wei Lim¹, Joonphil Choi², Seung Ki Moon², Haining Zhang², Noori Kim³
¹Singapore Institute of Technology and Newcastle University in Singapore, Singapore
²Nanyang Technological University, Singapore
³Newcastle University in Singapore, Singapore

IEEM20-P-1158/The Managers Kit Turbo: Setting Up and Establish Teams in Case of an Emergency of a Manufacturing Cell

Samuel Bassetto, El Hassan El Mekkaoui
Polytechnique Montréal, Canada

Poster Session 3

16/12/2020 10:00 - 11:30

Chairs: Wen WANG *Shanghai Jiao Tong University*
Min XIE *City University of Hong Kong*

[Abstracts: see page 86](#)

IEEM20-P-0409/Optimization of Multiple Products Transportation Under the Background of Industrial Symbiosis Network

Na Gao, Yuting Li, Yuxi Mai, Haoxuan Xu
Northwestern Polytechnical University, China

IEEM20-P-0029/Process Capability Index Under Simultaneous Effects of Process Deterioration and Learning Process

Angus Jeang¹, Chien-Ping Chung²,
Zih-Huei Wang¹

¹Feng Chia University, Taiwan

²MingDao University, Taiwan

IEEM20-P-0102/Advanced Planning and Scheduling System Based on Multi-resource Closed-loop Management

Xin Yuan¹, Yiwen Chen², Bo Liu¹, Xinguo Ming¹

¹Shanghai Jiao Tong University, China

²National University of Singapore, Singapore

IEEM20-P-0322/Influence of Six Sigma DMAIC to Reduce Time Wasting of Line Supervisor in Production Manufacturing

Kabuya Kanyinda, Ian Lazarus, Oludolapo Olanrewaju
Durban University of Technology, South Africa

IEEM20-P-0303/Digital Twin-based Framework for Green Building Maintenance System

Wen Wang, Hao Hu, JiaChun Zhang, Zhe Hu
Shanghai Jiao Tong University, China

IEEM20-P-1164/A Model of Adding Relations with Short Communication Lengths in Two Levels of a Complete K-ary Linking Pin Organization Structure

Kiyoshi Sawada
University of Marketing and Distribution Sciences, Japan

IEEM20-P-1041/How Far We Moved and How Long the Road Ahead? On the On-road Testing of Prototype Automated Driving Systems

Kuo-Wei Wu, Chung-Chih Liao, Wen-Fang Wu
National Taiwan University, Taiwan

IEEM20-P-0416/Safety and Security Study for Shore Power System: State-of-the-Art

Yaqiong Lv¹, Xiaohua Cao¹, Qianwen Zhou¹, Wenqin Zhao¹, Kai Ding²

¹Wuhan University of Technology, China

²State Grid Hubei Electric Power Research Institute, China

Poster Session 4

16/12/2020 19:00 - 20:30

Chairs: Tahir MAHMOOD *Department of Technology, School of Science and Technology, The Open University of Hong Kong, Kowloon, Hong Kong*
Omid Fatahi VALILAI *Jacobs University Bremen gGmbH*

[Abstracts: see page 87](#)

IEEM20-P-0304/Joint Strategy of Advance Selling and Resalable Returns for Fashion Products

Xiaowen Sun, Yan Chen
Macau University of Science and Technology, China

IEEM20-P-0432/Research on Tourism Supply Chain Coordination Under the Background of Low-Carbon Tourism

Xiangping Wang, Huajun Tang
Macau University of Science and Technology, China

IEEM20-P-0018/Evaluation of Integrated Configuration: Cost and Time Models

Linda L. Zhang¹, Carman Ka Man Lee²,
Pervaiz Akhtar³

¹IESEG School of Management

(LEM-CNRS 9221), France

²The Hong Kong Polytechnic University, China

³University of Aberdeen, United Kingdom

IEEM20-P-0187/Concept Design of a System Architecture for a Manufacturing Cyber-physical Digital Twin System

Weidong Lin, Malcolm Yoke Hean Low
Singapore Institute of Technology, Singapore

IEEM20-P-0456/Profit-driven Maintenance in Process Industries

Lucas Correa Lemes, Lars Hvam
Technical University of Denmark, Denmark

IEEM20-P-0392/A Simulation Study of Strategic Consumer Purchases

TianYi Guo, SiHan Wang, Yan Chen
Macau University of Science and Technology, China

IEEM20-P-0567/Simulation Modeling for Inventory Planning and Control in Maintenance Systems Using Lot-for-Lot Reordering Strategy

Mojahid Saeed Osman
American University of Sharjah, United Arab Emirates

IEEM20-P-0137/Developing Knowledge Management System for Supporting Learning Activity in the Ceramics Craft Education

Tzu-Yun Hsu, Hsien-Jung Wu
National Taichung University of Science and Technology, Taiwan

IEEM20-P-0373/Digital Maturity in Theory and Practice: A Case Study of a Swedish Smart-Built Environment Firm

Jonathan Strömberg, Leif Sundberg,
Annika Hasselblad
Mid Sweden University, Sweden

IEEM20-P-1148/3D Printed Strain Gauge Sensor For Transport Rail Structural Monitoring - A

Proof-of-Concept Study

John Jie Ming Ying¹, Joonphil Choi²,
Seung Ki Moon², Haining Zhang², Noori Kim³

¹Singapore Institute of Technology and
Newcastle University in Singapore,
Singapore

²Nanyang Technological University,
Singapore

³Newcastle University in Singapore,
Singapore

IEEM20-P-0181/The Process-Ranking Benchmarking (PRB) Model: Simplifying the IT-Procurement Decisional Process

Simon Olofsson, Annika Hasselblad,
Leif Olsson
Mid Sweden University, Sweden

Production Planning and Control 1

15/12/2020 14:30 - 16:00

Chairs: Songlin CHEN *Nanyang Technological University*
Aries SUSANTY *Diponegoro University Indonesia*

[Abstracts: see page 45](#)

IEEM20-P-0022/Multi-factory Job Shop Scheduling With Due Date Objective

Jacob Lohmer, Daniel Spengler, Rainer Lasch
Technische Universität Dresden, Germany

IEEM20-P-0070/Risk Assessment and Treatment Planning for Energy-flexible Production Systems Using an Additional Cost Model

Stefan Roth, Markus Weber, Andrea Hohmann, Gunther Reinhart
Fraunhofer Institute for Casting, Composite and Processing Technology IGCV, Germany

IEEM20-P-0205/Automated Data Acquisition and Processing for Factory Layout Planning

Dominik Melcher, Benjamin Küster, Ludger Overmeyer
University of Hanover, Germany

IEEM20-P-0491/Planning of Available Resources Considering Ergonomics Under Deterministic Highly Variable Demand

Marco Bonini, Jan Schuhmacher, Augusto Urru, Jan Philipp Wezel, Vera Hummel, Wolfgang Echelmeyer
Reutlingen University, Germany

IEEM20-P-0516/Why a Systematic Investigation of Production Planning and Control Procedures is Needed for the Target-oriented Configuration of PPC

Alexander Mütze¹, Simon Hillnhagen², Philipp Schäfers¹, Matthias Schmidt², Peter Nyhuis¹

¹*Leibniz University Hannover, Germany*

²*Leuphana University of Lüneburg, Germany*

IEEM20-P-0517/Reverse Logistics with Disassembly, Assembly, Repair and Substitution

Youcef Boutarfa¹, Ahmed Senoussi¹, Nadjib Brahimi²

¹*Université Batna 2, Algeria*

²*Remmes School of Business, France*

Production Planning and Control 2

16/12/2020 10:00 - 11:30

Chairs: Yaqiong LV *Wuhan University of Technology*
Ding ZHANG *City University of Hong Kong*

[Abstracts: see page 68](#)

IEEM20-P-0180/Simulation Optimization Framework for Online Deployment and Adjustment of Reconfigurable Machines in Job Shops

Xuechen Feng, Ziqi Zhao, Canrong Zhang
Tsinghua University, China

IEEM20-P-0202/Implementing Real-time Scheduling System for a Precision Engineering Company in Singapore

Sisui Ngoh, Tay Jin Chua, Tian Xiang Cai, Ravi Kumar Katru, Clement Tan Beng Kwee, Xinlin Lin, Martin Choo Boon Yang, Wei Qing Lee
Singapore Institute of Manufacturing Technology, Singapore

IEEM20-P-0227/Production Decisions for Standard and Customized Products with Postponement

Xiaoqian Shi, Jie Lin, Meimei Zheng
Shanghai Jiao Tong University, China

IEEM20-P-0449/Allocation Optimization for Subscription Box Services

Ayca Erdogan, Ayse Gundogdu Senturk, Jonathan Balasingham
San Jose State University, United States

IEEM20-P-0130/Simulation-based Assembly Line Balancing in U-shaped, Parallel U-shaped, and Parallel Adjacent U-shaped Layouts

Pheakra Doung¹, Ronnachai Sirovetnukul¹, Jun Ren²

¹*Mahidol University, Thailand*

²*Liverpool John Moores University, United Kingdom*

Project Management 1

15/12/2020 10:00 - 11:30

Chairs: Songlin CHEN *Nanyang Technological University*
Tahir MAHMOOD *Department of Technology, School of Science and Technology, The Open University of Hong Kong, Kowloon, Hong Kong*

[Abstracts: see page 55](#)

IEEM20-P-0010/Breakthrough Capabilities for Delivering High-performing Project Management Offices (PMOs) in Construction Enterprises

Mahmoud Ershadi¹, Marcus Jefferies¹, Peter Davis¹, Mohammad Mojtahedi²
¹*University of Newcastle, Australia*
²*University of New South Wales, Australia*

IEEM20-P-0117/How Could Antecedents to Project Collaborative Effectiveness Through Project War-Room Meetings, Develop Cohesion in Multicultural Teams: While Problem-Solving?

Adrian Hepworth¹, Sevil Hepworth²
¹*University of Liverpool Management School, Azerbaijan*
²*University of Liverpool the Centre for Higher Education Studies, Azerbaijan*

IEEM20-P-0228/Evaluation of the "Internet +" Environmental Public Welfare Project Based on Value Co-creation

Jie Zhang, Yali Zhang, Haixin Zhang, Guanghui He
Northwestern Polytechnical University, China

IEEM20-P-0489/Gearing Food Manufacturing Industry Towards Lean Six Sigma Implementation: An Exploratory Study on Readiness Factors

Sarina Abdul Halim Lim¹, Nurul Najihah Azalanazlay¹, Ungku Fatimah Ungku Zainal Abidin¹, Anjar Priyono²
¹*Universiti Putra Malaysia, Malaysia*
²*Universitas Islam Indonesia, Indonesia*

IEEM20-P-0447/Project Performance Evaluation System: A Case Study in a Construction Enterprise in Colombia

Sassha Rico, Luciana Alencar
Universidade Federal de Pernambuco, Brazil

IEEM20-P-0568/Application of Fuzzy Set Theory to Evaluate Large Scale Transport Infrastructure Risk Assessment and Application of Best Practices for Risk Management

Baudhi Abeysekara
University of Moratuwa, Sri Lanka

Project Management 2

15/12/2020 16:30 - 18:00

Chairs: Hichem Haddou BENDERBAL
IMT Atlantique
Nadjib BRAHIMI Rennes School
of Business

[Abstracts: see page 52](#)

IEEM20-P-0237/Empirical Classification of Advanced Information Technology Towards Their Support of Leadership Behaviors in Virtual Project Management Settings

Christina Mayer, Susanne Mütze-Niewöhner, Verena Nitsch
RWTH Aachen University, Germany

IEEM20-P-0307/Towards an Extended Team Model for Agile Development of Complex Products

Niklas Steireif, Marisa Schirmer, Maximilian Schnitzler, Susanne Mütze-Niewöhner
RWTH Aachen University, Germany

IEEM20-P-0337/A Taxonomy for Engineering Change Management in Complex ETO Firms

Emrah Arica¹, Ottar Bakaas¹, Pavan Sriram²
¹SINTEF Technology and Society, Norway
²Norwegian University of Science and Technology, Norway

IEEM20-P-0448/Sustainability in the Civil Construction based on Emergy Analysis Theory (EmA): A Systematic Review of Literature

Luanda Lima, Marcelo Alencar, Luciana Alencar
Universidade Federal de Pernambuco, Brazil

IEEM20-P-0174/Investigating the Effects of Modular Product Structures to Support Design Decisions in Modularization Projects

Erik Greve¹, Christoph Fuchs², Bahram Hamraz², Marc Windheim², Lea-Nadine Schwede¹, Dieter Krause¹
¹Hamburg University of Technology, Germany
²Siemens Advanta, Germany

Quality Control and Management

16/12/2020 12:00 - 13:30

Chairs: Zied HAJEJ LGIPM/Lorraine
University
Danping LIN Shanghai
Maritime University

[Abstracts: see page 84](#)

IEEM20-P-0114/Development and Validation of a Failure-Cause-Searching and Solution-Finding Algorithm Based on Complaint Information from the Use Phase

Amirbabak Ansari, Nadine Schlueter, Marius Heinrichsmeyer, Manuel Loewer
University of Wuppertal, Germany

IEEM20-P-0148/A Failure Handling Process Model for Failure Management in Manual Assembly

Robin Exner, Quoc Hao Ngo, Junjie Liang, Max Ellerich, Robin Günther, Sebastian Schmitt, Robert Schmitt
RWTH Aachen University, Germany

IEEM20-P-0251/The Implementation of ISO 9001:2015 to Improve Quality Service: A Descriptive Study on a South African Service Organization

Marabe Hotpower Magana, Eric Mikobi Bakama, Sambil Charles Mukwakungu, Nita Sukdeo
University of Johannesburg, South Africa

IEEM20-P-0288/The Relationship Between the Implementation of Quality Management Practices and Service Quality in the South African Financial Service Industry

Kuthula Ntanzu, Alice Kabamba Lumbwe, Sambil Charles Mukwakungu, Nita Sukdeo
University of Johannesburg, South Africa

IEEM20-P-0344/An Integrated Modeling Framework for Multivariate Poisson Process with Temporal and Spatial Correlations

Cang Wu, Shubin Si
Northwestern Polytechnical University, China

IEEM20-P-0431/Total Quality Management & Customer Satisfaction in Public Hospitals in Sri Lanka

Pemal Daksith, Uthpalee Hewage
University of Moratuwa, Sri Lanka

Reliability and Maintenance Engineering 1

15/12/2020 12:00 - 13:30

Chairs: Danping LIN Shanghai
Maritime University
Xin WANG City University of
Hong Kong

[Abstracts: see page 56](#)

IEEM20-P-0153/Reliability and Safety Assessment of Automated Driving Systems: Review and Preview

Kuo-Wei Wu, Chung-Chih Liao, Wen-Fang Wu
National Taiwan University, Taiwan

IEEM20-P-0452/An Integrated Approach for Fuzzy Failure Mode and Effect Analysis Using Fuzzy AHP and Fuzzy MARCOS

Soumava Boral¹, Sanjay K. Chaturvedi², Ian Howard¹, Kristoffer McKee¹, V. N. Achuta Naikan²
¹Curtin University, Australia
²Indian Institute of Technology Kharagpur, India

IEEM20-P-0504/Mechanization of Qualitative Risk Based Inspection Analysis

Mehdi Eskandarzade¹, R. M. Chandima Ratnayake², Meysam Najafi Ershadi¹
¹University of Mohaghegh Ardabili, Iran
²University of Stavanger, Norway

IEEM20-P-1152/Modelling and Analysis of Accelerated Degradation Testing with Practical Issues Considered

Qingpei Hu
Chinese Academy of Sciences, China

IEEM20-P-0016/A Deterministic Analysis Method of Embedded System Based on Event-driven

Xianchen Shi, Yian Zhu, Xiangyu Zhang, Lian Li, Zonglong Qi, Jihuan Dou
Northwestern Polytechnical University, China

IEEM20-P-0219/Life Prediction of Self-Locking Nut for Aeroengine Based on Survival Analysis and Bayesian Network

Zhiqiang Cai, Yuhang Wang, Huiying Cao, Zhengjie Tian
Northwestern Polytechnical University, China

Reliability and Maintenance Engineering 2

16/12/2020 08:00 - 09:30

Chairs: Zied HAJEJ *LGIPM/Lorraine University*
Kuo-Wei WU *National Taiwan University*

[Abstracts: see page 83](#)

IEEM20-P-0035/Jump Diffusion Process Model Considering Component Dependency in Open Source Project for Development Effort Management

Yoshinobu Tamura¹, Sugisaki Kodai¹, Shigeru Yamada²

¹Tokyo City University, Japan

²Tottori University, Japan

IEEM20-P-1039/Exact Method and Approximated Method for Redundancy Allocation Problem of Multi-state Series-parallel System

Hanxiao Zhang, Yan-Fu Li
Tsinghua University, China

IEEM20-P-0235/High-Fidelity Finite Element Modelling and Simulation of Solid Resilient Tire: Application to Forklift Solid Resilient Tire

Aruna Premarathna¹, Supun Jayasinghe¹, Kushan Wijesundara¹, Pramila Gamage¹, Sisira Ranatunga²
¹University of Peradeniya, Sri Lanka
²Elastomeric Engineering (Co) Ltd., Sri Lanka

IEEM20-P-0413/Integrated Preventive Maintenance Improvement and Spare Part Ordering Strategy for Age Deterioration Components

Danping Lin¹, Carman Ka Man Lee², Wenyan Guo¹
¹Shanghai Maritime University, China
²The Hong Kong Polytechnic University, China

IEEM20-P-0417/Health State Prognostics Study Based on Extreme Learning Machine

Wenqin Zhao, Yaqiong Lv, Qianwen Zhou
Wuhan University of Technology, China

IEEM20-P-0163/Integrated Production, Maintenance and Control Chart of Supply Chain Management Under Quality Constraint

A. S. Abubakar, Ame Nyongue, Zied Hajej
University of Lorraine, France

Safety, Security and Risk Management

16/12/2020 12:00 - 13:30

Chairs: Michel ALDANONDO
Toulouse University / IMT-Mines Albi
Dingcheng ZHANG
City University of Hong Kong

[Abstracts: see page 79](#)

IEEM20-P-0017/An Investigation of the Perceived Adverse Impacts and Control of Construction Noise in China

Zhe Hu¹, Hao Hu¹, Weng Tat Chan², Feng Xu¹

¹Shanghai Jiao Tong University, China

²National University of Singapore, Singapore

IEEM20-P-0149/Digital Twin for Legal Requirements in Production and Logistics based on the Example of the Storage of Hazardous Substances

Giuseppe Perez, Benjamin Korth
Fraunhofer Institute for Material Flow and Logistics IML, Germany

IEEM20-P-0198/Frequency Probabilistic Risk Assessment Using Coloured Petri Nets for Telemedicine

Kenji Fujita, Kunihiko Hiraishi, Toshiaki Aoki
Japan Advanced Institute of Science and Technology, Japan

IEEM20-P-1093/Towards a Risk Engineering Knowledge Model for Technical System Offers in Engineer to Order Situations

Delphine Guillon¹, Rania Ayachi², Michel Aldanondo³, Elise Vareilles⁴, Thierry Coudert⁵, Laurent Geneste⁵
¹IMT Mines Albi - ESTIA, France
²Toulouse University / IMT-Mines Albi and INP-ENI Tarbes, France
³Toulouse University / IMT-Mines Albi, France, Metropolitan
⁴Institut Supérieur de l'Aéronautique et de l'Espace, France
⁵Toulouse University, France

IEEM20-P-0186/Risk Assessment for Food Safety in Chicken Slaughterhouse Industry

Hana Wahyuni, Iwan Vanany, Udisubakti Ciptomulyono
Institut Teknologi Sepuluh Nopember, Indonesia

Service Innovation and Management 1

15/12/2020 14:30 - 16:00

Chairs: Nagesh SHUKLA *University of Technology Sydney*
Annapoornima M
SUBRAMANIAN
National University of Singapore

[Abstracts: see page 51](#)

IEEM20-P-0140/Organizational Learning from Failure Can Augment Ambidexterity: Evidence from Japan

Sanetake Nagayoshi¹, Jun Nakamura²

¹Shizuoka University, Japan

²Chuo University, Japan

IEEM20-P-0248/The Business Ecosystem Management Canvas

Philipp Humbeck¹, Jan Jaeckle², Julia Duwe², Thomas Bauernhansl³
¹Graduate School of Excellence Advanced Manufacturing Engineering, Germany
²TRUMPF Werkzeugmaschinen GmbH + Co. KG, Germany
³Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany

IEEM20-P-0484/Lean Management 4.0 Proposition for the Evolution of Managerial Criteria

Eva Rother¹, Armand Baboli¹, Luc Bernardini²
¹University of Lyon, France
²FPT Industrial, France

IEEM20-P-0508/Business Model and Organization – Interdependencies for Customer-Centric Continuous Innovation in Subscription Business

G. Schuh, Andreas Gützlaff, Sven Cremer, Jannik Lammersmann, Yuan Liu
RWTH Aachen University, Germany

IEEM20-P-0526/Measuring Information Technology Service Levels: A Literature Review

Franziska Schorr, Lars Hvam
Technical University of Denmark, Denmark

IEEM20-P-0564/A User-centered Evaluation and Redesign Approach for E-Government APP

Danni Chang¹, Fan Li², Leni Huang¹
¹Shanghai Jiao Tong University, China
²Fraunhofer Singapore, Singapore

Service Innovation and Management 2

16/12/2020 08:00 - 09:30

Chairs: Fitra LESTARI *Industrial Engineering Department*
Danping LIN *Shanghai Maritime University*

[Abstracts: see page 72](#)

IEEM20-P-0062/Affecting Factors of Consumers' Purchase Decision on Sustainable Fashion Clothing Products

Hui Zheng, Lei Chen
Donghua University, China

IEEM20-P-0067/Performance Analysis for a Two-stage Queuing System with Online Service

Liyang Zhang, Li Xiao
Tsinghua University, China

IEEM20-P-0078/Impact of Halal Labeling on Brand Image on Cosmetic Product

Fitra Lestari, Hertina Hertina, Lusiana Ritia, Irsan Riandika, Ahmad Mas'ari
Sultan Syarif Kasim State Islamic University, Indonesia

IEEM20-P-0061/A Study on IoT-enabled Appliance Management Service Platform Business Model

Tatsuya Inaba
Kanagawa Institute of Technology, Japan

IEEM20-P-0262/Is a Disruptive Technology Disruptive? The Readiness Perspective Based on TOE

Nan Chang, Yali Zhang, Di Lu, Xin Zheng, JianWu Xue
Northwestern Polytechnical University, China

Supply Chain Management 1

15/12/2020 08:00 - 09:30

Chairs: Adnan HASSAN *Universiti Teknologi Malaysia*
Yugowati PRAHARSI
Shipbuilding Institute of Polytechnic Surabaya

[Abstracts: see page 43](#)

IEEM20-P-0021/Modeling of an Industrial Ecosystem at Traditional Shipyards in Indonesia for the Sustainability of the Material Supply Chain

Yugowati Praharsi¹, Muhammad Abu Jami'in¹, Gaguk Suhardjito¹, Hui-Ming Wee²

¹Shipbuilding Institute of Polytechnic Surabaya, Indonesia

²Chung Yuan Christian University, Taiwan

IEEM20-P-0073/The Optimal Choice for Local Content Requirement and Tariff Under Social Welfare Maximization

Lin Gan, Li Xiao
Tsinghua University, China

IEEM20-P-0079/Flood Shelters Location Using P-median Model

Wichitsawat Suksawat Na Ayudhya King Mongkut's Institute of Technology Ladkrabang, Thailand

IEEM20-P-0184/An Inventory Optimization Model Under Demand Uncertainty for Autonomous Multi-site Inventory Planning with Material Substitutability and Transshipment

Mojtaba Shakeri¹, Chi Xu², Puay Siew Tan²

¹Singapore Institute of Manufacturing Technology, Singapore

²Agency for Science, Technology and Research (A*STAR), Singapore

IEEM20-P-0232/Dual Sourcing Problem with Capacities and Setup Cost

Xiaoqian Shi, Linlin Ji, Meimei Zheng
Shanghai Jiao Tong University, China

Supply Chain Management 2

15/12/2020 12:00 - 13:30

Chairs: Adnan HASSAN *Universiti Teknologi Malaysia*
Yugowati PRAHARSI
Shipbuilding Institute of Polytechnic Surabaya

[Abstracts: see page 45](#)

IEEM20-P-0510/Optimal Planning of a Closed-loop Supply Chain with Recovery Options and Carbon Emission Considerations

Fareeduddin Mohammed, Adnan Hassan
Universiti Teknologi Malaysia, Malaysia

IEEM20-P-1010/Evaluation Framework in Sustainable Cold Chain for Perishable Food Products: A Literature Review

Shuo Dang, Dong Li
University of Liverpool, United Kingdom

IEEM20-P-0152/Choosing the Right Communication Medium for Knowledge Transfer in Global Production Networks

G. Schuh, Andreas Gützlaff, Katharina Thomas, Niklas Rodemann, Isabel Rittstieg
RWTH Aachen University, Germany

IEEM20-P-0068/Modeling the Recall Process of Bulk-Liquid Industry: A Linear Programming Approach

Ivan Gunawan¹, Iwan Vanany², Erwin Widodo³

¹Universitas Katolik Widya Mandala Surabaya, Indonesia

²Institut Teknologi Sepuluh Nopember, Indonesia

³Institut Teknologi Sepuluh Nopember (ITS), Indonesia

IEEM20-P-0124/Framework for the Proactive Identification of Adaptation Needs in the Configuration of Global Production Networks

Niklas Rodemann, Katharina Thomas, Andreas Gützlaff, G. Schuh
RWTH Aachen University, Germany

IEEM20-P-0135/Impact of Internal Factors on the Implementation of Halal Logistics

Aries Susanty¹, Nia Budi Puspitasari¹, Oktivia Selvina¹, Sumunar Jati²

¹Diponegoro University, Indonesia

²Lembaga Pengkajian Pangan, Obat-obatan, dan Kosmetika Majelis Ulama Indonesia, Indonesia

Supply Chain Management 3

16/12/2020 08:00 - 09:30

Chairs: Adnan HASSAN *Universiti Teknologi Malaysia*
Yugowati PRAHARSI
Shipbuilding Institute of Polytechnic Surabaya

[Abstracts: see page 67](#)

IEEM20-P-0397/Optimal Decisions for Reverse Supply Chain Considering IERs of Dual Collection Channel

Qiaolun Gu¹, Tiegang Gao²
¹*Tianjin University of Technology and Education, China*
²*Nankai University, China*

IEEM20-P-0425/Risk Analysis of Upstream Halal Supply Chain in Meat Industry in Indonesia Using DEMATEL-Based ANP

Safira Hazhiyah Ikramina Busyra,
Romadhani Ardi
Universitas Indonesia, Indonesia

IEEM20-P-0426/Prioritizing Risks of Halal Meat Supply Chain in Indonesian Downstream Sector Using DEMATEL-Based ANP

Nadya Rishelin, Romadhani Ardi
Universitas Indonesia, Indonesia

IEEM20-P-0429/Supply Chain Risk Assessment of Generic Medicine in Indonesia Using DEMATEL-Based ANP (DANP)

Sukma Azzah Kharisma, Romadhani Ardi
Universitas Indonesia, Indonesia

IEEM20-P-0462/Production and Pricing Decisions in a Product-Service System Supply Chain

Qingwei Wang¹, Meimei Zheng¹, Wei Weng²
¹*Shanghai Jiao Tong University, China*
²*Kanazawa University, Japan*

IEEM20-P-0493/DEMATEL-Based Analytic Network Process (ANP) Approach to Assess the Vaccine Supply Chain Risk in Indonesia

Annisa Chairani Sudarmin, Romadhani Ardi
Universitas Indonesia, Indonesia

Supply Chain Management 4

16/12/2020 12:00 - 13:30

Chairs: Gitae KIM *Hanbat National University*
Aries SUSANTY *Diponegoro University Indonesia*

[Abstracts: see page 68](#)

IEEM20-P-0136/Sustainability Assessment of Contract Farming Broiler Chicken Supply Chain Using Rap-Poultry

Aries Susanty, Nia Budi Puspitasari,
Ratna Purwaningsih, Ardina Ruri Siregar
Diponegoro University, Indonesia

IEEM20-P-0138/Vehicle Arrangement Problem for an Automobile Carrier Terminal

Etsuko Nishimura, H. Guo
Kobe University, Japan

IEEM20-P-0147/Bi-objective Multistage Decentralized Supply Chain Planning

Marjia Haque¹, Sanjoy Kumar Paul²,
Ruhul Sarker¹, Daryl Essam¹
¹*University of New South Wales, Canberra, Australia*
²*University of Technology Sydney, Australia*

IEEM20-P-0212/The Impact of Smart-Warehousing on a Local Foodservice Equipment-company's External Customers

Palesa Kekana, Eric Mikobi Bakama,
Sambil Charles Mukwakungu, Nita Sukdeo
University of Johannesburg, South Africa

IEEM20-P-0214/Impacts of Emerging Information Technologies on Supply Chains: A Systematic Literature Review

Xueping Gong¹, Zhaojun Yang¹, Jun Sun², Mengdi Wu¹
¹*Xidian University, China*
²*University of Texas Rio Grande Valley, United States*

IEEM20-P-1059/Coordination, Capacity Planning and Joint Decision-making in Agricultural Supply Chains Under Supply and Demand Uncertainty

Chenqiang Yue, Dong Li, Dongping Song
University of Liverpool, United Kingdom

Supply Chain Management 5

16/12/2020 19:00 - 20:30

Chairs: Gitae KIM *Hanbat National University*
Aries SUSANTY *Diponegoro University Indonesia*

[Abstracts: see page 71](#)

IEEM20-P-0287/Qualitative Aspects of Communication and Relations Between the Actors in a Supply Chain for Forest Fuel

Johanna Enström
Skogforsk, Sweden

IEEM20-P-0334/Determination of an Efficient Degree of Centralization in Global Production Networks

G. Schuh, Andreas Gützlaff, Katharina Thomas, Tino Xaver Schlosser
RWTH Aachen University, Germany

IEEM20-P-0550/Blockchain in Supply Chains and Logistics: Trends in Development

Fredrik Högberg, Muhammad Al Amin Rashid Othman, Christine Große
Mid Sweden University, Sweden

IEEM20-P-0466/Impact of Sharing Point of Sales Data and Inventory Information on Bullwhip Effect

Sandun Tharaka Matharage, Uthpalee Hewage, H. Niles Perera
University of Moratuwa, Sri Lanka

IEEM20-P-1136/Coordination Between Buyer and Supplier Using Game Theory

Gitae Kim
Hanbat National University, South Korea

IEEM20-P-0481/Controlling of Migration in Production Networks

G. Schuh, Andreas Gützlaff, Sven Cremer, Lars Geesmann, Dino Hardjosuwito
RWTH Aachen University, Germany

IEEM20-P-0203/Supplier Selection and Order Allocation Under Disruption: Multi-Objective Evolutionary Algorithms

Farnaz Javadi Gargari¹, Ehsan Pourjavad²
¹*Alzahra University, Iran*
²*Polytechnique Montreal, Canada*

Systems Modeling and Simulation 1

15/12/2020 10:00 - 11:30

Chairs: Zhiqiang CAI *Northwestern Polytechnical University*
Yoshinobu TAMURA *Tokyo City University*

[Abstracts: see page 44](#)

IEEM20-P-0433/A Mixed-integer Programming Approach to Group Control of Elevator Systems with Destination Hall Call Registration

Yulun Wu, Shunji Tanaka
Kyoto University, Japan

IEEM20-P-1140/Additive Manufacturing of Dynamic Lifeboat Hook Assembly

Ulanbek Auyeskhani¹, Namhun Kim¹,
Van Loi Tran², Chung-Soo Kim²,
Dong-Hyun Kim²
¹*Ulsan National Institute of Science and
Technology, South Korea*
²*Korea Institute of Industrial Technology,
South Korea*

IEEM20-P-0415/Effect of Network Structure and Preference Difference on Knowledge Transfer in Inter-organizational R&D Project

Xiaonan Wang, P. Guo, D. Wang
*Northwestern Polytechnical University,
China*

IEEM20-P-0315/Container Movement Evaluation Using System Dynamics Simulation

Fajar Kurniawan, Siti Nurmayana Musa,
Noor Hasnah Moin
Universiti Malaya, Malaysia

IEEM20-P-0472/Electric Vehicle Diffusion in the Indonesian Automobile Market: A System Dynamics Modelling

Erwin Stefano Lonan, Romadhani Ardi
Universitas Indonesia, Indonesia

IEEM20-P-0525/Optimization by Hybridization of Algorithms RGA and ILS to Solve the Container Stacking Problem at Tripoli-Lebanon Seaport

Nobar Kassabian¹, Zakaria
Hammoudan², Olivier Grunder³,
Lhassane Idoumghar¹

¹*Université de Haute-Alsace, France*

²*Jinan University, Lebanon*

³*Université de technologie de Belfort
Montbéliard, France*

Systems Modeling and Simulation 2

15/12/2020 16:30 - 18:00

Chairs: Szu Hui NG *National University
of Singapore*
Nagesh SHUKLA *University of
Technology Sydney*

[Abstracts: see page 46](#)

IEEM20-P-0038/Cloud-based Cyber-Physical Robotic Mobile Fulfillment Systems Considering Order Correlation Pattern

Kin Lok Keung, Carman Ka Man Lee,
Ping Ji, Jiage Huo
*The Hong Kong Polytechnic University,
China*

IEEM20-P-0051/A Simulation-based Method for Predicting the Time-varying Passenger Demand at Metro Rail Transit Line 3 Using Monte Carlo Simulation

Yogi Tri Prasetyo, Benjamin Tabares Jr.
Mapúa University, Philippines

IEEM20-P-0111/Simulation Modeling of Production System Considering Human Behavior

Fansen Kong, Xiangdong Kong,
Haoyang Wu, Yixin Zhang, Peidi Fang
Jilin University, China

IEEM20-P-0209/Towards a European Hyperloop Network: An Alternative to Air and Rail Passenger Travel

Deep Vijay Merchant, Stanislav
Chankov
Jacobs University Bremen, Germany

IEEM20-P-0543/A Cross-disciplinary Model-Based Systems Engineering Workflow of Automated Production Systems Leveraging Socio-technical Aspects

Minjie Zou, Birgit Vogel-Heuser,
Michael Sollfrank, Juliane Fischer
Technical University of Munich, Germany

Systems Modeling and Simulation 3

16/12/2020 14:30 - 16:00

Chairs: Gabriel FUENTES *Centre for
Applied Research at NHH*
Dingcheng ZHANG *City
University of Hong Kong*

[Abstracts: see page 69](#)

IEEM20-P-0258/A 0-1 Mixed-Integer Program Approach Towards Solving the Stochastic Aircraft Sequencing Problem with Constant Deceleration Rate

Jitamitra Desai, Ashish Singh Bhandari
*Indian Institute of Management Bangalore,
India*

IEEM20-P-0451/Determining the Freight Volumes for a Decentralized Waterborne Container Transportation Service

Cyril Alias, Dieter Gründer, Lennart
Dahlke, Jonas zum Felde, Lea Pusch
*DST - Development Center for Ship
Technology and Transport Systems,
Germany*

IEEM20-P-0479/Data-driven Learning for Approximation of Nonlinear Functions with Stochastic Disturbances

Quang Minh Ta, Huu-Thiet Nguyen,
Chien Chern Cheah
*Nanyang Technological University,
Singapore*

IEEM20-P-1151/Agent-based Simulation of Heuristics-driven Evacuation Behavior Under Radiological Emergency: A Case Study of the Ko-ri Area

Jeongsik Kim¹, Byoung-Jik Kim², Byung
Joo Min¹, Namhun Kim¹
¹*Ulsan National Institute of Science and
Technology, South Korea*
²*Korea Institute of Nuclear Safety, South
Korea*

IEEM20-P-0206/Identifying Suitable Transshipment Points for a Decentralized Waterborne Container Transportation Network

Cyril Alias¹, Lennart Dahlke¹, Ole
Heerwagen¹, Dieter Gründer¹, L. Pusch¹,
Jonas zum Felde¹, Sven Severin²

¹*DST - Development Center for Ship
Technology and Transport Systems,
Germany*

²*RIF Institut für Forschung und Transfer
e.V., Germany*

IEEM20-P-0554/Modelling the Impact of COVID-19 Pandemic on a Hardware Retail Supply Chain

Abhishek Sathyanarayana, Nagesh
Shukla, Firouzeh Taghikhah
University of Technology Sydney, Australia

Technology and Knowledge Management 1

15/12/2020 08:00 - 09:30

Chairs: Arnesh TELUKDARIE
University of Johannesburg
Tingyao XIONG *Radford University*

[Abstracts: see page 54](#)

IEEM20-P-0011/Adoption of Information Technology in Modern Manufacturing Operation

Shu Lun Mak, Chi Ho Li, W. F. Tang,
Ming Yan Wu, C. W. Lai
The Open University of Hong Kong, Hong Kong SAR

IEEM20-P-0204/Knowledge Revealing and Organizational Legitimacy: Comparisons between Different Types of Firms in China

Yan Xie¹, Jiaqi Huang¹, Kai Xu²
¹*Northwestern Polytechnical University, China*
²*University of Texas at San Antonio, United States*

IEEM20-P-0244/Promoting the Original Innovation for Disruptive Technology

Xin Zheng, Yali Zhang, Liaoliao Li, Nan Chang, Jianwu Xue
Northwestern Polytechnical University, China

IEEM20-P-0477/How Do Innovation Intermediaries Influence Outbound Open Innovation in China? A Moderated Mediation Mechanism

Yan Xie¹, Kai Xu², Jiaqi Huang¹
¹*Northwestern Polytechnical University, China*
²*University of Texas at San Antonio, United States*

IEEM20-P-0296/A Study on Ambidextrousness of R&D Organization in ICT Companies

Iori Nakaoka¹, Yunju Chen², Yousin Park³, Hirochika Akaoka⁴, Seigo Matsuno¹
¹*National Institute of Technology, Ube College, Japan*
²*Shiga University, Japan*
³*Prefectural University of Hiroshima, Japan*
⁴*Kyoto Sangyo University, Japan*

IEEM20-P-0374/Impact of Reabsorption of Spilled Knowledge on Patent Value

Takafumi Miyazaki, Ryo Takemura,
Takuya Harada, Noritomo Ouchi
Aoyama Gakuin University, Japan

Technology and Knowledge Management 2

15/12/2020 14:30 - 16:00

Chairs: Kah Hin CHAI *National University of Singapore*
Leif OLSSON *Mid Sweden University*

[Abstracts: see page 57](#)

IEEM20-P-0060/Cyber-Physical Operator Assistance Systems in Industry: Cross-Hierarchical Perspectives on Augmenting Human Abilities

Mirco Moencks, Elisa Roth, Thomas Bohné
University of Cambridge, United Kingdom

IEEM20-P-0246/Case Study for the Integrated Development of a Modular System for Vehicle Superstructures of Battery Electric Light Commercial Vehicles

G. Schuh¹, Christian Dölle¹, Ramon Kreutzer², Marc Patzwald², Jan Koch¹
¹*RWTH Aachen University, Germany*
²*Fraunhofer Institute for Production Technology IPT, Germany*

IEEM20-P-0301/The Enhancement of E-learning for the Boring Process to Leverage the Knowledge Management Maturity

Zulma Luklu Il Maqnun, Fadel Muhammad, Amelia Kurniawati, Mochamad Teguh Kurniawan
Telkom University, Indonesia

IEEM20-P-0551/The Impact of Business Intelligence on Decision-Making in Public Organisations

Aron Berhane, Mohamad Nabeel, Christine Große
Mid Sweden University, Sweden

IEEM20-P-0053/Development and Evaluation of a Blockchain Concept for Production Planning and Control in the Semiconductor Industry

Laura Herrgoß¹, Jacob Lohmer², Germar Schneider¹, Rainer Lasch²
¹*Infineon Technologies Dresden GmbH & Co. KG, Germany*
²*Technische Universität Dresden, Germany*

IEEM20-P-0558/Methodology for the Assessment of Complexity in Corporate Value Networks

Michael Riesener, Christian Dölle, Julian Krefß, G. Schuh
RWTH Aachen University, Germany

Session	Supply Chain Management 1
Date	15/12/2020
Time	08:00 - 09:30
Chairs	Adnan HASSAN <i>Universiti Teknologi Malaysia</i> Yugowati PRAHARSI <i>Shipbuilding Institute of Polytechnic Surabaya</i>

IEEM20-P-0021/ Modeling of an Industrial Ecosystem at Traditional Shipyards in Indonesia for the Sustainability of the Material Supply Chain

Yugowati Praharsi¹, Muhammad Abu Jami'in¹, Gaguk Suhardjito¹, Hui-Ming Wee²

¹Shipbuilding Institute of Polytechnic Surabaya, Indonesia

²Chung Yuan Christian University, Taiwan

Traditional shipyard in East Java Indonesia has produced lot of wooden fishing boats. However, the sustainability of its production process has not yet been discussed. In this study, we aimed to investigate how the model of industrial ecosystem on wooden boat building. We surveyed to the traditional shipyards and interviewed the worker, the owner and the project leader. We also discussed about the activities of sustainable supply chain to support the industrial ecosystem. Finally, some recommendations are proposed to support the regulations on environment, social, and economics sectors to achieve the sustainability of the material supply chain.

IEEM20-P-0073/ The Optimal Choice for Local Content Requirement and Tariff Under Social Welfare Maximization

Lin Gan, Li Xiao

Tsinghua University, China

Local content requirement (LCR) is widely used by governments to protect the local economy in many countries. In this paper, we study a model with one foreign OEM who can source components from a foreign supplier with advanced technology and a local supplier. We consider this problem from the local government's perspective and maximize the social welfare to derive closed-form solutions for the optimal LCR and tariff. The result shows that (1) the LCR policy is beneficial when the technical gap between local and global suppliers is low, and (2) the optimal LCR and tariff, as well as the corresponding OEM's after-tax profit and social welfare increase with respect to the market size. Furthermore, (3) the host government benefits from the technology upgrade of global suppliers under tariff mode and losses from it under LCR mode, while the OEM can gain more profit in both modes.

IEEM20-P-0079/ Flood Shelters Location Using P-median Model

Wichitsawat Suksawat Na Ayudhya

King Mongkut's Institute of Technology Ladkrabang, Thailand

In the past recent years, the northeastern part of Thailand called "E-san" has experienced flooding. The death toll in year 2019 flood reached at least 33 people. For proactive flood response, the authority must plan effort schemes to provide shelters and foods. The location of flood relief shelter is a key for assistance to flood victims. This paper is to employ P-median model by incorporating with historical data to determine the suitable flood relief shelters. We also examine two scenarios: in the first one district is served by only one flood relief shelter and in last one the number of flood relief shelter to district depending on the number of residents who dwells in that district. We tested our model with data collected from the district in the southeastern E-san areas.

IEEM20-P-0184/ An Inventory Optimization Model Under Demand Uncertainty for Autonomous Multi-site Inventory Planning with Material Substitutability and Transshipment

Mojtaba Shakeri¹, Chi Xu², Puay Siew Tan²

¹Singapore Institute of Manufacturing Technology, Singapore

²Agency for Science, Technology and Research (A*STAR), Singapore

This paper addresses multi-site inventory planning of raw materials in the packaging printing industry subject to demand uncertainty. Two types of material A and B exist in this setting where material B is converted to material A and material A is used for the main production. In addition, items of type A are substitutable with similar material specifications and can be transshipped across production sites to balance the inventory level in the entire network. The practice is currently carried out purely manually in the packaging printing sites of our industrial partner. With that in mind, we develop a holistic inventory optimization model to automate optimal inventory replenishment of raw materials with substitutability and transshipment support across multiple production sites. The objective is to minimize the global expected cost with respect to stochastic material demand.

IEEM20-P-0232/ Dual Sourcing Problem with Capacities and Setup Cost

Xiaoqian Shi, Linlin Ji, Meimei Zheng

Shanghai Jiao Tong University, China

This paper studies the ordering problem of a retailer, sourcing from two suppliers (i.e., domestic and offshore suppliers). Compared to the domestic sourcing, the offshore sourcing is cheaper with larger capacity, but it incurs additional costs (i.e., setup costs), such as cross transaction and quality control costs. We characterize the retailer's optimal order quantities from domestic and offshore suppliers. Our analytical result shows that the retailer's ordering policy is not affected by the setup cost when the setup cost is large enough. Numerical analysis reveals that the setup cost and the capacity of the offshore supplier have negative effects on the total order quantity.

Session	Systems Modeling and Simulation 1
Date	15/12/2020
Time	10:00 - 11:30
Chairs	Zhiqiang CAI <i>Northwestern Polytechnical University</i> Yoshinobu TAMURA <i>Tokyo City University</i>

IEEM20-P-0433/ A Mixed-integer Programming Approach to Group Control of Elevator Systems with Destination Hall Call Registration

Yulun Wu, Shunji Tanaka
Kyoto University, Japan

In this research, we focus on group control of an elevator system with destination hall call registration where passengers can directly register destination floors at every elevator lobby. To improve the elevator performance when transporting passengers, finding the optimal passenger-to-car assignment and car routing is considered as a good way. We formulate the problem of optimizing passenger-to-car assignment and car routing as a mixed-integer programming problem to minimize the average waiting time of all passengers waiting at elevator lobbies. Then, we perform computer simulation using a commercial integer programming solver and examine the effectiveness of the proposed optimization model. A conventional approach which is applied in most current elevator system is also compared with our approach.

IEEM20-P-1140/ Additive Manufacturing of Dynamic Lifeboat Hook Assembly

Ulanbek Auyeskan¹, Namhun Kim¹, Van Loi Tran², Chung-Soo Kim², Dong-Hyun Kim²

¹Ulsan National Institute of Science and Technology, South Korea

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Using Additive Manufacturing (AM) technology, Design for Additive Manufacturing (DFAM) enables us to consolidate sophisticated mechanical assemblies. The part consolidation by additive manufacturing has been mainly applied to only static systems such as brackets. In this study, we try to extend the current application area of DFAM to a dynamic product. With this regard, our work aims to redesign and conduct design validation of a lifeboat hook system with a dynamic operation mechanism. The objective is to decrease the number of hook components by leveraging conventional part consolidation including constraints such as heavy load bearing and functional dynamics. Furthermore, along with the side plates and groups which consist of numerous parts such as hook, cam and stopper were decreased by 55%. FEM analysis shows that in case of consolidated hook, even though original safe working load was increased by 2 times, our design seems to be promising candidate for replacing traditional lifeboat hook. Finally, a downscaled consolidated hook system was successfully built by a PBF machine and analyzed for precision.

IEEM20-P-0415/ Effect of Network Structure and Preference Difference on Knowledge Transfer in Inter-organizational R&D Project

Xiaonan Wang, P. Guo, D. Wang
Northwestern Polytechnical University, China

An evolutionary game model of knowledge transfer in inter-organizational R&D projects was established, and its local stability was analyzed. Then, the complex network and preference theory are introduced to establish the game model of knowledge transfer in the cooperation network of inter-organizational R&D projects under the condition of preference differences and different network structures. Finally, the influence of key factors, preference difference and network structures on strategy selection is analyzed. The results show that the cost coefficient has a negative correlation with the level of knowledge transfer, while the increase of other coefficients promote knowledge transfer behavior. The increase of altruistic preference degree and the proportion of altruistic preference agents can promote knowledge transfer behavior, while the increase of competitive preference degree and the proportion of competitive preference agents can inhibit knowledge transfer behavior. Moreover, the level of knowledge transfer is higher in the scale-free network than in the small-world network in most cases. However, punishment plays a greater role in the small-world network.

IEEM20-P-0315/ Container Movement Evaluation Using System Dynamics Simulation

Fajar Kurniawan, Siti Nurmaya Musa, Noor Hasnah Moin
Universiti Malaya, Malaysia

The paper evaluates the effect of container handling rules to the smoothness of container movement. The movement includes box transfer from into vessel, movement in stacking yard and discharging box in-out the port. High amount container stacked in stacking yard indicates problem in container flow. The goals of this research was to find out the variable that affected balance of container moves, then analyze rules of transfer process and set out the option of reference in order to reduce idle time and excessive stock of containers in stacking yard. The value of this study is to extract factors for reducing idle time and unbalance of container quantity in the chain of transfer area which effect on the port performance through system dynamics simulation. Result discovered reasonable rules could develop for enhancing continuity of container moves are effective arrangement in handling equipment and information sharing among stakeholders.

IEEM20-P-0472/ Electric Vehicle Diffusion in the Indonesian Automobile Market: A System Dynamics Modelling

Erwin Stefano Lonan, Romadhani Ardi
Universitas Indonesia, Indonesia

Recently, the increased of energy consumption of the land transportation sector and environmental pollution have rapidly promoted the development of Electric Vehicle (EV). Through Presidential Decree number 55 years 2019 who act as the umbrella policy, the Indonesian Government has shown its commitment to the acceleration of EV Industry. Successful policy for new entry industry depends heavily on scientific perspective to accurately predict impacts. This study developed a system dynamics model to analyze the EV adoption in Indonesia through scenario analysis to gain better understanding of the key factors effecting the early EV adoption. It is found that electric vehicle will have a fast growth in next decades and government policy support through subsidies in infrastructure development, manufacturing, and consumer purchase power are crucial to the mass adoption of EV.

IEEM20-P-0525/ Optimization by Hybridization of Algorithms RGA and ILS to Solve the Container Stacking Problem at Tripoli-Lebanon Seaport

Nobar Kassabian¹, Zakaria Hammoudan², Olivier Grunder³, Lhassane Idoumghar¹

¹Université de Haute-Alsace, France

²Jinan University, Lebanon

³Université de technologie de Belfort Montbéliard, France

The study in this paper mainly focuses on solving the problem of stacking incoming containers in the storage yard while taking into account several policies and constraints concerning the port of Tripoli Lebanon. A storage strategy is proposed in this paper, which is modeled mathematically with a mixed integer linear program for container stacking problem. As this problem is NP-Hard, large instances cannot be solved by Gurobi. We propose a heuristic hybridization approach between Randomized Greedy Algorithm (RGA) and Iterated Local Search (ILS) to tackle this problem. Numerical results on real size instances taken from the terminal port studied, show the efficiency of this hybridization for small and medium sized instances.

Session	Supply Chain Management 2
Date	15/12/2020
Time	12:00 - 13:30
Chairs	Adnan HASSAN <i>Universiti Teknologi Malaysia</i> Yugowati PRAHARSI <i>Shipbuilding Institute of Polytechnic Surabaya</i>

IEEM20-P-0510/ Optimal Planning of a Closed-loop Supply Chain with Recovery Options and Carbon Emission Considerations

Fareeduddin Mohammed, Adnan Hassan
Universiti Teknologi Malaysia, Malaysia

Climate change, increased carbon regulations, and globalized supply chains are driving industry practitioners and decision makers to implement various carbon policies to reduce carbon emissions. One of the effective approaches to mitigate carbon emissions is the implementation of closed-loop supply chain (CLSC). This paper proposes a deterministic mixed integer linear programming (MILP) model for a multi-period and multi-product closed loop supply chain network with multiple recovery, quality returns and carbon emission considerations. Transportation mode selection decision for logistic activities is also incorporated in the model. Results show that the model captures trade-offs between the total cost and carbon emission. Further, results suggest that carbon price directly effects on the total cost. Conversely, in carbon trading policy, due to having carbon buying and selling flexibility, both total cost and carbon emission are significantly reduced. Sensitivity analysis shows that the operational costs of various recovery activities impact on the total cost. This study provide evidence that besides achieving optimal closed-loop supply chain network design (CLSCND) and planning, it also reduces carbon emissions significantly without increasing the total cost.

IEEM20-P-1010/ Evaluation Framework in Sustainable Cold Chain for Perishable Food Products: A Literature Review

Shuo Dang, Dong Li
University of Liverpool, United Kingdom

The global food system today faces a great challenge of feeding fast growth population and higher levels of service quality. The researches regrading sustainable cold chain for perishable food products are tremendously growing with increasing number of publications, but always conceptual and quite a few have addressed issues of sustainability. There is a need to understand how continuous improving of food security and other sustainable performance can be translated to support optimisation of food waste management, environmental impacts and cold chain structure designs. Content analysis base literature review of 136 selected research articles, published between 2010 to 2019, was used to identify the theory connection of food security and sustainable cold chain, and create an overview of the evaluation theory used for cold chain management, optimisation and decision-making. In this study, some of the key findings unveil (1) energy efficiency is alternative way to evaluate food industry; (2) circular economy is a sustainable solution to reduce food waste and increase energy efficiency across the cold chain.

IEEM20-P-0152/ Choosing the Right Communication Medium for Knowledge Transfer in Global Production Networks

G. Schuh, Andreas Gützlaff, Katharina Thomas, Niklas Rodemann, Isabel Rittstieg
RWTH Aachen University, Germany

Producing companies have been facing the challenge of increasingly changing worldwide market conditions. As inter-national presence has gained greater importance, many companies have spread their production network globally. To coordinate such rapidly growing structures, the systematic transfer of in-house production knowledge is essential. Thereby, one of the main influence factors on knowledge transfer is communication. Hence, a large potential lies within the optimization of cross-site communication. This paper presents a systematic approach for the optimized selection of a situation-specific suitable communication medium for knowledge transfer tasks in global production networks along distinct and rateable criteria. The approach is then validated by a survey.

IEEM20-P-0068/ Modeling the Recall Process of Bulk-Liquid Industry: A Linear Programming Approach

Ivan Gunawan¹, Iwan Vanany², Erwin Widodo³
¹*Universitas Katolik Widya Mandala Surabaya, Indonesia*
²*Institut Teknologi Sepuluh Nopember, Indonesia*
³*Institut Teknologi Sepuluh Nopember (ITS), Indonesia*

This article presents a decision-making model in food recall. Four options can be selected for treating recalled products: disposed, redirected for other use, downgraded, and reprocessed. The model will help stakeholders to decide how the recalled products should be allocated for each follow-up action to minimize the recall cost. The model has been tested on a real recall case in the edible oil industry. The model is proven to be able to find the optimal allocation for recalled products to produce a minimum recall cost. The sensitivity analysis shows that the recall cost can also be reduced by a product pricing strategy. Downgrading is the most favorable decision in the real case example.

IEEM20-P-0124/ Framework for the Proactive Identification of Adaptation Needs in the Configuration of Global Production Networks

Niklas Rodemann, Katharina Thomas, Andreas Gützlaff, G. Schuh
RWTH Aachen University, Germany

Due to increasingly globally distributed value chains, companies today operate in global production networks. At the same time, the business environment is subject to growing volatility and uncertainty, forcing companies to constantly adapt. Changes are often detected too late, resulting in a delay in adapting the production network. This paper summarizes requirements for the proactive identification of adaptation needs in the configuration of global production networks and derives its key challenges. Furthermore, an overview of the most recent approaches is given and a framework for an efficient and user-friendly detection of adaptation needs is proposed.

IEEM20-P-0135/ Impact of Internal Factors on the Implementation of Halal Logistics

Aries Susanty¹, Nia Budi Puspitasari¹, Oktivia Selvina¹, Sumunar Jati²
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²*Lembaga Pengkajian Pangan, Obat-obatan, dan Kosmetika Majelis Ulama Indonesia, Indonesia*

The purpose of this research is to examine the impact of internal factors on the implementation of halal logistics in the Indonesian Food and Beverage Industry. This research adopts the Partial Least Square (PLS) method to predict the dependent variable by involving a large number of independent variables. This research uses 100 food and beverage companies as the sample. The result of this research indicated that image and reputation, social responsibility, and integrity of halal has a significant impact on the implementation of halal logistics.

Session	Production Planning and Control 1
Date	15/12/2020
Time	14:30 - 16:00
Chairs	Songlin CHEN <i>Nayang Technological University</i> Aries SUSANTY <i>Diponegoro University Indonesia</i>

IEEM20-P-0022/ Multi-factory Job Shop Scheduling With Due Date Objective

Jacob Lohmer, Daniel Spengler, Rainer Lasch
Technische Universität Dresden, Germany

The existing literature on distributed scheduling mainly focuses on the performance measures makespan, total completion time, or costs. Due date related objectives that are gaining in importance in the industry have not been considered to a similar extent. In this contribution, we present a model formulation of the distributed job shop scheduling problem with due date consideration and present adapted greedy heuristics as well as a genetic algorithm to solve large problem instances. Computational experiments are carried out to assess the performance of the model and the algorithms. The heuristics and metaheuristics show promising results in reasonable computation times, with the genetic algorithm outperforming the other heuristics. The results indicate that managers should consider incorporating due date related objectives in the decision-making process of production planning and scheduling in distributed manufacturing.

IEEM20-P-0070/ Risk Assessment and Treatment Planning for Energy-flexible Production Systems Using an Additional Cost Model

Stefan Roth, Markus Weber, Andrea Hohmann, Gunther Reinhart
Fraunhofer Institute for Casting, Composite and Processing Technology IGCV, Germany

As a result of the energy transition in Germany, companies can increasingly benefit from adjusting electricity consumption to fluctuating electricity prices. Through energy-oriented production planning, production processes are scheduled depending on price forecasts. The resulting electricity demand is procured with the obligation to consume the electricity within certain tolerances. The procurement entails risks, as faults or other unexpected events can lead to deviations in electricity consumption. These can be associated with high penalty costs, if contractual tolerances or the peak load are violated. To take a holistic view on the additional costs, the effects on production goals must also be considered. This paper shows the assessment of production risks and delivers an approach for suitable preventive or reactive measures by changing the production plan. The approach was applied on a use case of a foundry with exemplary risks, with the result of minimized fault-related additional costs through the selection of a cost-optimal measure.

IEEM20-P-0205/ Automated Data Acquisition and Processing for Factory Layout Planning

Dominik Melcher, Benjamin Küster, Ludger Overmeyer
University of Hanover, Germany

Factory planning is an important tool for manufacturing companies to raise their efficiency and to maintain their competitiveness by changing market or customer requirements. A special challenge is the acquisition of layout data and the processing of this data in suitable planning tools. Current approaches still measure manually or have to transfer acquired data from laser scanners by hand into planning tools, which leads to a high effort and error proneness. This paper presents a holistic concept for automated and systematic data acquisition and processing for factory planning processes.

IEEM20-P-0491/ Planning of Available Resources Considering Ergonomics Under Deterministic Highly Variable Demand

Marco Bonini, Jan Schuhmacher, Augusto Urru, Jan Philipp Wezel, Vera Hummel, Wolfgang Echelmeyer
Reutlingen University, Germany

In this paper, a method for hybrid short- to long-term planning of available resources for operations is presented, which is based on a known or deterministically forecasted but highly variable demand. The method considers quantitative measures such as the performance and the availability of resources, ergonomically relevant KPI and ultimately process costs in order to serve as a pragmatic planning tool for operations managers in SMEs. Specifically, the method enables exploiting the ergonomic advantages of available flexible automation technology (e.g. AGVs or picking robots), while assuring that these do not represent a capacity bottleneck. After presenting the method along with the necessary assumptions, mainly concerning the availability of data for the calculations, we report a case study that quantifies the impact of throughput variability on the selection of different process alternatives, where different teams of resources are used.

IEEM20-P-0516/ Why a Systematic Investigation of Production Planning and Control Procedures is Needed for the Target-oriented Configuration of PPC

Alexander Mütze¹, Simon Hillnhagen², Philipp Schäfers¹, Matthias Schmidt², Peter Nyhuis¹

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²*Leuphana University of Lüneburg, Germany*

The target-oriented configuration of production planning and control (PPC) confronts companies with major challenges. While there are already many publications dealing with the effect of specific procedures of PPC tasks on the logistic objectives, there is still a lack of a framework allowing a comprehensive and relatively simple examination of the target conformity of PPC configuration on the level of procedures. Furthermore, such a framework would thereby also enable companies to position their PPC among conflicting production and logistic objectives. This contribution presents the current state of knowledge on target-oriented and holistic PPC configuration and points out why a systematic investigation of the generally valid interdependencies of PPC procedures with each other as well as the impact on the most important objectives is necessary. Further, it is outlined which future research activities are planned and with a demonstrative example illustrated how complex cause-effect relationships within PPC on the level of procedures arise.

IEEM20-P-0517/ Reverse Logistics with Disassembly, Assembly, Repair and Substitution

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²*Rennes School of Business, France*

A reverse logistics planning problem is modeled and analyzed. The model considers returns of a particular electronic device from customers. Some of the collected products are remanufactured or refurbished. Others are disassembled for their key parts which can be considered as good as new. New products are assembled either using new parts or extracted ones. There are two types dynamic demands: demands for remanufactured/refurbished products and demands for new products. Demand of remanufactured/refurbished products can be satisfied using new products in case of shortage. This is a one way downward substitution. The objective is to minimize total costs while satisfying all demands. This problem is formulated as a MILP. The numerical results show that: i) it is hard for a solver to find optimal solutions for the problem in reasonable computational times for several instances with relatively small time horizons and ii) substitution is justified for a certain range of cost and demand parameters.

Session	Systems Modeling and Simulation 2
Date	15/12/2020
Time	16:30 - 18:00
Chairs	Szu Hui NG <i>National University of Singapore,</i> Nagesh SHUKLA <i>University of Technology Sydney</i>

IEEM20-P-0038/ Cloud-based Cyber-Physical Robotic Mobile Fulfillment Systems Considering Order Correlation Pattern

Kin Lok Keung, Carman Ka Man Lee, Ping Ji, Jiage Huo

The Hong Kong Polytechnic University, China

Ordering picking is the most time- and cost-consuming operation in the Robotic Mobile Fulfillment System (RMFS) and affects the entire supply chain operation efficiency and effectiveness. With the aid of digital operations, Cyber-Physical Systems (CPS) provide a nearly real-time control and response in the virtualized environment, thereby conducting a virtual prototype for near real-time simulation and prediction. The research presented in this paper explores the application of CPS in RMFS, considering the order correlation pattern. Four algorithms: Apriori algorithm, Frequent Pattern Growth algorithm, ECLAT algorithm and k-modes algorithm are introduced to reduce robotic conflicts of robots and enhance the capacity management in RMFS. The total completion time based on frequent itemset assignment is less than that based on random storage assignment. However, the dock grid conflicts are increased because the most frequent items are concentrated in a particular area.

IEEM20-P-0051/ A Simulation-based Method for Predicting the Time-varying Passenger Demand at Metro Rail Transit Line 3 Using Monte Carlo Simulation

Yogi Tri Prasetyo, Benjamin Tabares Jr.

Mapúa University, Philippines

Simulation methods consider the inherent randomness and uncertainty in modeling a system. The purpose of the current study was to provide a practical approach to estimate and predict the monthly inbound passenger flow of the Manila Metro Rail Transit Line 3 (MRT-3) by utilizing the Monte Carlo Simulation (MCS) method. MCS was used to generate random numbers from this distribution and was able to produce a reasonably forecasted model. By using the monthly passenger data, it was found that Logistic distribution had the best fit to estimate the given data. The results derived in this study could provide valuable insights, particularly on capacity planning, which can be used to improve the efficiency and sustainability of the existing rail system of MRT-3.

IEEM20-P-0111/ Simulation Modeling of Production System Considering Human Behavior

Fansen Kong, Xiangdong Kong, Haoyang Wu, Yixin Zhang, Peidi Fang

Jilin University, China

With the advent of industry 4.0, the manufacturing and assembly industry is increasingly pursuing digitization and automation, but it is still inseparable from human participation. People play an important role in the manufacturing and assembly industry. In the academic literature on human-machine research, more attention has been paid to human-machine interaction, and little attention has been paid to the impact of human behavior on the production system. The purpose of this paper is to consider the impact of time pressure on operating workers from the point of view of operating workers, and then to explore the impact of operating workers on the performance of the production line. For this reason, the theoretical operators of fuzzy mathematics are assisted to quantify the time pressure from two aspects. Then, the human behavior model is embedded into the production

system for simulation, and the necessary data are obtained for analysis. The results show that the time pressure has a significant effect on the working efficiency.

IEEM20-P-0209/ Towards a European Hyperloop Network: An Alternative to Air and Rail Passenger Travel

Deep Vijay Merchant, Stanislav Chankov
Jacobs University Bremen, Germany

Hyperloop is a novel transportation mode that can transform the way we travel. While entrepreneurs are working on turning this disruptive concept into reality, there is a lack of research on the Hyperloop route networks. Effective Hyperloop routes are essential for this concept as once built, they cannot be altered. The objective of this paper is to develop Hyperloop network routes for Europe and investigate their potential for passenger travel as an alternative transport mode to rail and air travel. The paper proposes two potential networks with different Hyperloop routes. An initial simulation study is conducted with four basic scenarios derived by varying the number of passengers (low and high) and the purpose of travel (using Hyperloop as an alternative to air or rail travel). The evaluation of the Hyperloop networks depends on four key performance indicators: (1) average travel time, (2) utilization, (3) passenger service level, and (4) revenue generation. The findings indicate that both networks have potential for the European passenger market, but their success depends on the behavior of the passengers using Hyperloop.

IEEM20-P-0543/ A Cross-disciplinary Model-Based Systems Engineering Workflow of Automated Production Systems Leveraging Socio-technical Aspects

Minjie Zou, Birgit Vogel-Heuser, Michael Sollfrank, Juliane Fischer
Technical University of Munich, Germany

With the increasing integration of multiple disciplines, Model-Based Systems Engineering (MBSE) has become more beneficial for the development of automated production systems. However, even though discipline-specific models can be connected via a system model, how to apply MBSE in a cross-disciplinary context in the industry remains challenging due to complex organization, inefficient communication and limited knowledge of the staff. In this paper, a workflow of automated production system development combining MBSE, sociology and team collaboration is proposed and leveraged against the traditional workflow. BPMN+I is applied for modeling cross-disciplinary collaborations and assessing team and organizational factors.

Session	Manufacturing Systems 2
Date	15/12/2020
Time	19:00 - 20:30
Chairs	Hichem Haddou BENDERBAL IMT Atlantique Junfeng WANG Huazhong University of Science and Technology

IEEM20-P-0155/ Diagnosis on Energy and Sustainability of Reconfigurable Manufacturing System (RMS) Design: A Bi-level Decomposition Approach

Amirhossein Khezri¹, Hichem Haddou Benderbal², Lyes Benyoucef³, Alexandre Dolgui²

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Sustainability and energy consumption awareness led industrial sector to reduce energy consumption. This reduction is regarded as a solution to reduce greenhouse gas emissions. Moreover, international regulations about maintenance activities involve hazardous energy-any electrical, mechanical, nuclear or other energies that can harm personnel- as a rising threat. Thus, energy audits and diagnosis of existing manufacturing systems are crucial to achieve energy efficiency. Future manufacturing paradigms as reconfigurable manufacturing system (RMS) have shown high responsiveness to cope with new challenges such as sustainability. This paper proposes a sustainable RMS design through process plan generation. The approach is developed to generate a process plan while diagnosing energy flow and assigning preventive maintenance activities related to reliability reduction in system components. More specifically, a mixed-integer non-linear program is proposed, then solved using a bi-level decomposition approach. The lower-level considers process plan generation following parts requirements and guided by energy loss as an objective. Afterwards, the upper-level diagnoses the reliability of the lower-level selected machines and tools. Moreover, it checks if preventive maintenance is required due to the level of hazardous energy and maintenance plan. The approach applicability is validated through an illustrative example.

IEEM20-P-0170/ Industrial Wastewater Treatment Configuration: Insights from a Northern Italy Textile Manufacturing District

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²Confindustria Como, Italy

³University of Technology Sydney, Australia

Industrial wastewater treatment is getting increased attention from academics, practitioners and regulators, due to the environmental hazard of discharging poorly treated wastewater into the environment. This paper analyzes the case of Como's textile district in Italy, to explore what factors are considered by firms in selecting the most appropriate wastewater treatment system configuration. The case studies highlighted that Como's wastewater consortium benefits the firms in the district, and it is a better solution compared to the presence of sub-optimal private treatment plants. The firms mentioned internal stakeholders, factors related to the wastewater and technology, and economics as the most relevant.

IEEM20-P-0213/ A Data Model to Apply Process Mining in End-to-End Order Processing Processes of Manufacturing Companies

G. Schuh, Andreas Gützlaß, Sven Cremer, Seth Schmitz, Arian Ayati
RWTH Aachen University, Germany

To master ongoing market competitiveness, manufacturing companies try to increase process efficiency through process improvements. Mapping the end-to-end order processing is particularly important, as one needs to consider all order-fulfilling core processes to evaluate process performance. However, process mapping in manufacturing companies is mostly applied in partial processes and not on the end-to-end order processing. Process mining provides a data-based description of processes and their performance and thus objectively and effortlessly maps real as-is processes. The data basis for process mining is an event log. Nevertheless, the generation of an event log in end-to-end order processing is not as trivial as in partial processes, as different data from different information systems must be merged. This paper discusses the development of a data model through an Action Design Research (ADR) method, derived and validated across ADR-cycles. The data model presents, which data can be extracted from integrated database sources to create the required event log for process mining in end-to-end order processing.

IEEM20-P-0338/ Small Series Production and Geometric Analysis of Sheet Metal Car Body Parts Using Forming Tools Made of Fused Filament Fabricated PLA

G. Schuh, Georg Bergweiler, Falko Fiedler, Philipp Bickendorf, Philipp Schumacher

RWTH Aachen University, Germany

The automotive industry is currently facing increased pressure to innovate by developing and producing several drive concepts in parallel. This results in increased demands on product development. Rapid, cost-reduced implementation of tool changes during the product development process is becoming a decisive advantage in an increasingly competitive market. Other players are also entering vehicle development, which are digital, dynamic, flexible and close to the customer. The increasing number of small and medium-sized series and the trend towards mass customization are motivating the need for a flexible and cost-efficient production technology for car body parts. One solution to these challenges is the application of polymer-additive manufactured functional elements in forming tools for thin sheet metal. In this paper, the forming of several demonstrators is described. Therefore, thin sheet metals are deep drawn with tools made of PLA. The experiment represents a small series production of an exemplary car body part. This will be validated by optical measurement of the produced car body parts as well as the tool.

IEEM20-P-0343/ Exploring Reconfigurability in Manufacturing Through IIoT Connected MES/MOM

Soujanya Mantravadi¹, Jagjit Srati², Thomas Ditlev Brunoe¹, Charles Møller¹

¹Aalborg University, Denmark

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This paper explores the role of manufacturing execution systems (MES) with ISA 95 functionalities for the reconfigurability in a manufacturing enterprise. The work is aimed at supporting digitalization based on Industry 4.0 and the Industrial Internet of Things (IIoT) concepts. For this, we use the quality function deployment method to link ISA 95 MES functionalities and reconfigurability needs, based on a case example of a cyber-physical factory (AAU Smart Lab). Accordingly, we present a framework to assess reconfigurability for smart factory development. The paper identifies reconfigurability approaches using IIoT connected MES/MOM for tackling severe market disruptions (e.g. the one caused by the ongoing COVID-19 pandemic).

Session	Decision Analysis and Methods 1
Date	15/12/2020
Time	08:00 - 09:30
Chairs	Carman Ka Man LEE <i>The Hong Kong Polytechnic University</i> Vinay SINGH <i>ABV-IIITM Gwalior</i>

IEEM20-P-1145/ Stress-based Lattice Structure Design for Additive Manufacturing

Adrian Chung Baek, Namhun Kim

Ulsan National Institute of Science and Technology, South Korea

Recent developments in additive manufacturing (AM) have induced the research on development of lattices, engineered structures with high performances. Unfortunately, these structures are very challenging to design as conventional design techniques usually entail rigorous and expensive numerical calculations which halt the overall process. Their intricate frameworks lead to time-consuming and inefficient design processes, especially for inexperienced designers who are yet familiar with AM processes. Furthermore, the resulting designs are often infeasible due to manufacturing constraints, particularly AM constraints, being neglected in the design process. In this research, a novel design method is proposed considering the clarity of the design process as well as the computational efficiency and the manufacturability of the suggested structure design. The proposed method utilizes the stress field information to summon pre-defined cubic cells and generate the lattice structure. This results in a simplified procedure and a reduction of the computational cost. To consider the manufacturing constraints for the AM process, a modified STL slicing algorithm is integrated into the developed framework. Several examples are presented with reasonable solutions that demonstrate the efficiency of the proposed method.

IEEM20-P-0160/ Launch Strategies for Upgraded Products with Consideration of Self-cannibalization

Chao Nan Li, Yan Chen, Hai Jiao Luan, Li Shan Wang, Le Xin Sun, Tong Xin Wang, Xin Li

Macau University of Science and Technology, China

This paper studies optimal pricing and timing of a firm to launch an upgraded product to maximize its revenue, considering self-cannibalization between two generation products. Heterogeneous customers arriving to the market compare utilities resulted from existing and new products and try to maximize their utilities. We model the firm and customers' decision-makings as a two-stage dynamic game and its equilibrium results are derived. Our numerical analysis shows that technology innovation of the new product significantly improves the firm's revenue performance. Technology innovation brings added value to the new product, which allows a higher pricing for the upgraded product. However, it has no impact on the firm's optimal launch time. In addition, depreciation speed of the product has a negative impact on the firm's total revenue. However, it does not affect optimal launch strategies, which include optimal launch price and launch time.

IEEM20-P-0168/ Using Classification with K-means Clustering to Investigate Transaction Anomaly

Xing Scott Tan¹, Zijiang Yang¹, Younes Benlimane¹, Eric Liu²

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Applications of machine learning and related algorithms in Electronic Commerce (hereafter E-Commerce) have the potential to build robust analytical models that help examine transaction data and successfully detect and predict anomalies. Nonetheless, the robustness of such models can be undermined in the case of highly unbalanced data set. This paper presents a classification method built on K-means Clustering that addresses the issue of highly unbalanced data. In this method, we first pre-process our E-Commerce data and then apply clustering and classifying procedures to create a number of clusters where each resulting cluster includes similar transaction records. Next, four classifiers including Logistic Regression, Naive Bayes, RBFNetwork and NBtree classifiers are used to assess the resulting solution. Findings based on real-world data show that this method provides a better solution for transaction anomaly detection and prediction than traditional approaches. They also show that it straightforwardly resolves classification problems with data imbalance.

IEEM20-P-0238/ Two-Stage Newsvendor Problem with Loss Aversion and Probability Weighting Effects

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²*Kanazawa University, Japan*

This paper studies a two-stage newsvendor problem with two suppliers, where the retailer's loss aversion and probability weighting effects are considered. We solve the model by backward induction and derive the optimal order quantities in the first and second stages. We provide the prerequisites of the retailer's selection between the two suppliers. We find that the optimal order quantity in the first stage decreases with the loss aversion coefficient and the capacity of the second-stage, and increases with the cost of the second-stage. As the coefficient of the probability weighting function increases, the optimal first-order quantity may increase or decrease.

IEEM20-P-0348/ A Multiple Layer DEA Model for Evaluating Corporate Sustainable Performance Using Lean Manufacturing Practices

Willy Zalatar, Eppie Clark

De La Salle University, Philippines

The purpose of this study is to generate a quantitative means of assessing the relationship between lean production practices and a company's sustainable performance. A composite lean index (CLI) is formulated using multi-attribute value theory (MAVT) in order to measure a firm's lean performance. A composite sustainability index (CSI) is developed using MAVT to measure a company's sustainable performance considering its quadruple bottom line. Lastly, a multiple layer data envelopment analysis (MLDEA) model is set up to evaluate a company's sustainable performance using its lean manufacturing practices. The CLI is considered as the virtual input to the MLDEA model while the (CSI) is treated as the virtual output. "Efficient" firms are determined to score high in Supplier and Customer Relationships and Human Resources whereas "inefficient" companies scored low in Supplier and Customer Relationships and Process and Equipment. Furthermore, "efficient" companies are found to exhibit high scores in Worker Training, Parts Delivered JIT by Supplier, and Customer Orders Delivered JIT while "inefficient" companies have low scores in Orderliness and Cleanliness in the Plant, Error-Proof Equipment, and Rigorous Preventive Maintenance.

IEEM20-P-0422/ Application of Lean Six Sigma Methodology and Queueing Theory to Minimize Systemic Variability: A Case Study from Public Services

Felix Santhiapillai, R. M. Chandima Ratnayake

University of Stavanger, Norway

This manuscript examines the application of queueing theory as a means to minimize systemic variability and implement Lean Six Sigma (LSS) based initiatives in an office and/or knowledge work environment. The purpose of this study is to address and systematically deal with the challenges and utilization of limited resource capacity and to improve functional performance. An exploratory case study is conducted at one Norwegian police district, where participatory involvement by a crime investigation department was initiated. It was qualitatively assessed and identified that operating the public service reception on weekends was not considered value added for their value stream. Data was collected to determine operational measures relative to the reception's queueing model. The findings demonstrate significantly over-dimensioned use of capacity relative to public demand on weekends. Accordingly, by closing the service reception and re-allocating this capacity to critical crime investigation, there is a utilization potential with relatively low risk of public dissatisfaction, negative media coverage and increased arrivals on weekends.

Session	Big Data and Analytics 1
Date	15/12/2020
Time	10:00 - 11:30
Chairs	Carman Ka Man LEE <i>The Hong Kong Polytechnic University</i> Arnesh TELUKDARIE <i>University of Johannesburg</i>

IEEM20-P-0039/ The Prediction of Flight Delay: Big Data-driven Machine Learning Approach

Jiage Huo, Kin Lok Keung, Carman Ka Man Lee, Kam K.H. Ng, K.C. Li
The Hong Kong Polytechnic University, China

Nowadays, Hong Kong International Airport faces the issues of saturation and overload. The difficulties of selecting taxiways and reducing the lead time at the runway holding position are the severe consequences that appeared from increasing the number of passengers and increased cargo movement to Hong Kong International Airport but without constructing a new runway. This paper is primarily about predicting flight delays by using machine learning methodologies. The prediction results of several machine learning approaches are compared and analyzed thoroughly by using real data from the Hong Kong International Airport. The findings and recommendations from this paper are valuable to the aviation and insurance industries. Better planning of the airport system can be established through predicting flight delays.

IEEM20-P-1055/ TV Series Adaptations: An AI Toolkit For Success

Anjal Amin¹, Landry Digeon²

¹*The Möbius Trip, United States*

²*University of Maryland, Baltimore County, United States*

Our project, born from a humanities scholar and an AI engineer, offers an unprecedented approach to analyze TV series adaptations in order to shed light on cultural practices and provide cues for more successful adaptations. We propose a method called the Multimodal Intercultural Matrix (MIM) model paired with an Artificial Intelligence toolkit called the Möbius Trip. The MIM provides a framework to reverse-engineer a show and to quantify the various elements of the episodes for cultural analysis and comparison. The Möbius Trip allows for the automatic and systematic analysis of the show's episodes by mining big data sets from the television programs. These data sets can recognize aspects of each episode, such as a character's gender, facial expressions, speech patterns, and camera work. Our approach not only provides representations of a culture and its members, but it also informs us on the media, the media industry, and on the TV series industry practices. Our results and expertise will influence the production industry and provide advice to film-makers.

IEEM20-P-0366/ Business Applications for Current Developments in Big Data Clustering: An Overview

Glendon Hass¹, Parker Simon¹, Rasha Kashef²

¹*Western University, Canada*

²*Ryerson University, Canada*

The world's most valuable resource is no longer oil, but data" announces the headline of the May 6th, 2017 edition of *The Economist*; the digital revolution is here to stay. The primary currency of this movement is big data. The complexity of big data is defined as the relationships and how the data can be arranged with one another. Facebook has 30 billion pieces of unique information shared each month; this data's sheer size can cause an immeasurable amount of combinations for relational data. Analyzing this big data can reveal various useful insights for decision-makers. With the adoption of clustering analysis, patterns and hidden information can be developed from big raw data that can be used across many business problems and applications. In this paper, an overview of the state of the art of clustering analysis and its adoption in business applications in the era of big data is presented.

IEEM20-P-0398/ Visual-based People Counting and Profiling System for Use in Retail Data Analytics

Meygen Cruz, Jefferson James Keh, Ramiel Deticio, Carl Vincent Tan, John Anthony Jose, EDWIN SYBINGCO, Elmer Dadios
De La Salle University, Philippines

Data on various key performance indicators (KPIs) are crucial in preventing problems and growing a business. This paper focuses on the feasibility of gathering data on certain restaurant KPIs through an intelligent video analytics (IVA) system. The main challenge lies in maximizing the use of an existing CCTV camera with a fixed viewpoint, which is tailored for security purposes instead of video analytics, by using its footage in the IVA. The researchers partnered with a restaurant in a high-traffic business district to create and test the system. The final system gathered data on foot traffic, customer gender classification, and customer group size. Neural networks such as YOLO, Deep SORT, and InceptionV3 were employed in the implementation. The results show that while it is possible to gather data on these three metrics through the system, the speed and accuracy can still be improved through downsizing the frames, down sampling the videos, and using other algorithms.

IEEM20-P-539/ Detecting Bursts in Water Distribution System via Penalized Functional Decomposition

Yinwei Zhang, Kevin Lansey, Jian Liu

University of Arizona, United States

Detecting bursts in water distribution systems, as anomalies from normal daily usage, is of critical importance for urban infrastructure maintenance. Existing methods based on conventional statistical process control fall short of accurate estimations of burst magnitude and starting time. This research combines a functional basis expansion of water flow data stream and a penalized decomposition to parameterize and estimate the normal water usage profile and detect spars burst with a comparatively small magnitude. The effectiveness of the proposed method is demonstrated by a high-fidelity simulation case study.

IEEM20-P-0500/ SARIMA and Artificial Neural Network Models for Forecasting Electricity Consumption of a Microgrid Based Educational Building

Meditya Wasesa, Adhya Rare Tiara, Mochammad Agus Afrianto, Fakhri Ihsan Ramadhan, Irsyad Nashirul Haq, Justin Pradipta

Institut Teknologi Bandung, Indonesia

We develop Seasonal Autoregressive Integrated Moving Average (SARIMA) and Artificial Neural Network (ANN) models for predicting one-month and one-day ahead electricity consumption of a microgrid based educational building. The prediction models can provide forecasts up to hourly accuracy. For this objective, we use more than two million records of electricity consumption data imported from the smart meter system of a six-floor microgrid based educational building. We use the Hyndman-Khandakar stepwise algorithm, which generates the (1, 0, 1)×(0, 1, 1)24 SARIMA prediction models. For the ANN prediction models, we use a thirty one-neurons input layer, a twenty-neurons hidden layer, and a single neuron output layer. The experiment results indicate that the ANN models produce more accurate and consistent predictions than the SARIMA models both in the one-month ahead and one-day ahead prediction contexts.

Session	Decision Analysis and Methods 2
Date	15/12/2020
Time	12:00 - 13:30
Chairs	Yaqiong LV <i>Wuhan University of Technology</i> Vinay SINGH <i>ABV-IIITM Gwalior</i>

IEEM20-P-0446/ An Analysis of Decision to Retrofit Coal Based Power Plant with Carbon Capture Technology Having Uncertain Parameters

Shalini Kumari, Sasadhar Bera
Indian Institute of Management Ranchi, India

The increasing industrialization since its inception has drawn attention towards the impact of industrial activities on the global environment. The increasing concern of global warming and rising earth's temperature has driven the institution of the Paris Agreement to examine the threshold limit of emission of carbon dioxide, which is the major component of greenhouse gases (GHG). Carbon capture and storage (CCS) technologies play a vital role in achieving net-zero carbon emission. The motivation behind this paper is to review the execution of CCS innovation in thermal power plants with the help of a mixed-integer nonlinear programming model. The problem of uncertainty of emission information in the thermal power plant is solved using the fuzzy technique. The results presented here demonstrate the option of selection of technology in a coal-fired power plant.

IEEM20-P-0501/ Prediction of Raw Material Price Using Autoregressive Integrated Moving Average

Nutthaya Hankla, Ganda Boonsothonsatit
King Mongkut's University of Technology Thonburi, Thailand

In a highly competitive manufacturing industry, it is necessary to reduce logistics cost for remaining competitiveness and increasing business profitability. One of several causes primarily influencing logistics cost is inventory to support fluctuation of raw material price and decision makers when and how much raw material is purchased. These hence require time-series prediction of raw material price. For a small-sized manufacturing case, its main raw material of copper is predicted using Autoregressive Integrated Moving Average (ARIMA). It returns Mean Absolute Percentage Error (MAPE) less than 5 percent.

IEEM20-P-0533/ Energy Efficiency Measures and Production Resources: Towards an Integrative Classification Framework for Decision Makers

Mile Katic, Andrea Trianni
University of Technology Sydney, Australia

The adoption of energy efficiency measures (EEMs) is a significant area of concern for today's industrial organisations. Whilst literature on this subject has soared in recent decades, there remains a gap in understanding the extent of their impact on an organisation's operations as well as the manner, and whether, they are adopted in the first place. This paper provides a preliminary attempt at addressing these concerns by investing attention into the notion of production resources as a mechanism through which a deeper appreciation of EEM impact on operations could be provided through the development of a generalised decision-making framework. We end this paper with conclusions and areas for further work.

IEEM20-P-0557/ A Game-theory Based Parking Pricing Policy

Shijin Wang, Ting Hu
Tongji University, China

With the rapid increase of vehicles in China, traffic jams and parking problem have been becoming the major concern of the urban cities. A large number of studies have shown that parking fees, as economic leverage, can play a vital role in regulating the dynamic traffic demands. This paper proposes a pricing model that applies the principal-agent theory in parking pricing problem. A real-world case of a public parking lot in Shanghai is presented to show the reasonability and applicability of the policy.

IEEM20-P-0465/ Least-distance Data Envelopment Analysis Model for Bankruptcy-based Performance Assessment

Xu Wang, Takashi Hasuike
Waseda University, Japan

In this paper, the use of the Data envelopment analysis (DEA) as a quick-and-easy approach for bankruptcy-based performance assessment is presented. The attractive advantage of DEA is that it can provide an efficient target (improvement goal) for inefficient decision-making units (DMUs). The DMUs under evaluation are divided into two groups: efficient and inefficient, regarding cases of bankruptcy analysis, they are divided into nondefault firms and default firms. Moreover, the least-distance (LD)- DEA model has been actively researched and applied, because it can provide the closest efficient target that is achievable with the least effort. Thus, using the LD-DEA model for bankruptcy based performance assessment can give an early warning of a firm's financial performance and provide an improvement goal that can be easily achieved for default firms. As a case study, we demonstrate this approach using financial data of 61 Japanese banks. From the results, we find that our approach provides an improvement goal that can be achieved with fewer total modifications of inputs and outputs compared with that provided by slacks-based measure (SBM) model.

IEEM20-P-0459/ Experimental Study on Visual Variables Influencing Icon Similarity

Shiyuan Ding, Haiyan Wang, Chengqi Xue
Southeast University, China

The study on icon similarity can provide a powerful reference for designing more unique and highly recognizable icons, to help people interact with machines better with the help of a graphical user interface. This paper extracted a series of important icon visual variables and studied their influence on icon similarity judgment. Through the experiment of icons classification tasks, the strategy adopted by subjects to classify similar icons was obtained, and it was found that the subjects gave priority to the visual variables of the background and then paid attention to the visual variables of the icon body in the classification process. Through the comparison behavior experiment, the order of the four visual variables of icon body whose influence degree on icon similarity judgment was obtained. Combined with eye movement index of the subjects during the comparison experiment, it is concluded that the icons with high similarity receive more attention during the comparison. The results are of great significance for research on similarity recognition of icons.

Session	Service Innovation and Management 1
Date	15/12/2020
Time	14:30 - 16:00
Chairs	Nagesh SHUKLA <i>University of Technology Sydney</i> Annapoornima M SUBRAMANIAN <i>National University of Singapore</i>

IEEM20-P-0140/ Organizational Learning from Failure Can Augment Ambidexterity: Evidence from Japan

Sanetake Nagayoshi¹, Jun Nakamura²

¹Shizuoka University, Japan

²Chuo University, Japan

It is important for companies to adapt to changes in the business environment to gain or maintain a sustainable competitive advantage. In other words, they need to augment their management base by upgrading their current businesses and finding new business opportunities in line with future corporate growth and life cycles. However, it is difficult to achieve these objectives concurrently. In this study, we present a case of a Japanese company that has grown as a measure of information sharing and organizational learning from failure. We aim to explain how organizational learning from failure has led to ambidexterity, which consists of exploration and exploitation; we also examine whether organizational learning from failure is effective in exploration and exploitation. We used a quantitative approach through surveys and analysis of covariance structure. As a result, we find that organizational learning from failure is more effective for exploitation than for exploration in this company.

IEEM20-P-0248/ The Business Ecosystem Management Canvas

Philipp Humbeck¹, Jan Jaeckle², Julia Duwe², Thomas Bauernhansl³

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Increasing digitalization and the associated servitization lead to changes in user behavior and understanding of benefits. Customers are asking for faster adjustments to the value proposition and a higher degree of individualization. Companies in the mechanical and plant engineering sector are forced to develop innovative end-to-end solutions, so-called product service systems based on new business models. The integration of new types of competencies and resources is essential for this. Dynamic, cross-company systems are emerging as a new organizational form of economic activity, so-called business ecosystems. It becomes clear that there is an increased need for control and coordination, the business ecosystem management. The aim of the paper is to identify design fields and activities by means of inductive category building based on a literature research and expert workshops as well as the formation of the Business Ecosystem Management Canvas. The canvas is designed as an orientation guide and supports the responsible actors in the orchestration of business ecosystems, especially in their emergence and diversification phase. This was validated using a real case example.

IEEM20-P-0484/ Lean Management 4.0 Proposition for the Evolution of Managerial Criteria

Eva Rother¹, Armand Baboli¹, Luc Bernardini²

¹University of Lyon, France

²FPT Industrial, France

At a time when industry is experiencing its 4th revolution, the question of the evolution of the organization is raised and with it the role of operational excellence in this digital transformation. Lean management for the most part implies manufacturing organization and we can legitimately question ourselves on its relation to the concepts of digitalization. Our aim here is to methodologically analyze the managerial concepts of lean management and highlight them in relation to Industry 4.0. After reviewing the literature and the method laid out, we will evaluate the managerial concepts, individually confronting them with our operational experience and then propose a reflection on western 4.0 lean management, with two distinct choices and points of comparison. The article will conclude with perspectives for additional research.

IEEM20-P-0508/ Business Model and Organization – Interdependencies for Customer-Centric Continuous Innovation in Subscription Business

G. Schuh, Andreas Gützlaff, Sven Cremer, Jannik Lammersmann, Yuan Liu
RWTH Aachen University, Germany

Subscription business models are increasingly gaining attention in the manufacturing industry. By consequently focusing on solving the customers' problems instead of focusing on products, machine manufacturers may establish a long-term relationship with their customers and gain a stronger competitive position. In order to be successful, the business model needs to include the ability for continuous innovation and thus steadily increase the customers' benefits. At the same time, the introduction of a new business model comes along with a complex set of implications for the provider's organization. Literature suggests that mutual dependencies between the provider's business model, its organization and customers exist. Yet no management model so far is able to illustrate the complexity of these interdependencies in subscription models. The presented work intends to do so by including both the direct interdependencies between business models and organizations as well as indirect interdependencies which are caused by continuous innovation of offers and customer interactions. The model serves manufacturers of the machinery and equipment industry as an organizational guideline in managing subscription business models.

IEEM20-P-0526/ Measuring Information Technology Service Levels: A Literature Review

Franziska Schorr, Lars Hvam

Technical University of Denmark, Denmark

Due to their growing dependency on information technology (IT), firms have realised the need for IT services that optimally support the firms' business processes. To provide optimal service performance, the firms' IT departments must continuously manage IT service levels using suitable metrics. As IT services consist of a combination of technology, people, and processes, defining appropriate service level metrics has been a complex problem to solve for both researchers and IT managers. Using a systematic literature approach, we investigate the metrics that IT departments should utilise to measure IT service levels. This analysis suggests that service availability and responsiveness metrics are the most commonly employed metrics for approximating the IT service level. In the literature, we observe the need and trend to measure the impact of IT service levels on business performance and user satisfaction.

IEEM20-P-0564/ A User-centered Evaluation and Redesign Approach for E-Government APP

Danni Chang¹, Fan Li², Leni Huang¹

¹Shanghai Jiao Tong University, China

²Fraunhofer Singapore, Singapore

Nowadays, electronic government (E-gov) plays an increasingly important role to provide policy information and offer government services. Hence, the quality of E-gov services and the public experience with the E-gov applications have received increasing attention from both the government and society. This work is thusly intended to study the design and management of E-gov Apps. Particularly, the user-centered perspective is integrated to evaluate and improve the public experience of E-gov App. A comparative analysis of E-gov App design between China and other countries was presented, in which the existing design problems, especially in Shanghai government Apps, have been identified. Taking the E-gov App of Shanghai Minhang District as a practical case, a user-centered evaluation approach combining user survey and user experiments was deployed to examine the design problems of Minhang App. Based on the pain points in usability and aesthetics identified, an improved App design was generated. To validate the design quality of the new App, user tests were conducted, and it showed that the improved design can achieve better performance.

Session	Project Management 2
Date	15/12/2020
Time	16:30 - 18:00
Chairs	Hichem Haddou BENDERBAL IMT Atlantique, Nadjib BRAHIMI Rennes School of Business

IEEM20-P-0237/ Empirical Classification of Advanced Information Technology Towards Their Support of Leadership Behaviors in Virtual Project Management Settings

Christina Mayer, Susanne Mütze-Niewöhner, Verena Nitsch
RWTH Aachen University, Germany

In times of globalization and societal change on the topic of working remotely, virtual collaboration of project teams has a high relevance. The continuous improvement of advanced information technology makes it possible to work globally distributed and in home office. This paper focuses on the usage of communication tools to support leadership behaviors and on the behavior's requirements of media richness and media synchronicity. Managers (N=10) name in qualitative interviews communication tools, they are using for the communication with their employees concerning different leadership topics. These tools are classified in a theoretical model of leadership behavior. Building upon these results, a second study with project managers (N=75) who work in virtual teams rate these communication tools according to their usage for different leadership behaviors. Results show, that the demand on advanced information technology and their media richness and media synchronicity depends on the displayed leadership behavior. The results give implications for future investigations on the role of communication tools for the leadership of virtual teams.

IEEM20-P-0307/ Towards an Extended Team Model for Agile Development of Complex Products

Niklas Steireif, Marisa Schirmer, Maximilian Schnitzler, Susanne Mütze-Niewöhner
RWTH Aachen University, Germany

In order to handle the increasing complexity in product development projects, agility has established as a promising solution approach. A large number of agile methods from software development have aroused great interests among industrial users. However, deviating conditions in the development of complex mechanical engineering products pre-vent simple adoption of these agile methods. Therefore, this paper aims to present a robust transdisciplinary under-standing of agility for a complex product development. Using a systematic literature review, the paper derives central agile factors along different structural dimensions of an extended team model. In a final empirical evaluation, the derived agile factors are subjected to a practical assessment among development project managers. For further re-search, the results should allow the translation of the practically confirmed factors into measurable indicators of agility in product development.

IEEM20-P-0337/ A Taxonomy for Engineering Change Management in Complex ETO Firms

Emrah Arica¹, Ottar Bakaas¹, Pavan Sriram²

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²Norwegian University of Science and Technology, Norway

In this paper, we study a specific type of Engineer-to-Order (ETO) firms called Complex ETO characterized by one-of-a-kind products with high complexity and low volumes. Such firms are at high risk of encountering significant engineering changes due to their characteristics. The management of engineering changes have a large impact of time, cost, and quality of the project. The purpose of this paper is therefore to provide a holistic taxonomy for Engineering Change Management (ECM) that can guide the companies with set of actions to prevent, handle, and manage engineering changes. The study is based on literature and empirical findings from a single case study conducted in an offshore platform producer, which resulted in development and verification of the taxonomy.

IEEM20-P-0448/ Sustainability in the Civil Construction based on Emergy Analysis Theory (EmA): A Systematic Review of Literature

Luanda Lima, Marcelo Alencar, Luciana Alencar
Universidade Federal de Pernambuco, Brazil

In recent years, the demand for natural resources has increased worldwide. Given this scenario, to assess sustainability in a process, some tools were developed. Emergy Analysis is an alternative tool, which presents in its concept the list of all the energy needed for a system to produce a product/service, based on the energy consumed from its resources. Thus, a systematic literature review on Emergy Analysis in the construction industry is carried out through an analysis of articles published between 2000 and 2019. Data and information are compiled and presented, considering topics such as the number of papers published, the research institutions that investigate this issue, and the baseline adopted in previous studies. Besides, it was possible to identify that the planning and construction stages of sustainable urban projects adopt EmA and the characteristics of the main mathematical models used in this tool since due to the complexity and difficulty of interpretation of the data, it is necessary to address the assumptions of the models used, to calculate indicators of sustainability.

IEEM20-P-0174/ Investigating the Effects of Modular Product Structures to Support Design Decisions in Modularization Projects

Erik Greve¹, Christoph Fuchs², Bahram Hamraz², Marc Windheim², Lea-Nadine Schwede¹, Dieter Krause¹

¹Hamburg University of Technology, Germany

²Siemens Advanta, Germany

By using modular product structures, the external product variety required by customers can be realized with a minimum of internal variety of components and processes. Understanding the effects of this special product structuring strategy is essential in the early product planning phase to optimize the product structure for the entire value chain. For this purpose, an empirical study was conducted and is reported in this paper. Four real cases were analyzed to identify the effects of modular product structures considering effect occurrence and project-specific boundary conditions. The results are visualized in an extended impact model of modular product structures and traced back to possible measures of product structuring as well as essential target values in the company. These causal relationships serve product developers as decision support in planning and development of modular product structures.

Session	Big Data and Analytics 2
Date	15/12/2020
Time	19:00 - 20:30
Chairs	Philipp BAUMANN <i>University of Bern</i> Oliver STRUB <i>University of Bern</i>

IEEM20-P-0115/ A Dynamic Feedback System Analysis on the Mechanism of Shipping Freight

Xiwen Bai¹, Ming Qi Xu¹, Haiying Jia²

¹*Tsinghua University, China*

²*Norwegian School of Economics, Norway*

This study aims to investigate how congestions at ports affect the shipping freight market using a System Dynamics model, particularly in the liquified petroleum gas (LPG) maritime transportation market. We utilize maritime big data derived from the Automatic Identification System (AIS) for vessel tracking in the analysis. Our model captures the positive impact of port congestion, at its high level, on freight rate volatility when the shipping market is relatively in a tight condition. The proposed model provides insights into the shipping freight market development by innovatively considering port congestion level. The findings provide practical guidance for industrial practitioners to anticipate future freight rates based on the current congestion level and for port authorities to plan for infrastructure upgrades accordingly.

IEEM20-P-0234/ Optimal Feature Selection for Support Vector Machine Classifiers

Oliver Strub

University of Bern, Switzerland

Binary classification is a fundamental task in machine learning. It consists of learning a relationship between observable features of a set of training objects and their observable membership to either of two classes to predict as accurately as possible the class membership of new test objects whose features are observable but whose class membership is unknown. One of the most successful methods for binary classification is the support vector machine classifier that aims at finding a hyperplane in the feature space separating the training objects of the two classes. However, the accuracy of this classifier in predicting the correct classes strongly depends on the features selected for determining the hyperplane. In this paper, we propose the first exact approach, which is based on mixed-integer quadratic programming and delayed constraint generation, to identify an optimal set of relevant features for determining the hyperplane. The results of a computational experiment demonstrate that the proposed approach is able to successfully select an optimal set of relevant features in a short running time even for classification tasks with over 10,000 objects and 100 features.

IEEM20-P-0256/ News Media Sentiments and Stock Markets: The Indian Perspective

Shweta Agarwal, Utkarsh Goel, Shailendra Kumar

Indian Institute of Information Technology, Allahabad, India

Technological advancements accompanied with the gradual decrease in the cost of communication systems have ensured that the humankind is constantly bombarded with the information from around the world. Internet has become Information Super Highway on which any information travels with a lightning speed and easily permeates into all spheres of life. Capital markets also prosper on information and the information revolution has transformed these markets. This paper attempts to investigate the impact of information diffused through the news media on the stock markets of an emerging economy, with evidences from India.

IEEM20-P-0281/ Feature Engineering for Supply Analysis in Ocean Transportation

Roar Adland, Vit Prochazka

NHH Norwegian School of Economics, Norway

In recent years, much effort has been put into the application of ship tracking data for the purpose of shipping market modeling. Such high-frequency spatial data enables real time monitoring of the whereabouts of the global fleet and the activity along the networks on which it trades. However, for spatial data to be of use for price prediction it needs to be enhanced with commercial data, only part of which is publicly available. In this paper we expand on the inherent challenges in deriving the true demand and supply balance in the freight market and show examples of advanced feature engineering using merged spatial and commercial data.

IEEM20-P-0329/ Using of Social Media Data Analytics for Applying Digital Twins in Product Development

Abdiladif Ahmed Olad, Omid Fatahi Valilai

Jacobs University Bremen gGmbH, Germany

Product development as an iterative combination of different disciplines like design, process planning, engineering, manufacturing, logistics, marketing and sales is a challenging issue. Researchers have argued that high product mortality rate, is not only down to factors related with the design of a certain product, but also the fact that consumer engagement and customer behavior are decisive in the product development stages. Dealing with consumers is a big challenge due to the enormous variety of feedback data and qualitative aspects of them. Mostly, the communication channels with consumers are through Social Media (SM) which are usually unstructured and hard to be analyzed. This research has investigated the importance and influence of the emotional behavior of users in accepting new products through a social media analytical approach. The paper has developed a framework to relate the user emotions and new product feature development plan through SM platforms such as Twitter. It is discovered that emotions can be considered as one the important elements for identifying the subjective nature of product attributes. The paper shows that diverse emotions and their role in New Product Development (NPD) processes, specifically in pre-launch phase. A case study has been designed to show the capabilities of the proposed framework in this research. The pre-launch and post-launch emotion Comparisons indicate the possibility of shifting users' behavioral focus for the new product while considering the required market indicators.

IEEM20-P-0333/ A Binary Linear Programming-Based K-Means Algorithm For Clustering with Must-Link and Cannot-Link Constraints

Philipp Baumann

University of Bern, Switzerland

Clustering is probably the most extensively studied problem in unsupervised learning. Traditional clustering algorithms assign objects to clusters exclusively based on features of the objects. Constrained clustering is a generalization of traditional clustering where additional information about a dataset is given in the form of constraints. It has been shown that the clustering accuracy can be improved substantially by accounting for these constraints. We consider the constrained clustering problem where additional information is given in the form of must-link and cannot-link constraints for some pairs of objects. Various algorithms have been developed for this specific clustering problem. We propose a binary linear programming based k-means approach that can consider must-link and cannot link constraints. In a computational experiment, we compare the proposed algorithm to the DILSCC algorithm, which represents the state-of-the-art. Our results on 75 problem instances indicate that the proposed algorithm delivers better clusterings than the DILSCC algorithm in much shorter running time.

Session	Technology and Knowledge Management 1
Date	15/12/2020
Time	08:00 - 09:30
Chairs	Arnesh TELUKDARIE <i>University of Johannesburg</i> Tingyao XIONG <i>Radford University</i>

IEEM20-P-0011/ Adoption of Information Technology in Modern Manufacturing Operation

Shu Lun Mak, Chi Ho Li, W. F. Tang, Ming Yan Wu, C. W. Lai
The Open University of Hong Kong, Hong Kong SAR

The competition of manufacturing industry becomes serious and the enterprises are seeking for new opportunities to improve their competitiveness. The information and automation technologies are one of the possible solutions to improve the efficiency and competitiveness of manufacturers. This paper firstly reviews how both theoretical models, technology acceptance model (TAM) and diffusion of innovation (DOI) to affect the application of technology. Then the German and China governmental policies are discussed and the current situation of using information and automation technology in manufacturing operation are discussed. Finally how the application of technology improving productivity is concluded.

IEEM20-P-0204/ Knowledge Revealing and Organizational Legitimacy: Comparisons between Different Types of Firms in China

Yan Xie¹, Jiaqi Huang¹, Kai Xu²

¹*Northwestern Polytechnical University, China*

²*University of Texas at San Antonio, United States*

Knowledge revealing, as a unique form of open innovation, increasingly attracts interests in academia and practice. Yet, its impacts on firms are still under-researched. Based on open innovation research and impression management perspective, this paper examines the relationship between knowledge revealing and organizational legitimacy, and how the relationship varies between different types of firms in the Chinese context. Using the survey data from 217 manufacturing firms in China, we find that knowledge revealing has positive impacts on both political and business legitimacy. These impacts are stronger for new ventures than for established firms. While knowledge revealing has a stronger influence on political legitimacy for non-state-owned enterprises (non-SOEs) than for state-owned enterprises (SOEs), the effect of knowledge revealing on business legitimacy does not show significant difference between non-SOEs and SOEs. Our study, therefore, uncovers the legitimacy benefit of knowledge revealing in a firm-type-dependent manner.

IEEM20-P-0244/ Promoting the Original Innovation for Disruptive Technology

Xin Zheng, Yali Zhang, Liaoliao Li, Nan Chang, Jianwu Xue
Northwestern Polytechnical University, China

For the "COVID-19" pandemic spreading around the globe, the successful development of nucleic acid testing reagents is critical to disease prevention and control. It has also made governments and institutions aware of the importance of original innovation for disruptive technology. Based on the literature review, this paper discusses the concepts of disruptive technology and original innovation. It then extracts the core elements for original innovation by analyzing two cases of the fundamental research teams of Tsinghua University. Finally, it puts forward a model on achieving original innovation for disruptive technology to a project or team.

IEEM20-P-0477/ How Do Innovation Intermediaries Influence Outbound Open Innovation in China? A Moderated Mediation Mechanism

Yan Xie¹, Kai Xu², Jiaqi Huang¹

¹*Northwestern Polytechnical University, China*

²*University of Texas at San Antonio, United States*

Although firms devote much attention to outbound open innovation for economic or strategic benefits, how outbound open innovation is conducted effectively is still under-studied in the literature. Our paper introduces innovation intermediaries as an antecedent, and based on capability-based framework for open innovation and institutional theory constructs a moderated mediation mechanism through which innovation intermediaries influence outbound open innovation in China. The results of empirical test show that innovation intermediaries influence outbound open innovation via desorptive capacity, particularly in the form of two parallel routes, namely via identification capacity and transfer capacity. The relationship between innovation intermediaries, desorptive capacity and outbound open innovation is stronger in underdeveloped regions than in developed regions.

IEEM20-P-0296/ A Study on Ambidextrousness of R&D Organization in ICT Companies

Iori Nakaoka¹, Yunju Chen², Yousin Park³, Hirochika Akaoka⁴, Seigo Matsuno¹

¹*National Institute of Technology, Ube College, Japan*

²*Shiga University, Japan*

³*Prefectural University of Hiroshima, Japan*

⁴*Kyoto Sangyo University, Japan*

The purpose of this research is to examine the reason why Japanese ICT companies have not gained competitive advantages in the global markets by focusing on the problem of R&D organizational form in innovation, especially from the perspective of ambidextrous organization. We propose an exploration degree to measure the ambidextrousness of R&D organization that is calculated by social network analysis and text analytics method. As a result, the exploration degree on Japanese ICT companies are lower than foreign rival company which means Japanese companies tend to emphasize the exploitation type innovation and lack for explorational innovation.

IEEM20-P-0374/ Impact of Reabsorption of Spilled Knowledge on Patent Value

Takafumi Miyazaki, Ryo Takemura, Takuya Harada, Noritomo Ouchi
Aoyama Gakuin University, Japan

Innovation is often achieved by recombining existing knowledge. Thus, effective utilization of external knowledge is key for firms creating innovation. The concept of reabsorption, where an originating firm reabsorbs its spilled knowledge, including the advancements made by recipient firms, has attracted attention. Existing studies have not clarified the impact of reabsorption on patent value and have not confirmed whether an originating firm reabsorbs knowledge in the same or different technological fields. Therefore, this study attempts to examine the impact of reabsorption of knowledge on patent value considering technological fields using patent data. Reabsorption of spilled knowledge was tracked using patent citation data, and patent value was evaluated by the number of citations. By conducting negative binomial regression, we concluded that the reabsorption of spilled knowledge has a positive impact on patent value. Furthermore, the impact is greater when a firm reabsorbs spilled knowledge in different technological fields. Our results suggest that a firm has the ability to effectively create innovation by reabsorbing spilled knowledge.

Session	Project Management 1
Date	15/12/2020
Time	10:00 - 11:30
Chairs	Songlin CHEN <i>Nanyang Technological University,</i> Tahir MAHMOOD <i>Department of Technology,</i> <i>School of Science and Technology,</i> <i>The Open University of Hong Kong, Kowloon, Hong Kong</i>

IEEM20-P-0010/ Breakthrough Capabilities for Delivering High-performing Project Management Offices (PMOs) in Construction Enterprises

Mahmoud Ershadi¹, Marcus Jefferies¹, Peter Davis¹, Mohammad Mojtahedi²

¹*University of Newcastle, Australia*

²*University of New South Wales, Australia*

The concept of the project management office (PMO) is well-established in academic literature. This organizational phenomenon has revolutionized practices applied by organizations toward coordinating and overseeing multiple projects throughout the design, engineering, initiation, execution, and handover stages. The construction industry is one of the contexts in which more research is still needed to provide practical guidelines for achieving effective PMO functioning. This study explores several core capabilities of these entities from the perspective of construction project management practitioners working in the contracting sector. In this regard, we solicited expert judgment based on an online questionnaire followed by thematic analysis. Respondents suggested six drivers that can contribute to improving the effectiveness of construction PMOs in practice. This study provides insight into some capabilities that can be employed for delivering high-performing PMOs.

IEEM20-P-0117/ How Could Antecedents to Project Collaborative Effectiveness Through Project War-Room Meetings, Develop Cohesion in Multicultural Teams: While Problem-Solving?

Adrian Hepworth¹, Sevil Hepworth²

¹*University of Liverpool Management School, Azerbaijan*

²*University of Liverpool the Centre for Higher Education Studies, Azerbaijan*

This study focused on using War-Room Meetings (WRM) as a vehicle to developing team cohesion in multicultural project teams in Oil and Gas civil, and marine infrastructure projects. Although the concept of collaboration and multicultural diversity is extensively viewed as organisational social structures, most theories of developing cohesion are sceptical about the social process within which it might occur. We explored the theory of combining daily WRM and problem-solving while strengthening the social-structures in diverse, multicultural-teams. We started by examining mainstream literature to develop conceptual theories. This study also used interviews and an Action Learning group to collect data and evaluate ideas into action. Our findings suggested, team building, problem-solving, multicultural-teams, language barriers, and networking could improve by using WRM. These concepts influenced ambidexterity which balances between exploitation and exploration; therefore, manipulating ideas and using flexibility to test a variety of shared beliefs.

IEEM20-P-0228/ Evaluation of the "Internet +" Environmental Public Welfare Project Based on Value Co-creation

Jie Zhang, Yali Zhang, Haixin Zhang, Guanghui He

Northwestern Polytechnical University, China

The emerging "Internet +" environmental public welfare projects have been developing rapidly in recent years. However, there is no consensus reached on how to measure their effectiveness. From the perspective of value co-creation, this paper analyzes the value created by stakeholders of "Internet +" environmental public welfare projects in the whole life cycle of these projects, develops the evaluation index of project success, identifies the influencing factors based on "time-quality-cost", and designs the questionnaire containing 39 measurement items. On the ground of the exploratory factor analysis of 219 valid responses, the evaluation index system of the "Internet +" environmental public welfare project is established, including the preliminary preparation, implementation process, and subsequent influence. This set of indicators combines the traditional triple constraints, project stakeholders and project life cycle, and provides a reference for the development of "Internet +" environmental public welfare projects. The instrument is also useful for the evaluation research of public welfare projects participated by the whole people in the digital era.

IEEM20-P-0489/ Gearing Food Manufacturing Industry Towards Lean Six Sigma Implementation: An Exploratory Study on Readiness Factors

Sarina Abdul Halim Lim¹, Nurul Najihah Azalanazlly¹, Ungku Fatimah Ungku Zainal Abidin¹, Anjar Priyono²

¹*Universiti Putra Malaysia, Malaysia*

²*Universitas Islam Indonesia, Indonesia*

Lean Six Sigma (LSS) is a technique for business improvement that has flourished over the past decade due to its ability to minimise variations and increase efficiency, which enhanced the business performance and market credibility. However, LSS in the food industry was far away behind compared with other manufacturing settings. This paper focuses on the stage of LSS pre-implementation, with an intent to fill in the gap in the literature as to what type of competency is necessary to implement LSS in the food manufacturing settings. The objective of this study is to identify factors that influencing the readiness of LSS implementation in the food manufacturing industry. The semi-structured interviews were conducted with twelve food industry practitioners involved in quality management activities. Six LSS readiness factors are customised for the food manufacturing industry identified through 29 nodes. This study helps develop the LSS readiness framework and self-assessment tool, which can be a future reference for quality practitioners in the food industry.

IEEM20-P-0447/ Project Performance Evaluation System: A Case Study in a Construction Enterprise in Colombia

Sassha Rico, Luciana Alencar

Universidade Federal de Pernambuco, Brazil

Due to the increase of market competitors in different sectors, organizations currently seek new ways for continuous improvement. Companies initially focus on their internal processes that could captivate customers and stakeholders, mainly interested in the acquisition of products or services. To this extent, having processes that enhance differences from competitors is important to gain an advantage in the market. In this context, this paper aims to propose a methodology for evaluating the performance of projects, aligned with strategic organizational planning. The evaluation proposed in this paper is based on a literature review resulting in the application of the proposed methodology with a case study in a construction company in Colombia. The results demonstrate that the methodology developed in the company brought benefits in the studied areas; further allowing the identification and characterization of the critical processes that deserved greater attention, metrics, indicators, and those responsible, confirming better controls in the processes. After applying the methodology throughout the project's life cycle, the company relies on data that support decision making ensuring better use of resources for future projects.

IEEM20-P-0568/ Application of Fuzzy Set Theory to Evaluate Large Scale Transport Infrastructure Risk Assessment and Application of Best Practices for Risk Management

Baudhi Abeysekara

University of Moratuwa, Sri Lanka

This study explores the factors that pose risks to the efficiency with which capital is utilized in large-scale transport infrastructure investments and suggests for risk management best practices that may be applied in relation to each. The literature review categorizes risks into nine major categories. Four practices that enhance capital usage efficiency are selected: namely, value engineering, asset portfolio management, life cycle costing, and quality assurance. Fuzzy set theory is applied to analyze and evaluate risks and the effect of adopting best practices in relation to them. By linking each risk to a best practice, potential enhancements to capital usage efficiency in infrastructure investment projects are observed. Survey responses of 83 engineers involved in land transport infrastructure projects in Sri Lanka form the dataset of this study. Results demonstrate that quality assurance reduces the planning fallacy and political influence, while value engineering reduces risks associated with technical know-how and change order. The study concludes that risks in large scale transport infrastructure investments may be managed through efficiency-enhancing practices to reduce.

Session	Reliability and Maintenance Engineering 1
Date	15/12/2020
Time	12:00 - 13:30
Chairs	Danping LIN <i>Shanghai Maritime University</i> Xin WANG <i>City University of Hong Kong</i>

IEEM20-P-0153/ Reliability and Safety Assessment of Automated Driving Systems: Review and Preview

Kuo-Wei Wu, Chung-Chih Liao, Wen-Fang Wu
National Taiwan University, Taiwan

In 2018, SAE International released a revised version of ADS (Automated Driving System) classification standard—SAE J3016 and divided it into six different classification levels. Many people doubt about the reliability of AV (Autonomous Vehicles with ADS), ADS, and HAD (Highly Automated Driving). They may wonder if and when the public is ready to enter different SAE levels. To illustrate and resolve some of their questions, this paper divides “ADS reliability and safety” into the following four segments: (1) AV hardware reliability, (2) HAD reliability, (3) Integration reliability by road tests, and (4) resilience & CPS (Cyber-Physical System) reliability. The paper tries to answer the following RQs. RQ1: Are the reliability and safety of vehicle hardware sufficient for the current SAE level 0-2 vehicles? RQ2: Are HAD's decisions reliable in all current workable scenarios? RQ3: Is the failure rate of ADS significantly better than that of human-driven vehicles in public testing? RQ4: Do human drivers have to intervene or participate in while driving AVs?

IEEM20-P-0452/ An Integrated Approach for Fuzzy Failure Mode and Effect Analysis Using Fuzzy AHP and Fuzzy MARCOS

Soumava Boral¹, Sanjay K. Chaturvedi², Ian Howard¹, Kristoffer McKee¹, V. N. Achuta Naikan²

¹*Curtin University, Australia*

²*Indian Institute of Technology Kharagpur, India*

Failure mode and effects analysis (FMEA) is a potential risk evaluation tool in reliability engineering. The RPN based FMEA approach has been criticized for its multiple drawbacks. Recently, the Multi-Criteria based Decision Making (MCDM) methods have proven their efficiency to overcome the limitations of RPN based FMEA approach. This work develops an integrated fuzzy MCDM FMEA approach by employing Buckley's Fuzzy Analytical Hierarchy Process (FAHP) and modified Fuzzy Measurement of Alternatives and Ranking according to Compromise Solution (FMARCOS). Both FAHP and modified FMARCOS methods are capable to deal with the linguistic evaluations made by multiple experts and to arrive at a rational decision for risk ranking of the failure modes. A benchmark FMEA case is utilized to feature the superiority and robustness of the suggested approach. Finally, sensitivity analysis is done and the found risk ranking results are contrasted with other popular fuzzy MCDM approaches.

IEEM20-P-0504/ Mechanization of Qualitative Risk Based Inspection Analysis

Mehdi Eskandarzade¹, R. M. Chandima Ratnayake², Meysam Najafi Ershadi¹

¹*University of Mohaghegh Ardabili, Iran*

²*University of Stavanger, Norway*

The need for enhancing Risk-Based Inspection (RBI) strategies has received significant attraction of many researchers and practitioners in the offshore/onshore oil and gas. Qualitative RBI (QRBI) has many applications in risk assessment of the aging assets, screening of the asset based on their risk level, and also in full risk assessment analysis of the items in the absence of proven quantitative RBI procedure. Traditionally, Subject Matter Engineers (SMEs) perform qualitative RBI and so the procedure is vulnerable to human biases and errors. Unreliability also causes due to the performer-to-performer output variation. Mechanization of the QRBI process improves the quality of the analysis by reducing the effects of human biases, enhancing the accuracy and speed of the calculations and increasing the repeatability. This manuscript first discusses the evolution of the QRBI process and presents recent trends in mechanization of the QRBI process. Then, the application of Gray Relational Analysis (GRA) method in mechanizing of the QRBI process is presented. In order to validate the results from GRA based QRBI, they compared by the results obtained from commercial software of RBLX.

IEEM20-P-1152/ Modelling and Analysis of Accelerated Degradation Testing with Practical Issues Considered

Qingpei Hu

Chinese Academy of Sciences, China

In this talk, the modeling and analysis for accelerated degradation testing will be explored, with considerations on the practical issues. Firstly, due to the inconsistency of manufacturing, the performance of samples under testing will vary and the degradation process should incorporate the initial status into the modeling framework. Secondly, under some circumstances, the measurement for the testing samples of ADT can only be conducted under normal stress levels. Then performance recovery may occur for some failure modes. Recovery effects should be incorporated into the degradation process when modeling for accurate reliability evaluation. Thirdly, for some complex failure mode like a sequential hard and soft failure, the degradation starts after some event happens which can be modeled by some lifetime model. For such a case, a lifetime delayed degradation process should be considered. Practical case studies would be presented for each circumstance.

IEEM20-P-0016/ A Deterministic Analysis Method of Embedded System Based on Event-driven

Xianchen Shi, Yian Zhu, Xiangyu Zhang, Lian Li, Zonglong Qi, Jihuan Dou

Northwestern Polytechnical University, China

This paper elaborates on the deterministic analysis method for event-driven embedded system to reduce the impact of uncertain factors at the design stage. By abstracting each unit of the embedded system, the framework of the embedded system is built. Margin analysis of time resource and space resource is carried out to provide accurate reference for the designers and realize reasonable planning of resources, task priority and task scheduling.

IEEM20-P-0219/ Life Prediction of Self-Locking Nut for Aeroengine Based on Survival Analysis and Bayesian Network

Zhiqiang Cai, Yuhang Wang, Huiying Cao, Zhengjie Tian

Northwestern Polytechnical University, China

The self-locking nut is an advanced fastening part, which can be locked by friction. It has been widely used in the connection of aeroengine system nowadays. The performance and reliability of self-locking nut will directly affect the tightness of various aeroengine components, and play an important role in the operation of aeroengine. In this paper, based on the collected lifetime data of aeroengine self-locking nut, the survival analysis method is introduced to discover the influence of each individual variable on the life of self-locking nut at first. Then, after eliminating the irrelevant variables according to survival analysis, a novel Bayesian network (BN) based life prediction model is established to support the decision making of extending service life and improving system reliability. Finally, by comparing with the general BN model with all variables, the performance of the proposed model is verified, and the applications of the model are also given.

Session	Technology and Knowledge Management 2
Date	15/12/2020
Time	14:30 - 16:00
Chairs	Kah Hin CHAI <i>National University of Singapore</i> Leif OLSSON <i>Mid Sweden University</i>

IEEM20-P-0060/ Cyber-Physical Operator Assistance Systems in Industry: Cross-Hierarchical Perspectives on Augmenting Human Abilities

Mirco Moencks, Elisa Roth, Thomas Bohné
University of Cambridge, United Kingdom

In production systems, manual tasks need to be considered more than the sum of repetitive sub-tasks which can simply be taken over by autonomous systems. Despite technological advances in automation, the presence of human operators remains essential on future shop floors. Consequently, it is of interest for manufacturing organizations how cyber-physical operator assistance systems (C.O.A.S.) can augment skills of operators on the shop floor. However, there is a limited understanding of how relevant stakeholders in manufacturing organizations assess the suitability of COAS. This is crucial in so far as the adoption of COAS significantly depends on the approval of stakeholders throughout the respective manufacturing organization. This paper explores how stakeholders in manufacturing organizations assess the role of COAS on future shop floors. This is realized by conducting an exploratory, multi-method, qualitative study encompassing interviews of executives, instructors, and operators. Additionally, the study incorporates ethnographic observations in industrial education. A result of the study is that informants expect COAS to be promising for manufacturing organizations if systems augment cognitive abilities of operators, rather than their physical abilities.

IEEM20-P-0246/ Case Study for the Integrated Development of a Modular System for Vehicle Superstructures of Battery Electric Light Commercial Vehicles

G. Schuh¹, Christian Dölle¹, Ramon Kreutzer², Marc Patzwald², Jan Koch¹
¹*RWTH Aachen University, Germany*

²*Fraunhofer Institute for Production Technology IPT, Germany*

Considering fossil fuel scarcity, future transportation is a core challenge for industry and society. With increasing urbanization, the issue of emission-free transportation is of particular relevance for metropolitan areas. To reduce pollution, environmental zones have been set up in numerous German cities. These affect small and medium-sized companies (SMEs) that operate within the city centers, but whose logistics are diesel-based. At the same time, battery electric light commercial vehicles (BELCVs) are more expensive than diesel vehicles. Apart from component costs, this is partly due to lower volumes and limited economies of scale. In the context of vehicle structures in BELCVs, new possibilities for installation space design arise. This paper aims to modularize this installation space tailored to SMEs' needs. Since purchasing is the primary cost driver for SMEs, the presented case study pursues the goal of realizing "car-sharing" for BELCVs via modularization, so that capital investments can be distributed among several parties. Thus, the objectives of the present paper are sharing the lessons learned of the case study and contributing to the validation of the modular system design methodology used.

IEEM20-P-0301/ The Enhancement of E-learning for the Boring Process to Leverage the Knowledge Management Maturity

Zulma Luklu Il Maqnun, Fadel Muhammad, Amelia Kurniawati, Mochamad Teguh Kurniawan
Telkom University, Indonesia

To catch up with the dynamics of business needs, organizations need to maintain and regularly enhance the performance of their information system and human capital. An aerospace industry company is expected to have a sustainable implementation of knowledge-based e-learning. The company needed to enhance the e-learning that covers the entire content of the boring process. This study aimed to design the enhancement of e-learning of the boring process and to review the company's KM maturity. The knowledge conversion process retrieved thirty-one tacit knowledge and converted them as part of best practice and the knowledge content of e-learning. Afterward, the software development process was commenced to develop the adjustment of the e-learning structure and new features required. The review showed e-learning has contributed to the company's KM maturity on level 3 – Aware. By evaluating the KM maturity, the company can determine the initiatives improvements needed to leverage the KM practice.

IEEM20-P-0551/ The Impact of Business Intelligence on Decision-Making in Public Organisations

Aron Berhane, Mohamad Nabeel, Christine Große

Mid Sweden University, Sweden

This study investigates how business intelligence (BI) affects decision-making processes and the basis for decisions. Therefore, the inquiry includes literature from the field of BI and interviews with three Swedish agencies. It concentrates specifically on three fundamentals of BI-driven decision-making: data quality, data analysis and the human factor. The results emphasise BI's impact on decision-making and interrelated processes. Although BI does not reduce the volume of decisions, it enables a decision-maker or organisation to control and monitor the decision basis, which suggests that decision quality increases if the decision concerns issues that rest on statistics and facts. Based on theoretical and empirical findings, this paper contributes to an increased understanding of the impact of BI on decision-making at Swedish agencies.

IEEM20-P-0053/ Development and Evaluation of a Blockchain Concept for Production Planning and Control in the Semiconductor Industry

Laura Herrgoß¹, Jacob Lohmer², Germar Schneider¹, Rainer Lasch²

¹*Infineon Technologies Dresden GmbH & Co. KG, Germany*

²*Technische Universität Dresden, Germany*

Blockchain technology promises several benefits for operations management, but reported use cases, concepts and applications are rare. This contribution indicates the findings from a case study of analyzing the suitability of blockchain technology for semiconductor manufacturing at the 300 mm wafer frontend facility of Infineon Technologies in Dresden, Germany. This plant contains one of the most highly automated fabrication lines in the industry. Here, several different and isolated digital software tools are used to control manufacturing, all accessing centralized databases with different views and restrictions. We assess if and how a blockchain solution could and should be designed to enhance the analytic capabilities for this facility using the design science approach and evaluate the economic value of the designed application using the analytical hierarchy process.

IEEM20-P-0558/ Methodology for the Assessment of Complexity in Corporate Value Networks

Michael Riesener, Christian Dölle, Julian Krefß, G. Schuh

RWTH Aachen University, Germany

Nowadays, companies are forming corporate value networks to meet the increasing demands of customers and to implement new business models for the generation of new revenue streams. Nevertheless, managing a larger number of partnerships can often be challenging for companies. In this context, methods are required to manage network complexity. The literature neglects the holistic assessment of complexity in corporate value networks. In this paper, a methodology to assess complexity in corporate value networks within the mechanical and plant engineering industry is proposed. Various complexity drivers contributing to overall network complexity have been identified from the scientific literature and quantified using a verbalized ordinal scale. Different complexity dimensions are operationalized and visualized by the means of complexity vectors, which consist of the assessed complexity drivers. The proposed methodology enables the user to derive holistic measures in order to deal with complexity in corporate value networks.

Session	E-Business and E-Commerce 1
Date	15/12/2020
Time	16:30 - 18:00
Chairs	Krishna KOTTAKKI <i>Bundl Technologies</i> Linda ZHANG <i>IESEG School of Management</i> (LEM-CNRS 9221)

IEEM20-P-0167/ Digital Transformations in the Apparel Value Chain for Mass Personalization

Wasana Uduwela¹, R. K. J. De Silva², T. D. Rupasinghe³

¹Wasana Uduwela, Sri Lanka

²University of Moratuwa, Sri Lanka

³University of Kelaniya, Sri Lanka

Mass Personalization (MP) is being adopted in the apparel industry to provide customized product solutions to the customer. Customer co-creation is the key opportunity provided during the initial design phase. The best way to evaluate these new products is to create virtual prototypes based on the digital environment. Therefore, this article examines the digital approaches to the development of apparel prototypes by systematically reviewing the literature. The findings reveal that existing digital approaches are primarily aimed at visualizing a new product based on a 3D avatar created using scanned body measurements of a customer, although user experience is required for evaluation. The most important factor in the design process is the digital solutions to enhance the user experience of the new product (comfort of clothing) in its infancy. Therefore, this study explores digital technologies used in other industries to get an understanding on the possibilities of adopting the same in the apparel industry.

IEEM20-P-0384/ A Constrained Clustering Algorithm for the Location of Express Shops

Xilin Zhang, Xiao Liu, Jing Jiang
Shanghai Jiao Tong University, China

For many express companies, express shops are the first line of serving customers. Reasonable location of express shops is very important to improve customer satisfaction. To balance the operation cost for the express company and the convenience of customers, we need to shorten the distance of customers to their closest shop while maintaining an appropriate express amount at each shop. In order to optimize the location of express shops, a heuristic clustering algorithm considering the constraints of service scope and service capability is proposed. The validity of the model is validated by DB Shanghai regional data, and the constrained clustering algorithm is compared with immune genetic algorithm and K-means method. The results show that, within the ideal service capacity and distance constraints, the proposed clustering algorithm can cover 31%-35% more demand than immune genetic algorithm, 1.4%-13% higher than K-means method.

IEEM20-P-0468/ Efficient Detection of Shilling's Attacks in Collaborative Filtering Recommendation Systems Using Deep Learning Models

Mahsa Ebrahimian, Rasha Kashef
Ryerson University, Canada

Recommendation systems, especially collaborative filtering recommenders, are vulnerable to shilling attacks as some profit-driven users may inject fake profiles into the system to alter recommendation outputs. Current shilling attack detection methods are mostly based on feature extraction techniques. The hand-designed features can confine the model to specific domains or datasets while deep learning techniques enable us to derive deeper level features, enhance detection performance, and generalize the solution on various datasets and domains. This paper illustrates the application of two deep learning methods to detect shilling attacks. We conducted experiments on the MovieLens 100K and Netflix Dataset with different levels of attacks and types. Experimental results show that deep learning models can achieve an accuracy of up to 99%.

IEEM20-P-0486/ Relative Importance of Determinants Towards Users' Privacy Disclosure on Social Network Sites by Privacy Invasion Experience Based on Construal Level Theory

Li-Ting Huang¹, Jun-Der Leu²

¹Chang Gung University, Taiwan

²National Central University, Taiwan

Even users know the privacy risks of information disclosure, many still fail to adopt protection mechanisms or decrease information disclosure behavior on social network sites (SNSs). We explain this phenomenon by considering users' rational calculus, affection, as well as perception towards platform. The awareness towards privacy leaks gradually fades out with the time passing. Accordingly, we proposed that users' self-disclosure behaviors on SNSs are a decision-making process determined by individual rational, emotional, or situational factors. Users' choices of persuasion routes depend on psychological distance of privacy invasion events based on the perspective of construal level theory. Results from analyzing collected 241 usable records show three findings. First, users' decision of privacy disclosure is based on institutional trust and cognitive absorption, rather than perceived benefits. Second, cognitive absorption influenced by perceived playfulness is critical to privacy disclosure behavior. The influence of cognitive absorption on privacy disclosure varies from the time period of personal bad experience happened. Third, the influence of trust on privacy disclosure is getting more important when users have bad experience and when users have modified privacy settings.

IEEM20-P-0330/ An Integrated Scheme for Robot E-procurement

Yafei Nie, Shurong Tong

Northwestern Polytechnical University, China

E-procurement is an important way to purchase robots in recent years. Robot e-procurement requires efficient matching among buyers and sellers. Based on the characteristics of robot e-procurement, combined with the theories of e-procurement and transaction matching, the method of unidirectionally searching for seller' supply information is expanded. An integrated robot e-procurement framework including the catalog procurement, the inquiry procurement and the bidding procurement is proposed to achieve bi-directional search and procurement between buyers and sellers. Based on the selection of core attributes and calculation of user satisfaction, the matching method for robot procurement is put forward for users to efficiently match products in accordance with their requirements.

IEEM20-P-0355/ Customer Satisfaction with Order Fulfillment in E-Retail Supply Chains in China: An Empirical Study

Yilin Xie¹, Linda L. Zhang²

¹IESEG School of Management, France

²IESEG School of Management (LEM-CNRS 9221), France

The Internet has changed the way how customers make their purchases and how retailers do business. With the development of B2C e-commerce, the retailers compete intensively to improve customer satisfaction and further secure their loyal customer bases. In this study, we investigate the relationship between customer satisfaction and customer loyalty in retail supply chains in B2C e-commerce in China. A conceptual model is developed to reveal the relationships and the factors influencing B2C e-customer satisfaction. Partial Least Squares is employed to assess the relationships between observable and unobservable variables and between unobservable variables. More specifically, SmartPLS is adopted to test and visualize the relationships. Based on the results, we suggest that e-retailers in China should improve their after-sales service activities and strengthen flexible and responsive order fulfillment activities in the hope of satisfying customers and further increasing loyal customer base.

Session	Human Factors
Date	15/12/2020
Time	19:00 - 20:30
Chairs	Michel ALDANONDO <i>Toulouse University / IMT-Mines Albi</i> Linda ZHANG <i>IESEG School of Management (LEM-CNRS 9221)</i>

IEEM20-P-0028/ The Effect of Gender, Hand Anthropometry, Hand Dominance, and High School Grade on Hand Grip Strength in Filipino Teenagers Aged 15-18: A Structural Equation Modeling Approach

Yogi Tri Prasetyo, Rod Vincent L. Cortes, Franklin S. Bautista, Kenneth C.E. Piguing, Aaron Josh A. Bermudez, Charlotte N. Monteiro
Mapúa University, Philippines

Hand grip strength, or widely also known as Maximum Voluntary Contraction (MVC), is an important part in physical ergonomics. The purpose of the study was to establish Filipino teenagers' hand grip strength data. In addition, another objective of the study was to investigate the causal relationships of gender, hand anthropometric, hand dominance, and high school grade on hand grip strength in Filipino teenagers by utilizing the Structural Equation Modeling (SEM) approach. A total of 100 male and 100 female students were voluntary recruited from Mapúa Senior High School students to perform MVC. SEM indicated that gender was found to have the most significant effect on the hand grip strength, followed by hand anthropometric, and hand dominance. Interestingly, hand dominance was found to be significant on hand grip strength. This study is the first study that establish the hand grip strength among Filipino teenagers and it would be very beneficial for human factor engineers, hand therapists, and even medical doctors. Finally, the proposed SEM approach could be applied and extended in analyzing the hand grip strength in other countries.

IEEM20-P-0075/ Influence of Presentation Mode on User's Mental Map in Temporal Sequence Data Visualization

Wenlu Wang, Ningyue Peng, Haiyan Wang, Chengqi Xue
Southeast University, China

Spatial aggregation and small multiples are two mainstream visualization presentation methods for temporal sequence data. This study compares the effect of spatial aggregated and small multiples in mental map construction with three task genres: peak value identification (Task 1), variation tracking (Task 2), and trend comparison (Task 3). Spatially aggregated timestamps get transited through animations. Task completion time favors small multiples in Task 1, but spatial aggregation with animated transition is more favorable in Task 2 and Task 3 in terms of completion time and error rate. Subjective rating results are aligned with behavioral performance measures. This research can guide future temporal sequence data visualization design.

IEEM20-P-0178/ The Importance of Including Qualitative Data in Technology Evaluation - Investigating the Technology Implementation Evaluation Score (TIES)

Annika Hasselblad, Leif Olsson
Mid Sweden University, Sweden

The recent increase in welfare technology implementation calls for the development of evaluation methods. Previous research has identified the need for a coherent evaluation model to create indicators that combine individual, economic and organizational dimensions. The Technology Implementation Evaluation Score (TIES) works in this way. It provides a score by combining statistical and monetary data (quantitative data) with patient and caregiver opinions (qualitative data). This paper aims to investigate the effects of including qualitative data on the outcome of the TIES model, compared to only using quantitative data. Various combinations of inputs are investigated by performing a sensitivity analysis using extreme value scenarios. The result shows that the TIES model is more affected by the number of data types created and the weight attached to each input than the data used as inputs. The assessment shows that the model is appropriately constructed for the current home care case.

IEEM20-P-0220/ Young Consumers' Perception Towards Downstream Green Supply Chain Practices

Vaishnavy Perinparajah¹, H. Niles Perera¹, Jayani Ishara Sudusinghe², Uthpalee Hewage¹

¹*University of Moratuwa, Sri Lanka*

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Organizations, suppliers and consumers are highly sensitive towards environmental impacts arising from their operations today. Under this context, green consumption and the green packaging are gaining popularity among consumers. This research evaluates young educated consumer perception towards green packaging in Sri Lanka. A survey was conducted targeting university students who are reading for an undergraduate degree in Sri Lanka. Demographical information, attitudes and beliefs, knowledge about environmental sustainability, environmental awareness, and factors influencing their consumer behavior towards green packaging were collected through the survey. The data was analyzed using the Analytical Hierarchical Process. The findings of the research help understand main factors which influence the young educated consumer behavior towards green packaging and the level of influence of each factor. The analysis also reveals the hindrances and challenges withholding the use of green packaging.

IEEM20-P-0306/ What Makes a Robot Robotic? Application of Speed, Fluidity and Animation Principles to Define Human Versus Robotic Movement

Andrew Pahl, Bernhard Schmitt

Nanyang Technological University, Singapore

This study aims to define what robotic movement is. A great deal of research has been done on nonverbal communication and the perception of robot movements, but this large body of research is yet to have a solid definition of what "robotic" movement is in the first place. We present a series of 8 stop motion video clips to a general population sample who rates the movement on a robotic-human continuum and reports the amount of surprise they would experience if a robot or human were to move in the manner portrayed in the clip. We manipulate the type of robot as either industrial or humanoid. Additionally, we manipulate movement by applying principles of speed, fluidity and animation in order to generate a definition of robotic movement. Results suggest that asynchronous, separated axis movement produces higher perceptions of robotic movement whereas animation principle applications such as hesitation can suppress perceptions of robotic movement.

IEEM20-P-0434/ Comparing Design Preference of Guide Road Signs by Native Arabic Speakers and International Speakers in the State of Qatar

Asma Mahgoub, Pilsung Choe

Qatar University, Qatar

Guide road signs are used to help drivers. These signs should be designed properly and provided effectively to maximize the transmitted information in a short time in driving. The design of guide road signs should be made carefully when multi-languages are used, which is the case of Qatar. To compare the preference of a guide road sign design between different language speakers, an online survey was conducted. Participants rated a design using a 7-Likert scale. They preferred road signs having a background of different colors and a vertical text layout. A group t-test was conducted for comparisons between native Arabic speakers and international speakers whose native language is not Arabic. The results showed that there is no significant difference between the two groups. Based on the result, the proposed design can be effectively used for all drivers regardless of their native language in Qatar.

Session	Operations Research 1
Date	15/12/2020
Time	08:00 - 09:30
Chairs	Hyeong Suk NA <i>South Dakota School of Mines and Technology</i> Kuo-Wei WU <i>National Taiwan University</i>

IEEM20-P-0532/ A Robust Optimisation Formulation for Post-departure Rerouting Problem

Miriam Bongo, Charlle Sy

De La Salle University, Philippines

In this paper, a robust optimisation approach for air traffic flow management problem involving rerouting of flights under uncertainty is explored. During disruptions in typical aircraft operations, an inherent uncertainty in the capacity of airspace resources becomes evident. Therefore, when flights are en-route, stakeholders are required to arrive at a decision of assigning an alternate route so as to support the continued aircraft operations. Considering that stakeholders of the commercial aviation industry maintain individual interests other than the collective interest of safe operation of flights, a robust optimisation model is developed as a decision support system for rerouting of flights integrating these individual interests. The key results obtained from the illustrative case study conducted show that the route assignment varies significantly with the level of uncertainty. Such variations present important insights to the stakeholders in terms of resource capacity and cost, among others.

IEEM20-P-1061/ Behavioral Model to Understand Hurricane Evacuation Decision Making Affected by Social Influence

Hyeong Suk Na

South Dakota School of Mines and Technology, United States

Over the past few decades, human evacuation departure behavior has been described by various departure time choice models (DTCMs). Although this decision is given at the individual level, social media is transforming the communication channels for sharing the evacuation-related information during the evacuation; therefore, through social media evacuees collectively influence their departure time decisions and this causes high correlation among individual decisions. While it is apparent that this high correlation could be one of the main reasons of the simultaneous departures, there are only very few evacuation studies considering the effect of social influence on the human evacuation behavior. In this paper, to describe the departure behavior of evacuees interconnected by social influence, we propose a DTCM using a time inhomogeneous, discrete-time Markov chain. In other words, the evacuation decision probability of each evacuee at each stage is collectively affecting each other's decision in a social network representing a community of evacuees sharing the evacuation-related information. A numerical case study is provided to understand the effect of the evacuation planning on different social network topologies and the human evacuation behavior.

IEEM20-P-0290/ Job Shop Scheduling Problem Neural Network Solver with Dispatching Rules

Mun Hon Sim¹, Malcolm Yoke Hean Low², Chin Soon Chong³, Mojtaba Shakeri³

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³*Singapore Institute of Manufacturing Technology, Singapore*

Job Shop Scheduling Problem (JSSP) is an optimization problem in computer science and operations research. Many problems in real-world manufacturing processes can be translated into JSSP. In recent years, Machine Learning has shown great promises in solving optimization problems and can be used to solve JSSP instances. In this paper, an Artificial Neural Network (ANN) was designed and trained to solve JSSP instances using the priority of the operations as the learning output. Dispatching rules were implemented to break ties during the decoding of the priorities. Our experiment results showed that a hybrid algorithm that combines the best of ANN with dispatching rules and standalone dispatching rule-based heuristic outperforms previously reported results.

IEEM20-P-0300/ Portfolio Selection Utilizing Electronic Company Stocks During the Enhance Community Quarantine Period in the Philippines

Michael N. Young, Godfrey Arevalo, Ezekiel Mallari

Mapúa University, Philippines

This study presents a portfolio selection framework utilizing electric company stocks during the COVID-19 pandemic in the Philippines. A set of criteria is presented to identify the investment pool composed of electric companies. Returns are estimated through historical returns and assumed to be equally likely. Then, equally weighted portfolio strategy is applied to identify the optimal portfolio. The portfolio is then compared to a counterpart portfolio, a benchmark and the market. Back-test shows that the electric company portfolio outperforms its counterpart portfolio in all aspect, it can also outperform the market in terms of returns and standard deviations and be at par with the benchmark. This may lead to a generic portfolio selection framework for individual investors.

IEEM20-P-0438/ Performance Analysis of an Open Cycle Gas Turbine Power Plant in Grid Electricity Generation

Moses Kabeyi, Oludolapo Olanrewaju

Durban University of Technology, South Africa

In this study, there was a performance analysis of a working 30MW open cycle gas turbine power plant to get a general overview of role and performance of gas turbines in supply of grid electricity. The historical evaluation of the gas turbine power plant technology is presented with features and application of gas turbines in electricity generation. It was found that a significant amount of energy is lost with the exhaust gases, which are released to the atmosphere. The amount was up to 74.6%, which is wasteful, polluting and unsustainable. Analysis on possible conversion from the open cycle to combined cycle plant demonstrated that subject to practical limitations, specific fuel consumption reduces by 22% and power output increases by 11.53 MW, which is 38% increase from the Rankine cycle turbine. This will improve on specific fuel consumption, generate more revenue and contribute towards greenhouse emission mitigation through avoided use of fossil fuels for extra power generated.

IEEM20-P-0406/ Managing Sustainability in Electricity Generation

Moses Kabeyi, Oludolapo Olanrewaju

Durban University of Technology, South Africa

This study looked energy sustainability and sustainable development and measures necessary to ensure that electricity generation is sustainable. Current literature in form of published journal articles and conference proceedings as well as scientific and technical reports on the area of sustainable energy and development was examined. It was noted that there can be no development without energy and there can never be sustainable development without sustainable energy. There is need to sustainably exploit the energy resources to meet current energy needs and those of future generations in an environmentally friendly manner while noting that about 35% of the anthropogenic greenhouse gas emissions come from energy related activities in power generation. Technological advances which include smart grids and decentralization of generation as well as energy carrier technologies are rapidly providing electricity access options available beyond the traditional grid. The study showed that electrification of the global energy mix, electrification of the transport sector, energy efficiency measures and enhanced use of low carbon and renewable energy resources for electricity will play a significant role in the future sustainable energy transition. Additionally to realize energy sustainability effective measures include increased use of solar and wind for grid electricity, use of sustainable energy carriers like hydrogen, development and adoption of energy efficiency measures, limiting environmental impact of energy use including carbon sequestration and enhancing socioeconomic acceptability through community involvement and social acceptability, economic affordability and equity, lifestyles, land use and aesthetics. Whereas renewable energy is a solution to sustainable energy and electricity, current technology and limitation make it necessary to have an optimized mix of renewable and low carbon nonrenewable for sustainable grid electricity.

Session	Manufacturing Systems 1
Date	15/12/2020
Time	12:00 - 13:30
Chairs	Hyeong Suk NA <i>South Dakota School of Mines and Technology</i> Wen WANG <i>Shanghai Jiao Tong University</i>

IEEM20-P-0197/ Energy Management: Sustainable Approach Towards Industry 4.0

A. S. M. Monjurul Hasan, Andrea Trianni
University of Technology Sydney, Australia

Industry 4.0 concept is captivating the attention globally in a substantial rate that encompasses industrial digitalization with the means of advanced technical features. Maintaining the highest standard of industrial processes, Industry 4.0 demands to ensure energy efficiency also. Industries must ensure energy efficiency during the process flows, keeping in mind about the energy cost, carbon emission, and resource efficiency. Unfortunately, despite a significant potential for energy efficiency exists, that can be addressed by industries, implementing energy management practices. However, industries are still disinclined to take advantages of such opportunities. Research in this domain has little explored the potential relationships between energy management and Industry 4.0. In the paper, we aim at offering an overview of industrial energy management and related tools as well as Industry 4.0, preliminarily discussing potential opportunities and synergies.

IEEM20-P-1133/ Critical Success Factors for Internet of Things (IoT) Implementation in Manufacturing Companies in Indonesia: Literature Review and Future Research

Inaki M. Hakim, Moses L. Singih, I. Ketut Gunarta
Institut Teknologi Sepuluh Nopember, Indonesia

The implementation of IoT considers several factors to determine whether a company can apply IoT or not. There are endless possibilities, and numerous companies have already started their IoT journey. The implementation of IoT encourages increased productivity and quality, mainly supported by the use of technology. The application of IoT is an effort to automate and digitize production process with a marked increase in connectivity, interaction and boundaries between people, machines, and other resources through information and communication technology. Some of manufacturing companies in Indonesia has implemented IoT, so the industry will grow and be more competitive. Some implementation challenges of the IoT are data security issues, specific human characteristics, robust IoT platforms, data management, the need for a high level of stability and reliability in system integration. This article aims to highlight some critical factors companies need to consider for a successful IoT implementation in Indonesia.

IEEM20-P-0120/ Digital Twin Application for Production Optimization

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This paper is focused on the digital twin solution to validate the performance optimization of production lines. We propose three steps to approach the digital twin for production lines. As the first step, a simulation model is created to imitate real world behavior. After that, automation engineering is applied to communicate between real world and virtual model. A programmable logic controller (PLC) code is embedded as a communication language. Digital twin realization is shown by integration of simulation and automation. A case study presents how to bring practical benefits by applying the digital twin solution in production line virtual commissioning.

IEEM20-P-0123/ Adaptive Task Sharing in Human-Robot Interaction in Assembly

Christina Schmidbauer, Sebastian Schlund, Tudor B. Ionescu, Bernd Hader
TU Wien, Austria

The ongoing development of collaborative robots (cobots) bears great potential for assembly processes by enabling new possibilities of task allocation between humans and machines. A detailed, empirically based evaluation of how cobots can live up to these possibilities in industrial practice is still missing in the manufacturing literature. In this paper some of the existing shortcomings -referred to as "the productivity gap" - in current assembly automation processes are discussed. To cope with this gap, adaptive human-cobot task sharing is proposed and implemented as a complementary task allocation model. Its potential to increase productivity and flexibility in new and existing assembly applications is evaluated.

IEEM20-P-0134/ Enterprise-wide Value Stream Mapping: From Dysfunctional Organization to Cross-Functional, Collaborative Learning and Improvement

Daryl Powell¹, Cristina Bartolome²

¹*SINTEF Manufacturing AS, Norway*

²*Norwegian University of Science and Technology, Norway*

A value stream is defined as the set of all the specific actions required to bring a product through the three critical management tasks of any business: the problem-solving task, the information management task, and the physical transformation task. However, a headlong rush into adopting lean tools and techniques on the shop floor has resulted in the improvement of the information management and physical transformation tasks only, and has led many organizations towards a state of static process optimization rather than one of sustained lean growth. In this paper, we draw on practical insights from a multiple-firm action research initiative in two companies to present an alternative method for value stream mapping that also incorporates the problem-solving task. This technique has allowed the organizations to achieve not only sustainable improvement in operational performance, but also significant growth in people productivity. What emerged was a product-centric approach to cross-functional learning and improvement, which has implications for both lean theory and practice.

IEEM20-P-0054/ Design and Development of a Hydrothermal Reactor for Bio Coal Production for Application in Solid Waste Management Technologies

Michelle Mugaronji¹, Mercy Manyuchi², C. Mbohwa², Edison Muzenda², W. Stinner³, Nita Sukdeo³

¹*Harare Institute of Technology, Zimbabwe*

²*University of Johannesburg, South Africa*

³*Germany Biomass Research Center, Germany*

This paper focuses on the design and development of a hydrothermal carbonization (HTC) reactor for processing biomass (brewers spent grains) to 69 tons per day of bio coal at 220 °C as the carbonizing temperature. A batch operation was used and a reactor with a height of 4.7m and a diameter of 3.1m. Stainless steel was chosen as the material of construction and a residence time of 2 hours in the HTC reactor for optimum conversion to bio coal. The HAZOP and process control was done to ensure health and safety in the plan.

Session	Information Processing and Engineering 1
Date	15/12/2020
Time	14:30 - 16:00
Chairs	Gabriel FUENTES Centre for Applied Research at NHH Seung Ki MOON Nanyang Technological University

IEEM20-P-0161/ Research on Layout Design of Situation Interface Based on Comprehensive Importance Evaluation of Nodes

Hao Wu, Haiyan Wang, Xiaojiao Chen, Chengqi Xue
Southeast University, China

To optimize the layout design of the situation interface, this paper proposes a layout design method of situation interface based on comprehensive importance evaluation of nodes. Taking the AIS information service platform as an example, this paper first analyzes the typical tasks of the interface, and construct an information graphic cell network according to the association between the task and the interface information graphic cells; then build a node comprehensive importance evaluation model and classify the node importance levels; Finally, Re-layout the information graphic cells of different importance levels according to the interface layout insights and use CogTool to compare the performance of the typical tasks of the original interface and the redesigned interface, the results show that: the layout design of interface information elements based on the evaluation of the comprehensive importance of nodes can effectively improve the user's task operation efficiency. The research results can provide a reference for the layout optimization of the information graphic cells of the situation interface.

IEEM20-P-0164/ Exploring AI-Driven Business Models: Conceptualization and Expectations in the Machinery Industry

Carsten Hahn¹, Tim Traunecker², Manuel Niever¹, Gustav Basedow³

¹Karlsruhe University of Applied Sciences, Germany

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³esentri AG, Germany

Companies collecting and creating valuable insights with artificial intelligence (AI) are able to secure a decisive competitive advantage. Business model innovation serves as a strong competitive differentiator and together with technological progress, new businesses fueled by AI are created every year. The main scientific result of this research is the conceptualization of AI-driven business models and an overview about the target state and potentials of these business models in practice based on a descriptive study. AI-driven business models can be conceptualized as business models that use artificial intelligence technologies to build at least one of the business model components. Compared to data-driven business models, which constitute a subgroup of business models, AI-driven business models are based on a set of techniques, that learn and improve their performance without humans having to explicitly program them. The contribution to practice is made as the proposed potentials of developing these business models can support decision-makers in evaluating the use of AI technologies. Innovating its business model with the help of AI can help to survive in a highly competitive business environment.

IEEM20-P-0171/ A Pilot Study of Industry 4.0 Asset Interoperability Challenges in an Industry 4.0 Laboratory

Sune Chung Jepsen, Thomas Ingemann Mørk, Jakob Hviid, Torben Worm
University of Southern Denmark, Denmark

System integration is a crucial concept in the Industry 4.0 (I4.0) vision, where information processes supporting flexible production are digital. System integration paves the way for leveraging the Industrial Internet of Things, big data analysis, simulation, cloud computing, and augmented reality. The first step towards system integration is to examine the assets (machine software) ability to exchange information in an I4.0 setting. This paper aims to analyze challenges for asset interoperability by conducting asset integration in the University I4.0 laboratory (I4.0 lab). Conducting asset integration has been a part of building an Information Backbone (IB) as a minimum viable product in the I4.0 lab. An IB is a software infrastructure that involves integrating into various assets, e.g., warehouse, transport, and robotic systems, and providing communication among them. The pilot study reveals that the maturity of assets interoperability readiness are at very different levels, e.g. missing external interfaces, poor documentation, and varying technologies. These challenges need to be further addressed to collect architectural requirements for system integration, and establish a common vocabulary and understanding of I4.0 concepts.

IEEM20-P-0279/ Addressing Supply Chain Vulnerability by Supporting Emerging IT: An Analysis Based on SCOR Framework

Mengdi Wu¹, Zhaojun Yang¹, Jun Sun², Xueping Gong¹

¹Xidian University, China

²University of Texas Rio Grande Valley, United States

Due to the uncertainty of the external environment and the counter-globalization trend caused by the COVID-19 pandemic, supply chain vulnerability has become a prominent problem. Under this background, the development of emerging information technology (IT) provides a new means for enterprises to deal with the situation. A review of the existing literature shows that emerging IT can effectively improve the ability of enterprises to respond to supply chain risks. Based on the supply chain operation reference (SCOR) framework, this paper summarizes the factors pertaining to supply chain vulnerability. It then identifies five relevant emerging technologies: big data analysis (BDA), Internet of Things (IoT), blockchain (BC), radio frequency identification (RFID), additive manufacturing (3D printing). Their functional characteristics help alleviate the related vulnerabilities in the entire SCOR procedure of a supply chain. The analysis provides useful insights for enterprise managers to mitigate supply chain vulnerability with emerging IT technologies.

IEEM20-P-0402/ A Customized Smart Medical Mask For Healthcare Personnel

Noori Kim¹, Joslyn Jun Wei Lim², John Jie Ming Ying², Haining Zhang³, Seung Ki Moon³, Joonphil Choi³

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²Singapore Institute of Technology and Newcastle University in Singapore, Singapore

³Nanyang Technological University, Singapore

A medical mask is one of the vital Personal Protective Equipment (PPE) used by Healthcare Personnel (HCP) to protect themselves, patients, and others while providing their essential services to the public. HCPs all around the world are fighting on the frontlines of COVID-19. While they are saving people's lives from Coronavirus, it is also critical to monitor the HCPs' health conditions continuously. In this study, we propose a framework to develop a customized smart medical mask system to monitor the HCP's temperature and strain on the face. Aerosol Jet Printing (AJP) technology is applied to develop the mask that embeds 3D printed sensors with wireless function. The proposed design process utilizes a 3D scanned picture of an individual face, then analyzing its geometrical attributes to determine the adjusted places for the sensors on the mask and optimize the design parameters of the sensors. The two types of sensors, temperature, and strain are fabricated using the AJP technology. The temperature monitoring is to detect respiratory breathing fever and irregular, which is one of the symptoms of respiratory diseases. And strain monitoring is for alarming possible face irritation and bruising caused by tight sealing of masks. The sensing data is transmitted to the cloud for real-time monitoring purposes. This paper showcases the customized yet affordable additive manufacturing built on the Internet of Things technology for a personalized healthcare application to alarm workload and body condition of HCP.

IEEM20-P-0419/ A Spatial Framework for Extracting Suez Canal Transit Information from AIS

Gabriel Fuentes¹, Roar Adland²

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²NHH Norwegian School of Economics, Norway

The Suez Canal is one of the world's most important maritime routes, as shown by the almost 19,000 transits made every year. Despite its importance to seaborne trade, few statistics about the operation are available. This paper outlines a method to generate transit information from the matching of Automatic Identification System (AIS) ship tracking data and the modeled spatial environment of the Suez Canal. Additionally, important features such as the waiting time at anchor and the access routes to the Canal are extracted from adjustments to Density-Based Spatial Clustering of Applications with Noise (DBSCAN) algorithm. The algorithm is designed to be deployed in a distributed setting for the handling of big data sets.

Session	Operations Research 2
Date	15/12/2020
Time	16:30 - 18:00
Chairs	Ripon CHAKRABORTTY UNSW Canberra at ADFA Gitae KIM Hanbat National University

IEEM20-P-0030/ Performance Analysis of Greedy-based Construction Heuristics on Classical Vehicle Routing Problem

Yandong He¹, Mingyao Qi¹, Fuli Zhou², Huilin Li³

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²Zhengzhou University of Light Industry, China

³Shenzhen Yantian District People's Hospital, China

Vehicle Routing Problem (VRP) has been studying in the past 60 years, many versions of basic VRP has also been extended. In this paper, we introduce and design some greedy-based construction heuristics to obtain better initial feasible solutions for some classical VRP with time windows (VRPTW). This construction heuristics include basic greedy heuristics (BG), global K-greedy heuristics (GKG), random greedy heuristics (RG) and random K-greedy heuristics (RKG). At last the performance analysis of these heuristics is given about basic VRPTW and VRPTW with roaming delivery locations (VRPTW-RDL). Some interesting conclusions is given.

IEEM20-P-0042/ Optimization of Capacitated Vehicle Routing Problem for Recyclable Solid Waste Collection Using Genetic and Seed Genetic Algorithms Hybridized With Greedy Algorithm

Gevorg Guloyan, Ridvan Aydin

American University of the Middle East, Kuwait

There has been a growing interest in collecting recyclable waste to reduce total carbon emissions, generate economic growth, and promote total lifecycle sustainability. This paper studies capacitated vehicle routing problem (CVRP) related to recyclable solid waste collection. The problem differs from the classical CVRP in terms of considering a separate recycling station in addition to the main depot. Genetic Algorithm (GA) and Seed Genetic Algorithm (SGA) hybridized with Greedy Algorithm are proposed. The objective of this study is to determine the optimal routes for the collection and delivery of recyclable solid waste. Hybrid GA and hybrid SGA are used to find the optimal solution while minimizing the total traveling distance. In addition, a web-crawling bot is developed to generate the matrix of real distances rather than considering the Euclidean distances. A real case of collecting recyclable waste in Yerevan, Armenia by an NGO has been studied to evaluate the effectiveness of the proposed approach. The results show that SGA provides better solutions than GA, and that these algorithms are better than the solution adopted by the NGO.

IEEM20-P-0045/ A Large Neighbourhood Search Approach to Airline Schedule Disruption Recovery Problem

Kam K.H. Ng, Kin Lok Keung, Carman Ka Man Lee, Yuk Ting Hester Chow

The Hong Kong Polytechnic University, China

The occurrence of unplanned aircraft shortages and disruption of flight schedules during the day-to-day operations of airlines is inevitable. When equipment failure causes unsafe flight, the aircraft will be grounded or temporarily delayed when the weather shuts down the airport or the required flight crew is unavailable. Real-time decisions must be made to reduce revenue loss, passenger inconvenience and operating costs by reallocating available aircraft and cancelling or delaying flights. A large neighbourhood search algorithm is used in this research to construct a feasible and efficient solution to the airline schedule disruption recovery problem. We aim to reduce the aircraft turn-around times, including total delay time, the number of flight adjustments and the number of flights delayed for more than one hour, as an objective function. Ten real-life cases are solved, and the proposed approach yields an approximate 50% improvement in solution quality.

IEEM20-P-0162/ Model for Hazardous Material Transportation Problem via Lane Reservation Under Considering Environmental Risk

Zhen Zhou, Haoyan Zhao

Northwestern Polytechnical University, China

This paper investigated a hazardous material transportation problem via lane reservation under considering environmental risk. A new bi-objective model for it is formulated. Then two delicate preprocessing techniques are developed based on some properties of the investigated problem. On this basis, the investigated problem is solved by an improved ϵ -constraint method. Finally, the performance evaluation of the proposed model and method is given by a real-network-topology-based instance. The computational results show that the proposed model and method are effective.

IEEM20-P-0189/ A Multi-objective Emergency Scheduling Model for Forest Fires with Priority Areas

Lubing Wang, Peng Wu, Feng Chu

Fuzhou University, China

With global warming, the probability of forest fires is increasing greatly, and more research attention has been paid to forest fires emergency scheduling. This paper addresses a resource-constrained emergency scheduling problem for dealing with forest fires with priority disaster areas. It aims to determine an optimal fire-fighting scheduling plan for multiple forest fire points to minimize the total transport distance and the fire extinguishing rescue time, simultaneously. To effectively solve this problem, we formulate a multi-objective mixed-integer linear programming model, and an iterative and fuzzy logic decision-making based on ϵ -constraint -constraint method is designed to obtain a preferred emergency scheduling scheme. Finally, the computational results on benchmark and randomly generate test instances verify the effectiveness and feasibility of the proposed model and method.

IEEM20-P-0242/ An Order-First Split-Second Approach to a Novel Variant of the Cardinality-Constrained Covering Traveling Salesperson Problem

Chantal Schöni, Philipp Baumann, Norbert Trautmann

University of Bern, Switzerland

We deal with the following application of the cardinality-constrained covering traveling salesperson problem. A company offers the valuation of real-estate properties, which includes an on-site visit by a contractor. Each contractor visits several properties during a tour, which must comprise not less than a minimum and not more than a maximum number of visits and must not exceed a prescribed length. Given a set of properties, the planning problem is to determine the respective tours such that the total relevant cost of all tours is minimized; for each tour, this cost consists of some fixed costs plus some variable costs proportional to the total distance of the tour. We propose a novel order first split-second approach which at first devises a giant tour, then splits this tour into feasible tours, and eventually tries to improve these tours individually. Our computational results for a set of test instances from the literature indicate that the proposed approach runs much faster than the reference approaches and devises good feasible solutions; for the largest instances, the proposed approach even outperforms the reference approaches.

Session	Poster Session 1
Date	15/12/2020
Time	10:00 - 11:30
Chairs	Ai Chin THOO <i>Universiti Teknologi Malaysia</i> Roger JIAO <i>Georgia Institute of Technology</i>

IEEM20-P-1073/ The Key Success Factor for Attracting Foreign Investment After the Popularity of COVID-19

San-Weng Huang¹, James Liou¹, Gwo-Hshiung Tzeng²

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²National Taipei University, Taiwan

COVID-19 has had a devastating impact on the world economy. In order to stabilize the economic situation, governments of various countries have proposed economic development strategies. In the past, promoting investment has been one of the important means by which governments of various countries promote national economic development. After the epidemic, global resources will be redistributed, and how to increase advantages to attract foreign capital will be crucial. In the past, scholars used statistical and economic models for discussion. However, factors in the real world should influence each other. Therefore, this study will use the decision experiment and evaluation laboratory (DEMATEL) method to explore the key factors that enhance the national advantage after the outbreak. The case will be comprehensively discussed with countries with excellent international epidemic prevention performance.

IEEM20-P-0364/ Productivity Evaluation of Asia Textile Industry

H. T. Tsai¹, T. H. Ho², Chia-Nan Wang²

¹Jinn Her Enterprise Co., Ltd., Taiwan

²National Kaohsiung University of Science and Technology, Taiwan

In recent years, textile industry is considered "key" by the advantages: less investment, payback fast, cheap and abundant labor, solves many jobs and contribute largely on exports, nearness to growing markets. Beside that recent liberalization of the world's textile and apparel trade policies facilitate to the Asian region has become a potential global center for textile and clothing exports. This research develops an integrated method based on data envelopment analysis (DEA) to establish an assessment model management performance of the group countries market, which has been one of the Asia biggest and most attractive marketplace and by using the Malmquist productivity index (MPI), we can estimate the productivity change in the textile industry.

IEEM20-P-0439/ Optimized Layout of Emergency Monitoring for Sudden Marine Pollution Accidents

Xiaotian Liang, Yu Guo, Weitao Xiong, Qingqing Yang, Jiang Jiang

National University of Defense Technology, China

The selection of monitoring sites in emergency monitoring of sudden marine pollution accidents is directly related to the reliability of monitoring results. Firstly, this paper creatively puts forward the concept and calculation model of the effectiveness of monitoring sites, which is described in terms of the pollutant concentration and the sensitivity of the region. Then, taking the maximum of the effectiveness of monitoring sites and the minimum of the number of monitoring sites as the objective function, and considering the constraints such as monitoring resource capacity and monitoring risk, a multi-objective optimization model is constructed, and the Pareto frontier is obtained by using NSGA-II algorithm, after which the most satisfactory scheme is selected by the weighted TOPSIS method. Finally, an example is given to illustrate the feasibility of the model, which can quickly give a scientific, reasonable, economical and efficient scheme for the layout of monitoring sites and provide decision support for marine emergency monitoring.

IEEM20-P-0158/ Advance Selling Decision for Perishable Products in the Presence of Strategic Consumers

Yanli Fang¹, Zhuoyi Ren², Zhaobin Wei¹

¹Huizhou University, China

²Guizhou University, China

The advance selling strategy is often used in the sales process of perishable products with a short life cycle. The advance sales can encourage more strategic consumers to buy the product in advance with a discount price due to the extended sales period, but may also bring more profits for the seller. The seller often faces a newsvendor problem, i.e., they must order the joint decisions about an advance-selling price and inventory with uncertain demand in a two-period season, where the first period is the advance selling period and the second is the spot selling (and consumption) period. This paper establishes a two-period theoretical model to discuss the interaction

between the advance selling decisions and consumers' strategic purchasing behaviors. The game model show how the seller should optimally respond to consumers' strategic behavior and characterize a cost threshold above which they should whether to advance sell. Finally, it is found that the advance selling strategy is not always optimal, but is related to the parameters of the cost per unit, the consumers' valuations and heterogeneity.

IEEM20-P-0172/ Resource Allocation of Internet Display Advertising Considering Multiple Metric Constraints

Hanmin Wang, Xinglu Liu, Wai Kin (Victor) Chan

Tsinghua University, China

In this work, we investigate the resource allocation problem in contract display advertising with a learning and planning approach. We formulate the problem as a mixed integer nonlinear programming, aiming to determine the resource allocation strategy in each advertising slot with CPC (cost per click), CPA (cost per action), CPM (cost per mille), CTR (click through rate), and budget constraints, thus maximizing the total page view. Since that the page view (PV) prediction is extremely complex, we assume our PV prediction function is concave and then we learn the PV prediction function for each slot using historical data. The concave assumption makes our objective function nonlinear, and we employ a piecewise linear approach to approximate PV function. To test the proposed model, we conduct numerical experiments with real data from the company. Results reveal that the proposed model outperforms the current allocation strategy. Moreover, our approach significantly increases the total contract page view and lowers the overall CPM.

IEEM20-P-1112/ Perceived Sustainability Performance of Eco-Industrial Park Through Environmental Consciousness and Strategic Intention

Ai Chin Thoo¹, Jin Ming Ngang¹, Zuraidah Sulaiman¹, Norhayati Zakuan¹, Hon Tat Huam²

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In Malaysia, there are an average of approximately 13,000 tonnes of industrial waste produced every day with low solid waste recycling rate of 15%. This study aims to examine the levels and components of environmental consciousness (e.g. attitude, subjective norm, perceived behavioral control), eco-industrial park strategic intention and perceived sustainability performance of Malaysian manufacturing industries on implementation of eco-industrial park. A total of 78 samples were collected using quantitative method through manual questionnaires distribution and Google Form. Purposive sampling technique was employed to select respondents who involved in manufacturing industries. Structural equation modeling (SEM) was employed for data analysis. The findings showed that attitude and subjective norm are not positively related to eco-industrial park strategic intention while perceived behavioral control has a positive and significant relationship with eco-industrial park strategic intention. In addition, eco-industrial park strategic intention is positively related to perceived sustainability performance on implementation of eco-industrial park. This study is expected to contribute to Malaysia government, practitioners and academicians about environmental consciousness level, eco-industrial park strategic intention and perceived sustainability performance on implementation of eco-industrial park in Malaysia.

IEEM20-P-0224/ Applying K-Means Technique and Decision Tree Analysis to Predict Taiwan ETF Performance

Keng-Chieh Yang, Wen-Ping Chao

National Kaohsiung University of Science and Technology, Taiwan

Exchange traded fund (ETF) is called stock index fund or exchange-traded fund. ETF is a mutual fund that passively tracks the performance of an index and is listed on a stock market, like ordinary stock trading for trading. ETF index funds are buying a basket at a time including stocks, bonds, foreign currencies, etc. This study explores the performance and investment decision analysis of Taiwan ETFs. We use Weka software for data exploration and analysis. The data is downloaded from Taiwan Economic Journal (TEJ) database. A total of 229 ETF data are analyzed. This study uses K-mean analysis to measure the performance of ETFs in Taiwan. In addition, decision tree analysis is used for further analysis. We also propose good performance ETFs. The findings can provide investors for ETF selection.

IEEM20-P-0207/ What Core Competence Can Students Learn from Off-Campus Internship?

Feng-Ming Sui¹, Jen-Chia Chang², Hsi-Chi Hsiao³

¹Hwa Hsia University of Technology/National Taipei University of Technology, Taiwan

²National Taipei University of Technology, Taiwan

³Cheng Shiu University, Taiwan

The purpose of this study is to determine the viewpoints of the industry and academe on core competencies expected of students after completing off-campus internships and the gap in expectations and realizations. Results show that compared to the academia, the industry gave greater emphasis to core competencies. The “general core” competency dimension consist of two competencies: “Understanding the overview of internship institution operations” and “Understanding guild regulations.” the “professional core” competency dimension consists of three competencies: “Related system testing and application competency,” “The ability to collect and analyze data” and “The ability to discover practical and technical problems”. It is suggested that schools should set up an off-campus internship counseling unit to equip students with internationalization, globalization and industry and community-based work experiences. Skills, attitude, and behaviors are emphasized in learning how to manage workplaces in different fields, thereby assisting students in gaining an insight into and planning their careers. Schools should also regularly make arrangement for instructors to go to companies for professional or technology-related seminars or researches, thereby enhancing the practical teaching competency of instructors.

IEEM20-P-0216/ Internet-based Collaborative Design, Manufacturing, and Supply Chain for Manufacturing Companies

Xin Yuan¹, Yiwen Chen², Qibo Zhang², Xinguo Ming¹

¹Shanghai Jiao Tong University, China

²National University of Singapore, Singapore

Collaborative framework in manufacturing has drawn wide attention. There exist huge methods and discussions on this topic under designing, supply chain, and manufacturing. With a motivation to improve system efficiency and give higher capital turnover, this work provides the following two parts. Firstly, this work designs a collaborative framework and methods in the designing, supply chain, and manufacturing. Next, this work plans potential collaboration methods with any two of those three components and gives illustrations. The result of this work, the six designed framework and methods aims to potentially achieve the intelligent and automated production logistics system, the entire process information management, fast capital turnover, transparent cost, accurate, smart manufacturing system, and the intelligent interconnection of equipment and human-machine systems with the least investment, quick output, and large output

IEEM20-P-0132/ Personal Health Mention Identification from Tweets Using Convolutional Neural Network

Yue Wang¹, Xiang Li², Daniel Y. Mo¹

¹The Hong Kong University of Science and Technology, Hong Kong SAR

²City University of Hong Kong, Hong Kong SAR

The past decade witnesses the unprecedented growth of social media users worldwide. People express health related outcomes, information, and views on social media platforms. This provides many opportunities to utilize the data source for health monitoring and surveillance, and digital epidemiology in real time. Personal health mention (PHM) is among one of the critical tasks for such purpose. It tries to identify whether a person's health condition is mentioned in a sentence. However, social media texts contain noises, many creative and novel phrases, sarcastic emoji expressions, and misspellings. This poses challenges to detect PHM from social media text. This paper explores the PHM identification task for six diseases from twitter using convolutional neural network (CNN). Specifically, word embeddings are used to encode the twitter text. Then they are fed into CNN structure to train the classifier for PHM identification. We also explore how the performance of different methods are affected by data imbalance issue and training sample size.

Session

Poster Session 2

Date

15/12/2020

Time

19:00 - 20:30

Chairs

Seung Ki MOON Nanyang Technological University

Omid Fatahi VALILAI Jacobs University Bremen

gGmbH

IEEM20-P-0292/ What Makes Consumers More Strategic? Evidence from an Experimental Study

Yi Liu, Qiyuan Li, Yan Chen

Macau University of Science and Technology, China

In a business environment full of dynamic pricing schemes and complex marketing strategies, modern customers get more strategic with their purchase decisions. Ignoring strategic consumer behavior can seriously damage a firm's business performance. Previous studies have proposed some countermeasures to alleviate the negative impacts of strategic consumer behavior. In this study, a scenario-based experimental study is conducted to identify possible factors which will impact customers' strategic waiting. Our experimental results show that the higher the price of the product, the more likely the customers will postpone their purchase and wait for price cut. In addition, high discount rate encourages customers to wait for the anticipated future discounts, while late discount impedes them to do so. In addition, we find that the information display strategy plays a completely different role when product price is different. Specifically, displaying only one impede customers' strategic waiting when product price is low, while it actually encourages customers' strategic waiting when product price is high, which is typically not desired by retailers.

IEEM20-P-0295/ Classification and Weighting of Strategic Projects in Organizations Under Multi-Criteria Decision-Making Situations

Fernanda Souza, Thais Rodrigues, Rodolfo Cardoso, Edwin Meza, Carlos

Frederico Barros

Federal Fluminense University, Brazil

Strategic Planning Alignment of all company organizational units facilitates a systemic holistic vision that favors efficient management. Thus, identifying each organizational unit's contribution is an essential step toward strengthening integration among Brazilian regulatory agencies on a vast set of different regulatory objects. This article addresses the Strategic Planning Realignment of a Brazilian regulatory agency from 2020 to 2030, by presenting a Voting Method, based on an Analytical Hierarchical Process for weighting and ranking projects linked to the strategic objectives of said agency. As a result, a high adherence to priorities (over 60%) arising from the hierarchical choice of Board of Directors for a strategic monitoring of projects and a high adherence of participants to the methodology (over 60%), denotes the concern with strategic effort selection.

IEEM20-P-0537/ Trade-terms Based Pricing Method for Export Commodity

Shijin Wang, Jiaolong Wang

Tongji University, China

By far, the researches on the pricing methods of export commodity from China are very limited. This paper proposes a pricing model for export commodity by taking risk factors and trade terms into account. More specifically, the pricing of bulk export commodities is affected by many factors, including cost factors, market supply and demand factors and risk factors. Cost factors include production costs and logistics costs, market supply and demand factors represent that commodity prices are affected by market supply and demand conditions, and risk factors mainly mean that different choices of trade terms, cost, insurance and freight (CIF) or free on board (FOB), will cause suppliers to bear different risks. In this paper, the economic order quantity (EOQ) model is used to quantify production costs, the “base price + freight index fluctuation” model and the “base price + fuel price fluctuation” model are used to quantify logistics costs, and the risk costs under the influence of risk factors are calculated based on historical data. Finally, a pricing model for commodities based on different trade terms (CIF or FOB) is established, and the optimal prices can be determined.

IEEM20-P-0360/ Research on the Relationship Between Self-identity and Organizational Citizenship Behavior of the New Generation Knowledge Workers - The Mediating Effects of Organizational Identification

Shuyan Gong
Northwestern Polytechnical University, China

The paper tends to study the influence of self-identity of the new generation knowledge workers on organizational citizenship behavior (OCB) and the mediating effects of workers' organizational identification from the perspective of Social Identity Theory. The research is carried out on a total of 610 valid questionnaires with the object of 800 new generation knowledge workers from 10 enterprises respectively located in China's Shanghai, Nanjing, Zhengzhou and Xi'an. The data obtained is processed by Exploratory Factor Analysis and Confirmatory Factor Analysis and the overall model is analyzed through Structural Equation Modeling. Finally, the article concludes that the self-identity of new generation knowledge workers has a significant positive impact on OCB during which workers' organizational identification acts as a mediator.

IEEM20-P-0553/ Research on Key Factors of Total Social Welfare System of Car Hailing Industry-Based on DEMATEL Method

Huafeng Cong, Rui Miao
Shanghai Jiao Tong University, China

Car hailing service is an important part of urban governance. The passengers, the enterprise and the government are three main participants of car hailing service. To evaluate and improve the total social welfare of car hailing industry, an index system considering the three participants as three dimensions is established, in addition, the DEMATEL (Decision Making Trial and Evaluation Laboratory) method is used to identify the key factor of the system and research the association rules among different dimensions. Finally, through an investigation case of a car hailing company, the key factors of total social welfare system are found and analyzed, from where the service operation methods for different dimensions are proposed.

IEEM20-P-0437/ A Procedure for Product Variety Reduction that Considers Linked Revenue

Tobias Kondrup Andersen¹, Anders Haug², Lars Hvam¹

¹*Technical University of Denmark, Denmark*

²*University of Southern Denmark, Denmark*

Manufacturing companies are facing rising complexity due to customer demands for customized products and additional support services. This complexity comes at a high cost, and the benefits to be gained from product variety reduction projects are therefore significant. Several methods for the reduction of product complexity have been proposed in the literature. Such methods, however, to a large extent fail to consider the role of "linked revenue", i.e., the revenue from the sales of product variants that is lost if other product variants bought by the same customers are eliminated. To address this gap in the literature, this paper develops a procedure for product variety reduction that considers linked revenue. The procedure supports managers in (1) identifying unprofitable products that can be pruned without risking the linked revenue of vital customers, (2) systematically evaluating the profitability and potential of these products, and (3) collecting feedback from affected account managers, before finally deciding which products to eliminate. The procedure is tested using a case study, which shows promising results.

IEEM20-P-0027/ Using Online Big Data for Determining the Importance of Product Attributes

Hanan Yakubu, C.K. Kwong
The Hong Kong Polytechnic University, China

The proliferation of e-commerce websites in recent times have spurred the number of online reviews on products generated online. This rapid development of e-commerce is usually accompanied by the desire of consumers to search for more information on a product before making any purchase. These two activities undertaken by consumers who tend to purchase products online, generates large volumes of data that provides some useful insight for product manufacturers. The data generated from online reviews and consumers online search activity on a product could help product manufacturers to determine the needs and requirements of consumers. Using data mining methods, this study proposes a methodology to estimate the value of the importance of product attributes. These product attributes are the customers' needs and requirements mined from online reviews and consumers' online search data. This study proposes to use Shapley value and Choquet integral to determine the importance of product attributes from online big data.

IEEM20-P-0549/ An Application on Building Information Model to Procurement Strategy of Copper Raw Material with Big Data Analytics

Sheng-Tun Li¹, Kuei-Chen Chiu², Tsung-He Chiu¹

¹*National Cheng Kung University, Taiwan*

²*Shih Chien University, Taiwan*

This research uses big data analysis to find the key factors of copper futures price fluctuations, successfully predicts copper price fluctuations, and applies them to the purchase strategy of copper raw materials for plant construction to help reduce plant construction costs. Since copper is an indispensable raw material in all building structures and pipeline configuration, the control of prices will help manufacturers from all walks of life to control the fluctuations in the price of copper raw materials and reduce the cost of building plants in the early stage of plant construction. Manufacturers "win at the starting point."

IEEM20-P-1134/ Aerosol Jet Printed Temperature Sensor for Wireless Monitoring

Joslyn Jun Wei Lim¹, Joonphil Choi², Seung Ki Moon², Haining Zhang², Noori Kim³

¹*Singapore Institute of Technology and Newcastle University in Singapore, Singapore*

²*Nanyang Technological University, Singapore*

³*Newcastle University in Singapore, Singapore*

Due to the current outbreak globally, Covid-19, it is crucial to keep monitoring temperatures for all those who have a chance of infection. As fever is one of the common symptoms of this disease, it is necessary to measure each individual's temperature, especially in the area where more people are present. Therefore, a three-dimensional (3D) printed temperature sensor with wireless function for medical applications is proposed. The sensing prototype is fabricated to detect and transmit users' body temperature to the cloud for real-time monitoring. The wireless temperature sensor is printed using the Aerosol Jet Printing (AJP) technique onto the substrate, polyimide (PI) with conductive ink, silver (Ag). This poster showcases the development of the temperature sensor using the AJP technique for medical applications. The strengths and limitations of various 3D printing methods, printed materials, and sensing prototype design are briefly discussed. Lastly, this work will end with a conclusion and future perspective of the field. The system has been suggested to be implemented in the clinical environment to lighten medical professionals' workload by providing efficient patient health monitoring.

IEEM20-P-1158/ The Managers Kit Turbo: Setting Up and Establish Teams in Case of an Emergency of a Manufacturing Cell

Samuel Bassetto, El Hassan El Mekkaoui

Polytechnique Montréal, Canada

This paper describes the managers support Kit to promptly install teams in case of an emergency of a manufacturing cell according to known best practices in industrial engineering aspects and allowing them to operate quickly and sustainably. The objective of the project is to provide full guide to the team leaders for a (very) rapid groups/teams creation in emergency infrastructure, field hospitals, temporary logistics sites, reception of refugee populations, etc. The structure, operation and animation of the teams are essential to ensure that operational performance is achieved as quickly as possible and supported by mechanisms of continuous improvement and respect for the limited capacity of the resources employed. The project will synthesize two tools developed over several years of research-action at the Polytechnique Montreal laboratory CIMAR-LAB: the FUSÉE guide and the FOCAL guide. These tools were adapted to be integrated into the situation of this pandemic COVID-19. A case study at two Canadian manufacturing organizations was used to collect empirical data and to analyse important aspects of this project. This guide is named TURBO: All United, Resilient, Better Organized.

Session	Supply Chain Management 3
Date	16/12/2020
Time	08:00 - 09:30
Chairs	Adnan HASSAN <i>Universiti Teknologi Malaysia</i> Yugowati PRAHARSI <i>Shipbuilding Institute of Polytechnic Surabaya</i>

IEEM20-P-0397/ Optimal Decisions for Reverse Supply Chain Considering IERs of Dual Collection Channel

Qiaolun Gu¹, Tiegang Gao²

¹Tianjin University of Technology and Education, China

²Nankai University, China

As one collection channel, online collection of used-products in reverse supply chain has become very important. In reverse supply chain with IERs (Inspection Error Rates) and dual collection channel, the dual collection channel refers to online collection channel and traditional offline collection channel. In online collection channel, the remanufacturer collects used-products via his collection center. In offline collection channel, the third party collector is responsible for collecting used-products. After collecting, the collection center and the third party collector carry out inspection activities with IERs. Considering their different IERs, we present the optimal price decisions for the third party collector, the remanufacturer and his collection center. By numerical example, we analyze the impacts of IERs and market share ratio on the optimal decisions. The research results show that: the third party collector intends to decrease his IERs so as to get more profits, and the remanufacturer's profit also increase owing to the IERs decreasing; however, the remanufacturer should pay more attention to the IERs decreasing in order to avoid losing market share ratio.

IEEM20-P-0425/ Risk Analysis of Upstream Halal Supply Chain in Meat Industry in Indonesia Using DEMATEL-Based ANP

Safira Hazhiyah Ikramina Busyra, Romadhani Ardi
Universitas Indonesia, Indonesia

Food safety and halal context become major aspects for consumers. In the supply chain, players in each function will face problem that make food contaminated. In the halal supply chain, products which is food can easily lose its halal status because is contaminations in the process of supply chain. Halal practice is should be applied in the whole processes of chain from farm-to-fork so that creates Halal Toyyiban. In the practice of halal supply chain there can be risks of contamination with halal food. Many study have identified risk in halal supply chain, but most of study is only accomplished in certain activity. This study aims to develop a risk analysis and priority model in the upstream level of halal supply chain meat industry. This study used a semi-quantitative method with Multi Criteria Decision Making (MCDM) approach that used DEMATEL-Based ANP (DANP) to find out the correlation between 6 dimensions and the important of the 40 risks in the dimensions.

IEEM20-P-0426/ Prioritizing Risks of Halal Meat Supply Chain in Indonesian Downstream Sector Using DEMATEL-Based ANP

Nadya Rishelin, Romadhani Ardi
Universitas Indonesia, Indonesia

Meat supply chain is vulnerable to non-halal and bacteria. Although many food and beverage products in Indonesia are halal certified, there is still the possibility of cross-contamination with non-halal, especially in the downstream sector. This study focuses on prioritizing halal supply chain risk of meat, especially beef in the downstream sector. Downstream sector of the meat supply chain in Indonesia consists of logistics, wholesalers, and food services. This study uses two steps that consists of risk identification through the literature review and expert validation, as well as risk prioritization using DEMATEL (Decision Making Evaluation and Laboratory) based ANP (Analytical Network Process) (DANP) method. The results are Network Relations Map (NRM) between three dimensions and 48 risks, as well as criteria weighting of each risk.

IEEM20-P-0429/ Supply Chain Risk Assessment of Generic Medicine in Indonesia Using DEMATEL-Based ANP (DANP)

Sukma Azzah Kharisma, Romadhani Ardi
Universitas Indonesia, Indonesia

In healthcare, pharmaceutical services are an inseparable part to support its sustainability by providing pharmaceutical products, including medicines. In Indonesia, the majority of prescribed medicines are generic medicines since the government of Indonesia published a regulation to prescribe generic medicines at the government's health facilities, including health facilities that cooperate with Jaminan Kesehatan Nasional (JKN), a national health insurance system. In result, the demand for generic medicines will increase as JKN participants increase. However, risks or uncertainties in the supply chain activities can hinder generic medicines supply. Therefore, this study aims to develop supply chain risk management of generic medicines in Indonesia with results to prioritize the risks. A Multiple-criteria decision-making (MCDM), DEMATEL (Decision Making Evaluation and Laboratory) based ANP (Analytical Network Process) (DANP) was used to assess the risks. The relations among risks also discussed in this study. The results show that the top five risks involve in generic medicines supply chain in Indonesia are shipping delay, failed to meet production capacity, the inefficiency of finance plan & realization, production process failure, and increase price of raw material.

IEEM20-P-0462/ Production and Pricing Decisions in a Product-Service System Supply Chain

Qingwei Wang¹, Meimei Zheng¹, Wei Weng²

¹Shanghai Jiao Tong University, China

²Kanazawa University, Japan

This research investigates a supply chain where a manufacturer sells products bundled with services to customers while satisfying the service level commitment. The demand is random and is sensitive to the selling price and the manufacturer's service level commitment. The manufacturer simultaneously decides the production quantity, the amount of service capacity and the retail price before the selling season. We develop a stylized model to derive the manufacturer's optimal decisions. We get the conditions in which the service capacity and the production quantity increase or decrease with the selling price. Numerical analysis shows that as the responsiveness of demand to the sales price increases, the service capacity and production quantity decrease.

IEEM20-P-0493/ DEMATEL-Based Analytic Network Process (ANP) Approach to Assess the Vaccine Supply Chain Risk in Indonesia

Annisa Chairani Sudarmin, Romadhani Ardi
Universitas Indonesia, Indonesia

The vaccine is a great discovery that is weak against a certain temperature. Storing it at the wrong temperature can damage the vaccine. Vaccines require cold chains in the supply chain that control the temperature and humidity of the vaccine to maintain its potential from the vaccine production process to the vaccine administration to the patient. Stakeholders must follow standard cold chain management procedures consistently. Due to the many risks that are surrounding it, risk management is necessary in order to run the supply chain efficiently. This study aims to provide a risk assessment in the vaccine supply chain in Indonesia with results to prioritize the risks. MCDM method, DEMATEL based ANP (DANP), was used to assess the risks. The relations among risks also discussed in this study. The results show that the five highest ranks of risks involve in Indonesia's vaccine supply chain are storage and warehousing, costs related to material supply, risk in planning & production scheduling or product order planning, transportation cost, and competitive risk.

Session	Production Planning and Control 2
Date	16/12/2020
Time	10:00 - 11:30
Chairs	Yaqiong LV <i>Wuhan University of Technology</i> Ding ZHANG <i>City University of Hong Kong</i>

IEEM20-P-0180/ Simulation Optimization Framework for Online Deployment and Adjustment of Reconfigurable Machines in Job Shops

Xuechen Feng, Ziqi Zhao, Canrong Zhang
Tsinghua University, China

In the era of Industry 4.0, to cope with the complex, volatile and fiercely competitive market environment, factories have to become more and more intelligent, flexible, and agile. This paper studies the reconfigurable machine deployment and adjustment problem in the multi-product job shop. This problem belongs to production process control and is part of the digital factory, as it forecasts the future performance for the adjustment of the reconfigurable machines in an online manner. To be more specific, we design an online simulation control system based on digital twin, which integrates the function of monitoring, decision-making and control. We use simulation optimization and design heuristic algorithm to solve the multi-objective capacity adjustment decision-making problem. The simulation results show the effectiveness and stability of the system and can be used to cope with the complex and ever-changing industrial environment such as machine breakdowns and rush orders.

IEEM20-P-0202/ Implementing Real-time Scheduling System for a Precision Engineering Company in Singapore

Sisui Ngho, Tay Jin Chua, Tian Xiang Cai, Ravi Kumar Katru, Clement Tan Beng Kwee, Xinlin Lin, Martin Choo Boon Yang, Wei Qing Lee
Singapore Institute of Manufacturing Technology, Singapore

A good Advanced Planning and Scheduling (APS) system APS helps to improve the order fulfilment process by providing real-time delivery commitment to customer order. However, the implementation of which can be difficult as it involves a great deal of business process improvement effort, which may involve some cleaning up of existing data, evaluation of the current work order tracking practices, re-evaluating bills of material and more. Such processes must take into account operational scenarios that are difficult to model and capture in a theoretical research paper, but are key to implementing an APS system. This paper deals with the challenges of real-world operational challenges of implementing an APS system and the software features, business improvements and operational workflow changes required to overcome these challenges for productivity gain.

IEEM20-P-0227/ Production Decisions for Standard and Customized Products with Postponement

Xiaoqian Shi, Jie Lin, Meimei Zheng
Shanghai Jiao Tong University, China

In this study, we analyze the optimal production decisions for standard and customized products. The manufacturer produces standard products in a make-to-stock fashion and customized products with a postponement strategy. Due to the high production cost of customized products with a postponement strategy, the manufacturer may not benefit from postponement in some cases. We investigate the condition in which producing customized products with postponement is beneficial for the manufacturer. Numerical examples reveal that it is more beneficial to produce customized products with postponement when the cost of preparing general components is relatively small (where the total cost of producing customized products keeps constant) and demand uncertainty is relatively high.

IEEM20-P-0449/ Allocation Optimization for Subscription Box Services

Ayca Erdogan, Ayse Gundogdu Senturk, Jonathan Balasingham
San Jose State University, United States

The subscription-based models are getting increasingly popular. The most well-known examples are streaming services, food services and monthly subscription boxes. This study considers a hypothetical company with subscription-based customized package as a product. In this type of systems, the demand is for the subscribed packages provided by the company based on the customer preferences, and the company needs to determine the product assortment in the package at each period. We propose two mixed integer programming models for the optimal selection of products to subscription bags while minimizing the total cost of operations or maximizing subscriber satisfaction. We compare cost and satisfaction scores of models to provide insights. We define a general framework for creating a mathematical optimization model for subscription-based services. We segment product by brand value, such as luxury, mid-tier and affordable, to create flexibility and better understand the customer satisfaction and cost. We define a success metric for satisfaction per cost to compare various scenarios with and without product segmentation. We observed that affordable products are a good way to keep the cost down and satisfaction levels adequate.

IEEM20-P-0130/ Simulation-based Assembly Line Balancing in U-shaped, Parallel U-shaped, and Parallel Adjacent U-shaped Layouts

Pheaktra Doung¹, Ronnachai Sirovetnukul¹, Jun Ren²
¹*Mahidol University, Thailand*

²*Liverpool John Moores University, United Kingdom*

This research focuses on simulation-based assembly line balancing by investigating three configurations in U-shaped assembly lines. The names of the three layouts are U-shaped lines, parallel U-shaped lines (PUL), and parallel adjacent U-shaped lines (PAUL). Since PUL and PAUL were proposed with limited implementations, this study adopts secondary data from a real case industry and models the selected layouts using ARENA simulation. Simulation results are utilized to compare the performances of the three layouts in terms of the number of workstations, line efficiency, and workload smoothness. Some tradeoffs are observed and discussed for the layouts and the selected KPIs. The results show that PAUL outperforms the U-shaped and PUL, but its average waiting time increases due to the least number of operators. Also, the total outputs lower as the cycle time increases. PAUL is a promising layout for improvement and implementation.

Session	Supply Chain Management 4
Date	16/12/2020
Time	12:00 - 13:30
Chairs	Gitae KIM <i>Hanbat National University</i> Aries SUSANTY <i>Diponegoro University Indonesia</i>

IEEM20-P-0136/ Sustainability Assessment of Contract Farming Broiler Chicken Supply Chain Using Rap-Poultry

Aries Susanty, Nia Budi Puspitasari, Ratna Purwaningsih, Ardina Ruri Siregar

Diponegoro University, Indonesia

This study aims to assess and compare sustainable performance on the economic, social, and environmental of the two contract farming broiler chicken supply chains (PT Ciomas Adisatwa and PT Charoen Pokphand). The study also aims to propose some recommendations based on sensitive indicators. The study was carried out using Rapid Appraisal for Poultry (Rap-Poultry) with Multidimensional Scaling (MDS), leverage analysis, Monte Carlo, and Delphi method. The data for measuring the sustainability of broiler chicken supply chains were collected from 60 farmers, who were located in Semarang, Demak, Kudus, Pati, and Rembang District, and 4 chicken slaughterhouse. Among 60 farmers who were being sampled, 30 were associated with PT Ciomas Adisatwa, which is a subsidiary of Japfa Comfeed and 30 were associated with PT Charoen Pokphand. The results showed that the broiler chicken supply chain that belongs to contract farming with PT Ciomas Adisatwa and PT Charoen Pokphand has a value of 57.67 and 59.63, both with moderate sustainability.

IEEM20-P-0138/ Vehicle Arrangement Problem for an Automobile Carrier Terminal

Etsuko Nishimura, H. Guo

Kobe University, Japan

Recent years, the production base of vehicles is globalization, and the transportation volume of finished vehicles is increasing dramatically. The terminal used as a hub exists in automobile carrier terminals as well as container terminals. This study considers the operational planning of an automobile carrier terminal. First, we focus on the automobile carrier operation company with the top of fleet size in the world. The feature of the layout of a terminal at which the ship operated by that company calls is investigated. Next, as a hub port of an automobile carrier terminal, that terminal in Singapore is the subject of consideration. The problem which arranges a finished vehicle in the parking sequence in a transshipment terminal is modelled. As the computational results, it is shown that the total service time greatly depends on the frequency of ship calling port with large number of vehicles handled, and the way to give a berth served.

IEEM20-P-0147/ Bi-objective Multistage Decentralized Supply Chain Planning

Marjia Haque¹, Sanjoy Kumar Paul², Ruhul Sarker¹, Daryl Essam¹

¹University of New South Wales, Canberra, Australia

²University of Technology Sydney, Australia

In this paper, we have considered a multistage decentralized supply chain (SC) with different independent entities where each stage's decision is made based on more than one objective. To do so, mathematical models are developed based on the concepts of the bilevel planning. Here, a strategy of total SC coordination is proposed as an upper level optimization problem with two objectives which are assumed to be implemented by an independent body. Different multiple objectives are considered in each SC stage as lower level problems. We developed a solution approach and solved the model with a multi-objective genetic algorithm approach using Matlab. From the pareto graph analysis, we considered different scenarios to obtain values that allow the decision-maker to select a suitable solution. Moreover, our proposed model is compared with a single-level centralized approach, with two commonly used objectives from literature. The comparison shows that modelling a complete decentralized SC network with independent entities having individual multiple objectives with our proposed model is more realistic and effective than single-level centralized modelling.

IEEM20-P-0212/ The Impact of Smart-Warehousing on a Local Foodservice Equipment- company's External Customers

Palesa Kekana, Eric Mikobi Bakama, Sambil Charles Mukwakungu, Nita Sukdeo

University of Johannesburg, South Africa

This paper highlights the impact that smart-warehousing has on customer satisfaction and loyalty in the foodservice industry. The study follows an exploratory approach which uses quantitative means to analyze the information collected. The high products demand in the foodservice makes the industry complex to handle as the need to satisfy the customer is a priority, thus the reason behind this study which can benefit both the concerned industry and academia. 90 respondents (60 customers and 30 warehouse employees) participated in the study where a questionnaire was given to them to collect critical information about the study. The retrieved data were captured and analyzed using Microsoft Excel was used to help determine the sample size as well as random numbers to define the sample. SPSS 25 was also used to conduct the correlation analysis and assess the relationship between the warehouse activities and the customers' credit notes (which are linked to their satisfaction and loyalty). The study revealed that there is a positive relationship between the use of smart-warehousing and the satisfaction and loyalty of customers.

IEEM20-P-0214/ Impacts of Emerging Information Technologies on Supply Chains: A Systematic Literature Review

Xueping Gong¹, Zhaojun Yang¹, Jun Sun², Mengdi Wu¹

¹Xidian University, China

²University of Texas Rio Grande Valley, United States

With the development of Industry 4.0 strategy, emerging information technologies exert tremendous influence on supply chains. Whereas more and more scholars pay attention to this phenomenon, it remains a question that which emerging information technologies impact supply chains the most. Using the bibliometrics method, this study identifies the influencing information technologies and analyzes the opportunities and challenges of applying them in supply chains.

IEEM20-P-1059/ Coordination, Capacity Planning and Joint Decision-making in Agricultural Supply Chains Under Supply and Demand Uncertainty

Chenqiang Yue, Dong Li, Dongping Song

University of Liverpool, United Kingdom

This paper examines the joint pricing and ordering decisions in a one-farmer-one-handler agricultural supply chain, where the farmer is capacitated, and both supply and demand are uncertain. Due to unique characteristics of agricultural products such as long lead-time (i.e. long production period) and seasonality, there is almost no flexibility to increase the production capacity to satisfy the extra demand in a short time when the stockout occurs. However, the existing literature has paid less attention to investigating the impact of capacity planning on optimal decisions and performance in an agribusiness environment with multiple firms. Therefore, this paper considers the case where the members have incentives to expand the farmer's production capacity in advance of selling seasons via certain coordination contracts. First, this paper demonstrates the wholesale price contract fails to coordinate the supply chain. Then, an option contract is applied to coordinate the supply chain under the handler-led scenario. Furthermore, this paper examines the impact of the handler's attitude towards risks on the optimal joint pricing and ordering decisions.

Session	Systems Modeling and Simulation 3
Date	16/12/2020
Time	14:30 - 16:00
Chairs	Gabriel FUENTES Centre for Applied Research at NHH
	Dingcheng ZHANG City University of Hong Kong

IEEM20-P-0258/ A 0-1 Mixed-Integer Program Approach Towards Solving the Stochastic Aircraft Sequencing Problem with Constant Deceleration Rate

Jitamitra Desai, Ashish Singh Bhandari

Indian Institute of Management Bangalore, India

In this research, we study the aircraft sequencing and scheduling problem on a single runway when subject to decelerating velocity patterns along their flight paths as well as stochastic target times of arrival. This problem is formulated as a 0-1 mixed-integer program (MIP), where the objective is to improve the efficiency of the air traffic management system by minimizing the absolute deviation of flights from their target time of operations. Based on synthetically generated instances, we probe several underlying characteristics of the problem, and our results indicate that the effect of variability in target times varies based on flight categories. Given the computational complexity in solving large-scale instances, we design a heuristic based on a restricted constrained position shifting (CPS) strategy, and our simulation results for these heuristics indicate a significant improvement in solve time while retaining a near-optimal solution.

IEEM20-P-0451/ Determining the Freight Volumes for a Decentralized Waterborne Container Transportation Service

Cyril Alias, Dieter Gründer, Lennart Dahlke, Jonas zum Felde, Lea Pusch

DST - Development Center for Ship Technology and Transport Systems, Germany

In order to establish a new decentralized waterborne container transportation service, both the supply side and the demand side need to be examined. With respect to the demand side, the expected freight volume is the major indicator of the extent of the demand. The designated service area of the new transportation service is examined for the container volume per municipality which is eligible and available for the new service. The determined municipal volumes are then to be assigned to the nodes of the transportation network. Since the network consists of two kind of nodes, origin ports and destination ports, the assignment process takes place in two steps. First, the municipal container volumes are assigned to the origin ports. Subsequently, these volumes are then allotted to the destination ports. Whereas many projects and initiatives carry out the assignment manually, the present work applies a set of predetermined assignment rules. With the help of these rules, similar problems can be solved in a comparable manner. Thereby, various logistics service concepts can be compared with each other in a more informative way.

IEEM20-P-0479/ Data-driven Learning for Approximation of Nonlinear Functions with Stochastic Disturbances

Quang Minh Ta, Huu-Thiet Nguyen, Chien Chern Cheah
Nanyang Technological University, Singapore

In this paper, a data-driven learning approach is proposed for approximation of nonlinear functions with stochastic disturbances. A neural network is built and trained so as to approximate nonlinear mappings whose measured outputs are perturbed by stochastic disturbances. In the proposed approach, an adaptive-based learning algorithm is employed to update the weights of the neural network. Mathematical formulation is developed with the consideration of the stochastic disturbances, and the stability of the system for functional approximation tasks is ensured, even in the presence of the stochastic disturbances. Simulations on the approximation of arbitrary functions with different nonlinearities are then performed to illustrate the effectiveness of the proposed data driven learning approach.

IEEM20-P-1151/ Agent-based Simulation of Heuristics-driven Evacuation Behavior Under Radiological Emergency: A Case Study of the Ko-ri Area

Jeongsik Kim¹, Byoung-Jik Kim², Byung Joo Min¹, Namhun Kim¹

¹Ulsan National Institute of Science and Technology, South Korea

²Korea Institute of Nuclear Safety, South Korea

The advancement of information and communications technology (ICT) has solved various real-world problems while predicting and managing changes in human society is still challenging. In this study, an agent-based approach is proposed for human evacuees under radiological emergencies. The cognitive concepts of heuristics and affordances are incorporated in a belief-desire-intention platform for agents to perceive and interact with their surrounding environs and neighbors. Two known heuristics of pedestrian and imitation behaviors are integrated to capture the evacuation behaviors and its system-level dynamics, with a case study of the Ko-ri site in the South Korea. The simulation results verify that the temporal dynamics of the evacuation behaviors is similar to the hump pattern of the empirical disasters. The availability heuristics of human beings is revealed to be underestimated in many evacuation simulations, whereas the property has been observed in wide domains. The proposed approach is expected to help the understanding of human evacuees, which rely on the embedded automatic system, and their management under emergencies.

IEEM20-P-0206/ Identifying Suitable Transshipment Points for a Decentralized Waterborne Container Transportation Network

Cyril Alias¹, Lennart Dahlke¹, Ole Heerwagen¹, Dieter Gründer¹, L. Pusch¹, Jonas zum Felde¹, Sven Severin²

¹DST - Development Center for Ship Technology and Transport Systems, Germany

²RIF Institut für Forschung und Transfer e.V., Germany

Developing a new waterborne logistics service based on a possibly higher number of transshipment points, smaller barges, and different transshipment techniques as a competitive alternative to existing road-borne transportation services requires an intelligent design of the network. The identification of such (not fully known) potential decentralized transshipment points poses a challenge which, however, is hardly covered in research literature. Mostly, the underlying network with the possible nodes and arcs are already known when starting to develop a new transportation service. It is of high relevance because the economic viability of a logistics concept can be influenced by adding or dropping the number of transshipment points. The present paper presents the use case from the West German canal system where all points of interest have been recorded in a database. With the help of the collected data, various examinations and comparisons can be conducted before eventually selecting a subset of relevant points of interest and examine different scenarios. The presented methodology acts as a blueprint and can be extended to further types of points of interest and other geographical areas.

IEEM20-P-0554/ Modelling the Impact of COVID-19 Pandemic on a Hardware Retail Supply Chain

Abhishek Sathyanarayana, Nagesh Shukla, Firouzeh Taghikhah
University of Technology Sydney, Australia

Due to the current COVID-19 (SARS-CoV-2) outbreak, supply chains have been severely disrupted in long term globally. In this paper, we present the results of a simulation study conducted on a case of the global supply chain. We have discussed the impact of COVID19 on the supply chains by citing some recent examples in the retail sector in Australia. We demonstrate the use of simulation modelling to quickly and reliably model and analyze supply chain disruptions through the use of anyLogistix simulation software. In this paper, we have simulated a case of an Australian hardware retail supply chain that has

a global supply network. We have investigated the impact of COVID19 disruptions on the supply chain performance. Our results highlighted the importance of waiting order cancellation strategy in the recovery period for reducing supply chain costs and maintaining service level. We also discussed the negative effect of distance between supplier and customer on the resiliency of delivery systems. This initial work was a proof of concept to simulate COVID19 disruptions on a retail supply chain.

Session	E-Business and E-Commerce 2
Date	16/12/2020
Time	16:30 - 18:00
Chairs	Krishna KOTTAKKI <i>Bundl Technologies</i> Linda ZHANG <i>IESEG School of Management</i> (LEM-CNRS 9221)

IEEM20-P-0080/ The Influence to Customer Engagement Behavior by Different Strategy for Different Objective in Online Marketing

Dongying Yang, Shuzo Fujimura

Tokyo Institute of Technology, Japan

This paper aims to find the correlation between each strategy for different objectives of tweets with customer engagement behaviors, and different effects on three behaviors. The prior research proved that diverse strategy and objective have a unique influence on customer engagement. However, the interaction effect within these strategies and objectives are not discussed. Thus, in this paper, we collect data from Adidas' official Twitter account, and categorize by three objectives, brand build, product sale, and marketing campaign. Then experiment the influence of every strategy for each objective. This paper finds the strategy have different performance for a specific objective, for instance, celebrity and mega-event have a positive influence on customer engagement for brand build, which is opposite to the general situation. Meanwhile, in one objective, the same strategy has different effects on different customer behaviors. Marketers can use these findings to achieve the marketing objective efficiently.

IEEM20-P-0267/ Customer Stickiness to "Internet +" Environmental Protection Public Welfare Platforms

Guanghai He, Yali Zhang, Xingqiao Jiang, Jie Zhang

Northwestern Polytechnical University, China

At present, "Internet +" environmental protection public welfare platforms present a good development trend by bridging the gap between customers and enterprises participating in public welfare. Maintaining customer stickiness to such platforms is the key to promoting the development of environmental protection public welfare undertakings. This is due to the fact that the cost of keeping existing customers is lower than attracting new ones. In addition, high customer stickiness will attract more enterprises to join the platforms carrying out environmental protection public welfare projects. This study aims to examine the factors affecting customer stickiness to environmental protection public welfare platforms from the perspective of users, including trust, satisfaction, flow experience and subjective norms. Drawing on data from 252 questionnaires distributed to customers adopting the platforms, structural equation model was used to test the hypotheses. The research results show that these factors positively influence customer stickiness through the mediation of adoption intention. Moreover, satisfaction positively affects trust and flow experience positively affects satisfaction.

IEEM20-P-0298/ An Optimization Framework for On-Demand Meal Delivery System

Siddhartha Paul¹, Sunil Rathee², Jose Matthew¹, Kranthi Adusumilli²

¹Swiggy, *Bundl Technologies, India*

²BUNDL Technologies, *India*

The success of an on-demand meal delivery business depends on the cost-effectiveness, speedy, and timely delivery of orders. This problem calls for an optimal trade-off between the cost and time of delivery in near real-time for large-scale orders. In this paper, a generic framework for the optimization of first-mile and last-mile of an on-demand meal delivery system is proposed. The objective is to minimize the overall Cost Per Delivery (CPD) and the delay in order delivery time. Few policies are recommended based on the Just-In-Time (JIT) concept and performances are compared within a simulation framework with real order data of a city. The simulation results indicate that the aggressive JIT policies result in substantial savings of CPD by reducing the wait time without compromising the Customer Experience (CX).

IEEM20-P-0299/ Customer Experience Driven Assignment Logic for Online Food Delivery

Krishna Kottakki, Sunil Rathee, Kranthi Adusumilli, Bharat Nayak, Jose Mathew, Saket Ahuja
BUNDL Technologies, India

This paper presents an assignment algorithm for online food delivery which balances both customer experience and delivery costs. Authors propose a multi-objective optimization model to maximize customer experience and minimize delivery costs. For this objective, customer experience is modelled as a time-variant piece-wise linear function, resulting in customer experience meal-delivery routing-problem (CXMDRP). The utility of the proposed methodology is demonstrated through a live experiment at one of the cities in India for 14 days, having approximately a hundred thousand food orders per day.

IEEM20-P-0320/ Equal Pricing or Free Pricing? The Pricing Strategies of B2C Platform

Houping Tian¹, Shuang Zheng¹, Chunfang Jiang¹, Changxian Liu²

¹Nanjing University of Science & Technology, China

²Nanjing University of Posts and Telecommunications, China

B2C platform, who provides unprecedented opportunities to enterprises to directly access to the customers, often has resale channel and direct channel simultaneously. In resale channel it purchases the products from the manufacturer and then resells them to the customers; in direct channel it offers the platform to the manufacturer to sell directly and charges the manufacturer a proportion of fees. Since products sell via both channels, a challenging problem to B2C platform is that when should it implement equal pricing strategy (i.e., the retail price equals to the direct selling price) or free pricing strategy (they set the prices respectively). We compare the pricing strategies by using game-theoretical model. Analyses show two interesting findings: Firstly, equal pricing strategy can mitigate channel conflict; however, it does not necessarily increase B2C platform's profits. Secondly, the choice of pricing strategy is affected by the customers' channel preference: B2C platform prefers equal pricing strategy only when customers are resale channel oriented; otherwise it prefers free pricing strategy. However, to the manufacturer, it always prefers free pricing strategy and enjoys the freedom.

IEEM20-P-0321/ Consistent Pricing or Inconsistent Pricing: A Tool to Deal with Dominant E-tailers

Houping Tian¹, Chunfang Jiang¹, Shuang Zheng¹, Changxian Liu²

¹Nanjing University of Science & Technology, China

²Nanjing University of Posts and Telecommunications, China

Manufacturer, as a dominated player, often sells products via competing dominant platforms (e.g., Amazon.com, Tmall.com, et al.). The investigation reveals that prices of same products on different platforms are sometimes the same and sometimes different. This phenomenon yields a novel research problem: Why these pricing strategies (consistent pricing and inconsistent pricing) exist? How should the weak manufacturer choose an appropriate one and protect his profits? We focus on it and model the problems by considering two important factors, i.e., competition between e-tailers and spillover effect from online channel to offline channel. By employing Stackelberg approach to our analysis where dominant e-tailers play as the leader and the manufacturer plays as the follower, we have two new findings: For the e-tailer, he always prefers inconsistent pricing regardless of spillover effect and platform competition. However, manufacturer prefers this strategy only when the spillover is negative. In case that the spillover is positive, manufacturer can use consistent pricing as a tool to mitigate competition between e-tailers, which improves not only online sales but also offline sales, and in turn increases manufacturer's profits.

Session	Supply Chain Management 5
Date	16/12/2020
Time	19:00 - 20:30
Chairs	Gitae KIM <i>Hanbat National University</i> Aries SUSANTY <i>Diponegoro University Indonesia</i>

IEEM20-P-0287/ Qualitative Aspects of Communication and Relations Between the Actors in a Supply Chain for Forest Fuel

Johanna Enström

Skogforsk, Sweden

Recent literature within SCM has pointed out communication and human relations as less developed areas. This paper provides an in-depth presentation of these aspects in a studied supply chain for forest fuel, adopting an interview approach followed by thematic analyze. Two service contractors, performing chipping and transport of forest fuel, and the logistic manager at the trading company contracting them, were interviewed concerning the topics: work processes, information and relations, work situation and development. The three themes developed from the analysis (Acknowledging relationships, Gaps in understanding and communication, and Joint development) revealed several areas for further development. Such areas were the need for a continuous education process to increase understanding between the functional units; the need for a SCM-system where information are safely forwarded together with a secured information processes to ensure the information quality, and also clarification of the contractors authority in decision making.

IEEM20-P-0334/ Determination of an Efficient Degree of Centralization in Global Production Networks

G. Schuh, Andreas Gützlaff, Katharina Thomas, Tino Xaver Schlosser

RWTH Aachen University, Germany

Global production networks have grown to complex systems over the last years. Due to an increase of velocity and uncertainties in their surrounding, the active management of production networks and the assignment of responsibilities in the network are highly important to stay efficient. Mostly to be a subjective topic of the management, a systematical and objective approach is required to meet nowadays challenges. A literature review on existing approaches reveals the gap in research. In order to support companies with this challenge, this paper presents a general approach on how to find the right degree of centralization for main functions considering the overall efficiency in global production networks.

IEEM20-P-0550/ Blockchain in Supply Chains and Logistics: Trends in Development

Fredrik Högberg, Muhammad Al Amin Rashid Othman, Christine Große

Mid Sweden University, Sweden

Supply chains and logistics play an essential role in society and must continuously adapt to market changes, customer needs and technological developments, including emerging technologies such as blockchain (BC) and smart contracts. This study reviews current literature in the supply chain and logistics field to investigate emerging trends in BC developments. The results reveal several trends, such as process and flow development, the streamlining of cross-border transactions and the use of smart sensors in logistics. This paper highlights drivers of BC developments, including costs, security, data traceability, trust and transparency. As well as revealing knowledge gaps in research and practice, this study contributes to an increased understanding of the trends in BC developments within the area of supply chains and logistics.

IEEM20-P-0466/ Impact of Sharing Point of Sales Data and Inventory Information on Bullwhip Effect

Sandun Tharaka Matharage, Uthpalee Hewage, H. Niles Perera

University of Moratuwa, Sri Lanka

This paper reports the effect of sharing point of sales data and inventory information of downstream partners to mitigate the bullwhip effect in the fast moving consumer goods supply chain. The paper uses the "beer distribution game" in a laboratory setting using four treatments. The game was developed using Excel Macro and Visual Basic for Application Programming. In the control group, existence of the bullwhip effect is found due to order batching, shortage gaming and price fluctuation. The treatments investigate the existence of the bullwhip effect when either point of sales or inventory level information of downstream members are shared alone or the combination of both among supply chain partners. The results of these experiments conclude that, sharing point of sales data or inventory information individually will not reduce the bullwhip effect. However sharing point of sales data and inventory information together, will reduce the bullwhip effect in the focal industry to some degree.

IEEM20-P-1136/ Coordination Between Buyer and Supplier Using Game Theory

Gitae Kim

Hanbat National University, South Korea

Coordination in the supply chain management is an important problem so that it aims to achieve global optimum of the whole supply chain instead of local optimum. The buyer which purchases components or materials from the supplier and sells the product to customers wants to have flexible orders to response the changing demands. On the other hand, the supplier prefers static orders from the buyer to achieve the stable production. To resolve the conflict between them, Stackelberg strategy as a game theory approach has been proposed when one is assumed as a leader and the other is the follower. However, if we consider the buyer and the supplier have two players with the same levels of strategies, we can model this problem with two player game. In this paper, we use an iterated elimination of strictly dominated pure strategies (IESDS) to find the coordinated solution between the buyer and the supplier. Numerical examples provide the viability of IESDS for the coordination of supply chain.

IEEM20-P-0481/ Controlling of Migration in Production Networks

G. Schuh, Andreas Gützlaff, Sven Cremer, Lars Geesmann, Dino

Hardjosuwito

RWTH Aachen University, Germany

The planning and implementation of migration projects in global production networks is a complex planning task that is confronted with a dynamic global environment with highly complex interdependencies. Today's migration approaches are either large projects or isolated local investments. As such, they are not suitable for simultaneously addressing interdependencies and continuity. This paper illustrates a holistic and continuous methodology for rolling migration planning and implementation in global production networks. Seven steps enable the transformation from the current state of the production network into a target state regarding internal as well as external dynamics and interactions.

IEEM20-P-0203/ Supplier Selection and Order Allocation Under Disruption: Multi-Objective Evolutionary Algorithms

Farnaz Javadi Gargari¹, Ehsan Pourjavad²

¹*Alzahra University, Iran*

²*Polytechnique Montreal, Canada*

Disruption is one of the critical issues that affect the performance and costs of supply chain management. The appropriate adjusting of supply chain disruptions is considered as a competitive privilege for companies. Hence, this paper aims to improve an optimization approach to select suppliers and allocate the proper quota of order to each one considering supplier disruption. A Multi-Objective Mixed Integer Linear Programming (MOMILP) is proposed model with five objective functions, minimize costs of the transaction and supplying, the percentage of delayed products, and the percentage of returned products, as well as maximize capabilities of orders tracking by customers. Strength Pareto Evolutionary Algorithm-II (SPEA-II) and Non-Dominated Sorting Genetic Algorithm-II (NSGA-II) are developed to settle this problem. The efficiency of the solution algorithms is investigated based on four criteria for eight computational experiments. The results indicate the SPEA-II algorithm provides better solutions in comparison with the NSGA-II algorithm.

Session	Service Innovation and Management 2
Date	16/12/2020
Time	08:00 - 09:30
Chairs	Fitra LESTARI Industrial Engineering Department, Faculty of Science and Technology Sultan Syarif Kasim State Islamic University Danping LIN Shanghai Maritime University

IEEM20-P-0062/ Affecting Factors of Consumers' Purchase Decision on Sustainable Fashion Clothing Products

Hui Zheng, Lei Chen

Donghua University, China

Considering consumers' sustainable purchase decisions, this paper analyzes how the sustainable fashion environment, sustainable fashion product features and sustainable consumption awareness impact on consumers' purchase behavior. Sustainable fashion environment, sustainable fashion product features and sustainable consumption awareness have a significant influence on purchase behavior. Some suggestions are made to raise young people's awareness of environmental protection and to help garment enterprises implement a sustainable strategy.

IEEM20-P-0067/ Performance Analysis for a Two-stage Queuing System with Online Service

Liying Zhang, Li Xiao

Tsinghua University, China

We consider a two-stage queueing system where the first stage represents an online channel (official website or apps) and the second stage represents a face-to-face service. There are two streams of customers, one is passionate to experience two stages of service and the other is only willing to go through the second stage. This kind of customer behavioral preference may be due to different personality or availability of the first stage service (for example, elder people may not be familiar with smartphone and thus cannot access the first stage service). We characterize the joining equilibrium of customers with different preference and investigate the impact of the online channel on system performance. We consider two measures to evaluate system performance: throughput and social welfare. We show that the impact of online channel on system performance is mixed: it may improve throughput and social welfare; it may also impair throughput and social welfare. In addition, we provide sufficient conditions under which service provider is better off or worse off by operating the online channel.

IEEM20-P-0078/ Impact of Halal Labeling on Brand Image on Cosmetic Product

Fitra Lestari, Hertina Hertina, Lusiana Ritia, Irsan Riandika, Ahmad Mas'ari

Sultan Syarif Kasim State Islamic University, Indonesia

Indonesia has the largest number of Muslims in the world. Consequently, the halal product market has a high demand from customers. In addition, Halal Brand image is one of the company's strategies to attract many consumers. The purpose of this study is to measure the impact of halal labeling on brand image. The case study of this research was conducted in Indonesia by making cosmetic products that have halal labeling. This research used quantitative methods with a structural equation modeling approach and has 200 sample data. The results of this study found that the performance of the halal labeling had a significant effect on the brand image of halal product cosmetics of 97.4%. The implication of this research shows that the inclusion of halal labeling on cosmetic products has a good effect on brand image. Further research is suggested to conduct a study of product name selection to implement the concept of halal on the product. It aims to increase consumer confidence in buying cosmetic products.

IEEM20-P-0061/ A Study on IoT-enabled Appliance Management Service Platform Business Model

Tatsuya Inaba

Kanagawa Institute of Technology, Japan

Although IoT-enabled appliances are commercially available, business models to provide services to those appliances has not been established yet. This study proposes a platform business model and assesses the feasibility of the business model. We identify three areas that are necessary to establish the business model: rules and regulations, technical interface and incentives of potential participants. We investigate current situations and show the first two conditions have been satisfied or will be satisfied in the near future. We consider consumers and OEMs as potential participants of the platform business and show that they have incentives to use the platform service by using an agent-based simulation. These findings help not only platformers but also OEMs to design their strategies.

IEEM20-P-0262/ Is a Disruptive Technology Disruptive? The Readiness Perspective Based on TOE

Nan Chang, Yali Zhang, Di Lu, Xin Zheng, JianWu Xue

Northwestern Polytechnical University, China

Most enterprises want to increase their competitiveness through the implementation of disruptive technology, but not all enterprises have achieved their initial expectations after adopting disruptive technologies. One of the most important reasons is that the enterprise itself is not well prepared for a disruptive technology in all aspects, which leads to many problems and risks in the implementation process. As the successful implementation of disruptive technology depends on enterprises' innovativeness. The extant research focuses on its predictive identification, technical characteristics, and application directions. However, there is a lack of research on organizational preparation for implementing disruptive technologies to promote their success. Based on the technology-organization-environment (TOE) framework, this study reviews the literature to explore the readiness of enterprises adopting and implementing disruptive technologies. It extracts the factors that affect technological readiness, organizational readiness and environmental readiness respectively. Affecting an organization's choice of adopting disruptive technologies, these three aspects of readiness ultimately determine their success.

Session	Information Processing and Engineering 2
Date	16/12/2020
Time	10:00 - 11:30
Chairs	Vinay SINGH ABV-IIITM Gwalior Tingyao XIONG Radford University

IEEM20-P-0025/ Relating Environmental and Structural Uncertainty to Management Decision Making Style and Behavior During Information System Planning and Implementation

R.R.K. Sharma¹, Vinay Singh², K.K. Lai³

¹Indian Institute of Technology Kanpur, India

²ABV-Indian Institute of Information Technology and Management Gwalior, India

³Chaoyang University of Technology, Taiwan

In present study we attempt to relate environmental and structural uncertainties, analysis-paralysis syndrome and organizational politics encountered during Information System Implementation to strategy chosen by Innovators, Prospectors and Defenders. We hypothesized that Innovators and Prospectors type of organizations perceive higher environmental and structural uncertainty than the Defenders type. These uncertainties causes Information System implementation planning "analysis-paralysis" syndrome. As a consequence, these firms are more prone to the employees politicking behaviors. For empirically justification of hypotheses, we collected data from 101 highly experienced executives of 41 business units through structured questionnaire. Statistical result supported our majority of hypotheses.

IEEM20-P-0211/ A Feasible Schema Design Strategy for Amazon DynamoDB: A Nested Normal Form Approach

Wai Yin Mok

The University of Alabama in Huntsville, United States

Amazon DynamoDB is a next-gen NoSQL (Not only SQL), key-value and document database that delivers single-digit millisecond performance at any scale. As more complex web-based applications adopt DynamoDB, it is imperative to develop sound design strategies for DynamoDB schemas. Large-scale web-based applications often exhibit conflicting requirements. Hence, the research problem is to design the DynamoDB schemas of a given application with conflicting requirements such that the database must satisfy certain predetermined performance goals. In the era of relational databases, normal forms were developed to guide the schema design process. Past knowledge and experiences, we believe, are also applicable to DynamoDB schema design. Specifically, based upon Nested Normal Form and XML databases, this paper demonstrates the feasibility of a design strategy on DynamoDB schemas, particularly with the access patterns of the data in mind. Simulation further substantiates the feasibility of our approach.

IEEM20-P-0218/ Intelligent Maintenance of Complex Equipment Based on Blockchain and Digital Twin Technologies

Qiu Chen¹, Zhenwei Zhu², Shubin Si¹, Zhiqiang Cai¹

¹Northwestern Polytechnical University, China

²Shanghai Enfon Robotics Co., Ltd, China

With the development of modern equipment system and science and technology, equipment is more and more toward the direction of digital and intelligent development. Complex equipment often undertakes important tasks, once the failure occurs, the result will be particularly serious. Based on this, the main work of this paper is as follows. (1) This paper builds the whole life cycle data chain of complex equipment from design, parts production, equipment transportation and installation based on blockchain technology so that the data is effectively used, and the data privacy is protected. (2) The blockchain technology is applied to the construction of digital twin, and the mapping from physical entity to virtual space is realized. It is more effective and accurate to diagnose the state and forecast the future trend of complex equipment. (3) A new intelligent maintenance framework is proposed, which provides new ideas and solutions for the intelligent maintenance of complex equipment.

IEEM20-P-0463/ Reinforcement Learning-Based Differential Evolution for Solving Economic Dispatch Problems

Thammarsat Visutarrorm¹, Tsung-Che Chiang¹, Abdullah Konak², Sadan Kulturel-Konak²

¹National Taiwan Normal University, Taiwan

²Penn State Berks, United States

In power systems, economic dispatch (ED) deals with the power allocation of power generation units to meet the power demand and minimize the cost. Many metaheuristics have been proposed to solve the ED problem with promising results. However, the performance of these algorithms might be sensitive to their parameter settings, and parameter tuning requires considerable effort. In this paper, a reinforcement learning (RL)-based differential evolution (DE) is proposed to solve the ED problem. We develop an RL mechanism to adaptively set two critical parameters, crossover rate (CR) and scaling factor (F), of DE. The performance of the proposed RLDE is compared with the canonical DE and several algorithms in the literature using three test systems. Our algorithm shows good solution quality and strong robustness.

IEEM20-P-0058/ A Statistical Comparison of Novel Coronavirus Cases between the Philippines and South Korea

Kianna Denise C. Villapando, Maria Angelica D. Bare, Francee Mae F. Castro, Angelo Luis S. Doctora, William Davin D. Perez, Michael N. Young

Mapúa University, Philippines

The Novel Coronavirus has been affecting several regions across the globe. It is noticeable that several countries address the problem better than other nations due to social and economic factors. With this, the present study distinguished and analyzed the state of two countries, the Philippines and South Korea, in the current pandemic, in relation to their socio-economic factors. The data was obtained from online platforms and trackers, and these were statistically analyzed using joint probability distribution, one sample t-test, confidence intervals, and normal distribution. Upon performing the calculations, the study found out that South Korea has a better situation in the pandemic compared to the Philippines, since the said country had implemented commendable measures.

IEEM20-P-0436/ Evaluation of Chinese Sentiment Analysis APIs Based on Online Reviews

Tianwei Tang, Liang Huang, Yan Chen

Macao University of Science and Technology, China

Over the last decade, online reviews on social media platforms have become one of the most influential information sources. With the help of sentiment analysis tools, this unstructured information can be converted into structured data and analyzed to extract consumers' opinions on products and services to assist important business decision-makings. Due to its great practical value, sentiment analysis using technologies like artificial intelligence has attracted attentions of researchers and practitioners. Many major Internet companies have developed their application program interface (API) to provide sentiment analysis services for individuals and businesses. This study aims to test and evaluate current mainstream Chinese sentiment analysis applications. First, authentic online reviews are collected from Ctrip.com, a major online travel Agency in China, using a crawler. These reviews are then analyzed using major Chinese sentiment analysis APIs. Meanwhile, some interviewees were asked to classify and rate these reviews as positive, neutral or negative as well using a survey. After that, human-API discrepancy is compared and evaluated. Our results revealed that classification errors of these APIs are mainly caused by incorrect word segmentation and fail to integrate the context into semantic interpretation.

Session	Big Data and Analytics 3
Date	16/12/2020
Time	12:00 - 13:30
Chairs	Min XIE <i>City University of Hong Kong</i> Omid Fatahi VALILAI <i>Jacobs University Bremen</i> gGmbH

IEEM20-P-0534/ Monitoring and Control of Unstructured Manufacturing Big Data

Yesheng Cui¹, Sami Kara¹, Ka C. Chan²

¹The University of New South Wales, Australia

²University of Southern Queensland, Australia

Unstructured manufacturing big data silos are challenging for enabling various data-driven applications such as digital threads and digital twins in manufacturing. The management of big data silos requires to address the issues of large volume, data inconsistency, data redundancy, information silos and data security. This research developed a systematic approach to managing data silos using the state of art big data software. Applying this approach in the product life cycle can control data silos, data consistency, redundancy, timely update and enable the automatic workflow of each system.

IEEM20-P-0492/ Topological Data Analysis for Identifying Critical Transitions in Cryptocurrency Time Series

Patipol Saengduean, Sutthipong Noisagool, Farida Chamchod

Mahidol University, Thailand

In this study, we investigate financial crashes in the cryptocurrency market including both mini and major crashes for two cryptocurrencies, Bitcoin and Ethereum, during the period that the digital market crashed in 2018. By applying techniques in topological data analysis, we are able to predict financial transitions and explore optimal values of the window size and the dimension of point cloud data to obtain good early warning signals. Our results demonstrate good early warning signals before the financial crashes and also show that the L1-norm and C1 - norm of persistent landscapes peak before the crashes occur.

IEEM20-P-0536/ GPS-Derived Measures of Freight Trucks for Rest Areas: A Case-Study Based Analysis

Ahmed Karam, T. Illemann, Kristian Reinau

Aalborg University, Denmark

Comprehensive knowledge on how freight trucks utilize rest areas along motorways is essential to prioritize effectively which rest areas need expansion and to decide on where to add new rest areas. Private logistics companies daily archive a large amount of GPS data from trucks that can provide knowledge on the usage patterns of rest areas. This paper presents a methodology to collect and process GPS data from logistics companies to aid public authorities in planning road infrastructures. The developed methodology combines a database management system implemented by PostgreSQL with PostGIS and a MATLAB code. The database system is used to collect and store the GPS data from logistics companies. The MATLAB code implements a systematic procedure to process the GPS data and extract parking statistics, such as average length of truck stay, number of parked trucks, and spatial analyses of the parked truck locations. The methodology is applied to a rest area using GPS data from two large Danish logistics companies. The results show the potentials of GPS truck data to understand the truck parking patterns.

IEEM20-P-0569/ User Aggregation Models for a Video-on-Demand (VoD) System

Subrato Mondal, Goutam Sen

Indian Institute of Technology Kharagpur, India

We consider the scalability issues in the static data segment location problem in information networks and provide integer linear programming (ILP) formulations for user aggregation. We explore three approaches based on k-means clustering, locality-of-reference and biased locality of reference. The second and third approaches are innovatively modeled as discrete optimization problems. The models are tested in IBM ILOG CPLEX Optimization Studio platform and the computational results are discussed in this paper.

IEEM20-P-0369/ Data Quality Issues When Quantifying Costs of Complexity

Aleksandra Staskiewicz¹, Lars Hvam¹, Anders Haug²

¹Technical University of Denmark, Denmark

²University of Southern Denmark, Denmark

Increased demand for product and service variety has meant that many manufacturing companies face problems of increasing product and process complexity. Literature on complexity management provides means for reducing product and process complexity based on quantifying product complexity costs, but when determining product complexity cost, little attention is paid to data quality challenges. The purpose of this paper is to expand the literature on quantifying product complexity costs by clarifying the role of data quality. This is done based on a case study at a world-leading healthcare product manufacturer, where reducing product complexity was investigated. The case study showed that poor data quality resulted in extra use of resources for finding the needed data and implied that the scope of the project had to be significantly reduced. On this basis, this paper argues that methods for reducing product complexity need to incorporate data quality perspectives more.

IEEM20-P-0562/ A User Segmentation Approach for UGC Platform Based on a New Lead User Identification Index System and K-means Clustering

Danni Chang¹, Jing Zhao¹, Fanxing Zou¹, Gangyan Xu²

¹Shanghai Jiao Tong University, China

²Harbin Institute of Technology, China

Nowadays, user-generated content (UGC) has become an important part of Internet user data. This study aims to develop an innovative user identification approach based on UGC platforms. To achieve the objective, this research proposed i) a web mining process to crawl UGC data; ii) a lead user identification index system for evaluating the innovation capability of users; and iii) a user classification process based on K-means clustering according to their UGC performance. Particularly, the complete user performance data of more than 100 users on Douban (one of the biggest UGC platforms in China) were collected, and the web mining, factor analysis, and clustering algorithm was integrated to process the data and classify user groups according to their UGC performance. The classification results were verified through incorporating expertise, and it showed that the classification can exactly recognize the users with proper lead user status. This research is expected to help small and medium enterprises without powerful big data ability to identify innovative users and valuable UGC data more efficiently and facilitate the further product improvement.

Session	Intelligent Systems
Date	16/12/2020
Time	14:30 - 16:00
Chairs	Ramakrushna PADHY <i>IIM Kashipur</i> Annapoornima M SUBRAMANIAN <i>National University of Singapore</i>

IEEM20-P-0336/ Enablers and Barriers to the Implementation of Digital Twins in the Process Industry: A Systematic Literature Review

Matteo Perno¹, Lars Hvam¹, Anders Haug²

¹Technical University of Denmark, Denmark

²University of Southern Denmark, Denmark

Since its first introduction in 2002, the interest in the concept of "Digital Twins" has grown exponentially among researchers and industry practitioners. An increasing number of Digital Twin implementations are made in many industries. Given the novelty of the concept, companies from any industry type face significant challenges when implementing Digital Twins. Furthermore, only little research has been conducted in the process industry, which may be explained by the high complexity of representing and modeling the physics behind the production processes in an accurate manner. This study aims at filling this gap by providing a clear categorization of the main barriers that process companies face when implementing Digital Twins of their assets, as well as the key enabling factors and technologies that can be leveraged to overcome such challenges. Furthermore, a model based on the findings from the literature study is proposed. The results indicate a dearth in the literature focused on the process industry, therefore, key learnings from other industry sectors are gathered, and suggestions for further research are proposed.

IEEM20-P-0403/ Neural Network Control of Optical Tweezers System for Manipulation of Microscopic Objects

Gulam Dastagir Khan, Chien Chern Cheah

Nanyang Technological University, Singapore

Though different techniques have been formulated in the past for the optical micro-manipulation, the feasibility of these techniques mostly relied on the common assumption of the known structure of robotic tweezers dynamics. However, in most cases, the system has unmodeled dynamics because of which it is difficult to comprehend the structure of the regressor matrix. This creates complications in the designing and implementation of controllers for the optical tweezers systems. In this paper, we propose a neural network-based controller for set-point control of an optical tweezers system with uncertain dynamics. We use the neural networks to approximate the dynamics of the robotic tweezers and thus the proposed method allows the control of the system without knowing the structure of the dynamic model. Numerical simulations are also presented to demonstrate the effectiveness of the proposed approach.

IEEM20-P-0485/ Optimization of Multilayer Design for FTTH Networks Based on Geographical Information

Kaltham Al Romaithi¹, Anis Ouali², Kin Poon², Peng-Yong Kong², Beum-Seuk Lee³

¹Abu Dhabi Police, United Arab Emirates

²Khalifa University, United Arab Emirates

³British Telecom, United Kingdom

Due to the explosive growth in Internet traffic, the demand for faster technologies with greater capacities has escalated. The use of Fiber to the Home (FTTH) access networks with very high bandwidth has been chosen by many telecom companies to meet this ever-growing demand. However, poorly designed networks not only can incur very high deployment cost but also high maintenance cost. This drives the need for an automated method by which a cost-effective network design can be achieved. In this paper, we propose a network design scheme, combining exact and heuristic optimization techniques, to solve the Greenfield Gigabit Passive Optical Network (GPON)/FTTH multi-layer design problem with minimal geographical information input. Results are provided in this paper demonstrating the effectiveness and feasibility of the proposed approach.

IEEM20-P-0559/ Development of a Novel Control Approach for Collaborative Robotics in I4 Intelligent Flexible Assembling Cells

Aleksandar Protic¹, Ziyue Jin², Romeo Marian², Khalid Abd², Duncan Campbell³, Javaan Chahl⁴

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Industrial robots have served industry for decades, especially the automotive industry. The traditional industrial robotics have shown their limits in task management due to the rigid and time-consuming programming and task planning. In recent years, to achieve the Industry 4 transformation, a broad range of collaborative robots (cobots) have been employed for autonomously executing tasks in different domains. Cobots, mainly used in manufacturing, were extensively developed, and integrated into real production contexts to optimise processes and improve productivity. However, motion control and programming for cobots remain an obstacle to achieve their potential as the procedure still takes time and disrupts processes. This paper critically reviews current mainstream control methods for industrial robotics to execute tasks and proposes an approach for rapid task re-planning for cobots in a flexible assembly workcell. The proposed method allows cobots to execute flexible assembly tasks for small batch production/assembly, or even single products and to re-plan the new task without interruption. Its advantages and limitations are also discussed.

IEEM20-P-0560/ Implementation of a Bi-directional Digital Twin for Industry 4 Labs in Academia: A Solution Based on OPC UA

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With the increased demands of smarter manufacturing approaches around the world, the process of industrial digital transformation is being pushed in and by both industry and academia. Learning factories and testing laboratories have been developed for decades for teaching and training purposes in Academia. Nowadays, as the future trend in industry, Industry 4 is being merged into the latest development of learning factories and testing laboratories. This paper presents the development and implementation of a bi-directional digital twin application in an Industry 4 testing laboratory at University of South Australia. The solution is based on the establishment of OPC UA connection between two cobots of different brands, the use of NX Siemens as a CAD simulation platform and a SCADA system from Inductive Automation. Due to differences between system interfaces, communication between different modules was challenging. Python OPC UA servers were developed. The digital twin replicates the physical system and is driven by inputs from the assembly cell.

Session	Decision Analysis and Methods 3
Date	16/12/2020
Time	16:30 - 18:00
Chairs	Ramakrushna PADHY IIM Kashipur Xin WANG City University of Hong Kong

IEEM20-P-0450/ On-Chip Democracy: A Study on the Use of Voting Systems for Computer Cache Memory Management

Nguyen Anh Vu Doan, Akshay Srivatsa, Nael Fafous, Sebastian Nagel, Thomas Wild, Andreas Herkersdorf

Technical University of Munich, Germany

In computer architecture, memory management is required to optimize data accesses by the processor(s). Therefore, cache replacement policies, such as LRU, FIFO, etc., have been developed. These standalone policies optimize for a single access attribute, limiting their impact for applications with non-uniform behaviors. In this work, we propose a preliminary study on the use of voting systems for computer memory management, with a Hybrid Voting-based Eviction policy (HyVE). HyVE combines existing policies by taking their individual ranking of the eviction candidates and uses a voting system to select the evicted data. The Borda count and the Condorcet method are applied, and we analyze how their properties regarding Arrow's axioms of democracy affect the results. Simulations show that HyVE/Borda consistently performs better than its constituent standalone policies, improving cache performance by 3% compared to LRU on average. Compared to the Borda count, we observe that the Condorcet method performance falls short in this computer memory context, although respecting the Condorcet criterion. This can be explained by the small number of voters involved, which seems to be compensated by Borda's point system.

IEEM20-P-0464/ Blockchain Adoption Time of Shipowners: A Game Theoretic Analysis

Shuyi Pu, Jasmine Siu Lee Lam

Nanyang Technological University, Singapore

With continuous overcapacity in vessel tonnage and slower growth of global trade, shipowners are facing fierce competition and are pushed to look for innovative ways to improve their performance and reduce costs. Blockchain is one of the emerging technologies that has the potential to help shipowners to achieve these goals. This study aims to analyse if and when shipowners would adopt blockchain when facing a request from a big shipper. A game theory model is developed to analyse the optimal adoption time of shipowners. The analytical solutions of the optimal adoption time of each shipowner are obtained in different situations. The numerical analysis reveals that the higher shipping quantity carried by the shipowners, the earlier they would join the blockchain network. Shipowners with very small shipping quantities would be unlikely to adopt blockchain until more than a decade later. It is suggested that blockchain initiators should start with large shipowners when promoting blockchain.

IEEM20-P-1187/ Drivers for Lithium-ion Battery Recycling Industry: A Delphi Study

Asit Tripathy¹, Atanu Bhuyan¹, Amitosh Gautam², Ramakrushna Padhy¹

¹Indian Institute of Management Kashipur, India

²National Productivity Council, India

India's Lithium-ion battery (LIB) recycling industry is in a transition phase. However, no current work has examined the key opportunities which motivate stakeholders in promoting the recycling of LIB in emerging economies, nor in the context of India. This investigation is intended at identifying the present and potential environments of India's LIB recycling industry. The research follows a theoretical lens based on the triple bottom line (TBL) approach to categorize the factors responsible as drivers for the LIB recycling industry. A Multiple-Criteria Decision-Making (MCDM) approach incorporating DEMATEL and ANP techniques is used to explore the causal relationships between the three dimensions of the triple bottom line as well as their key factors. Further, the MCDM framework is tested using the Delphi method, and a questionnaire survey is conducted among 30 experts representing a multi-stakeholder perspective. Our research findings can support the policy planner as well as the other stakeholders by defining essential parameters and their interrelationships to prioritize the drivers for the LIB recycling industry.

IEEM20-P-0561/ The Implementation of the Lean Thinking Concept for Reducing Waste: A Study Case in the Leather Tanning Process

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¹Universitas Pembangunan Nasional Veteran Yogyakarta, Indonesia

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The company is always trying to improve its excellence to compete with other companies engaged in the same field. The reducing waste is to increase of these advantages. During the production process waste occurs, including product defects, waiting, and transportation. Lean thinking is an approach that aims to streamline the process by reducing waste that occurs in the production process flow. The investigation on the cause of the waste is by using a diagram of cause and effects. Once the cause is known, efforts are made to improve the cause of the waste that occurs. The use of VALSAT tools, detailed mapping, and value stream mapping for improvement efforts will be made by making current state mapping and future state mapping. After obtaining an overview of future state mapping, a simulation is performed to create a simulation model based on the current situation and after repairs.

IEEM20-P-0455/ Data Model for Managing Product Complexity

Michael Riesener, Christian Dölle, Jan Koch, G. Schuh

RWTH Aachen University, Germany

Across all industries, companies face the challenge of managing the complexity offered externally to customers while at the same time mastering or, if necessary, reducing internal complexity. However, due to volatile markets, increasing need for individualization and shorter product life cycles, companies tend to respond with a greater variety of products. In addition, the increasing number of externally offered product and component variants are subject to continuous change over time. In order to manage product-induced complexity, analyses of the market, the product and the processes are of importance. For this purpose, existing approaches insufficiently address the use of existing company data. Therefore, this paper aims at the development of a data model to improve the transparency and controllability of product complexity. This is achieved by accessing decision-relevant information.

IEEM20-P-0217/ Evolutionary Analysis of Vaccination Strategies for Infectious Diseases Considering Neutral Strategy

Xueyu Meng, Huiying Cao, Muhammad Rashid Bhatti, Zhiqiang Cai

Northwestern Polytechnical University, China

In this paper, we propose an evolutionary game model of epidemic vaccination strategies considering neutral strategy on the homogeneous network. By establishing a state layer and a strategy layer for each individual in the network, we conduct an evolutionary game analysis of epidemic vaccination strategies. Firstly, we take into account various factors such as vaccination effectiveness, government subsidy rate, treatment discount rate, vaccination cost and treatment cost based on the traditional SIR model. We fully analyze various risk factors affecting vaccination. In the strategy layer, we introduce a new neutral strategy. Then, we analyze the proportion of individuals and game benefit of each strategy and use the mean field theory to establish a dynamic equation based on the proposed model. Simulation results show that in order to increase the number of individuals vaccinated when the network evolution is stable, the vaccination effectiveness should be increased and vaccination cost should be reduced. For government decision making, choosing the appropriate vaccination cost determines whether the network evolves towards vaccination strategy.

Session	Decision Analysis and Methods 4
Date	16/12/2020
Time	19:00 - 20:30
Chairs	Nizar CHATTI <i>Université d'Angers</i> Ramakrushna PADHY <i>IIM Kashipur</i>

IEEM20-P-0145/ Dynamic Bayesian Network Decision Model for Improving Fault Detection Procedure

Nizar Chatti¹, Khaoula Tidriri², Tarun Kumar Bera³

¹University of Angers, France

²University of Grenoble Alpes, France

³Thapar Institute of Engineering and Technology, India

In Model-Based Diagnosis (MBD) approaches, the decision-making generally relies on a binary fault signature matrix which is systematically generated from structural diagnosability analysis. However, this task becomes complicated when considering hybrid systems undergoing discrete modes shift and variation of states which may increase false alarms rate during the fault indicators (i.e. residuals) evaluation stage. This paper proposes a generic computer-aided diagnosis approach based on Dynamic Bayesian Network (DBN) in order to enhance robustness with regards to discrete mode changes. The Hybrid Bond Graph (HBG) Model is used as a multidisciplinary and integrated tool for dynamic modeling of all modes. The originality of the proposed approach relies on its ability to integrate statistical monitoring scheme based on cumulative sum (CUSUM) control chart using historical available data and qualitative reasoning mechanism based on fault indicators generated on the basis of HBG structural analysis. A synthetic case study is used to show the effectiveness of the developed DBN-based approach and its superior performance with regards to traditional thresholds based approaches.

IEEM20-P-0139/ Digitizing Company Analytics – Digitalization Concept for Valuable Insights

Janne Harkonen, Erno Mustonen, Joni Koskinen, Hannu Hannila

University of Oulu, Finland

Digitalizing business analytics by generating relevant information from data to gain valuable insights and to enhance decision-making is a key ability for companies. We describe a potential concept for digitizing company analytics to enable data-driven approach by providing a path from information needs to visualizing the analysis results, including the consideration of analysis logic, relevant data, and necessary data model. Company business processes, IT applications, and data assets provide the foundations to build upon. The developed concept may enable practitioners to consider possible applications and the needed, already existing technologies.

IEEM20-P-0347/ Creating Transparency in the Finished Vehicles Transportation Process Through the Implementation of a Real-Time Decision Support System

Angelina Schenk, Uwe Clausen

TU Dortmund University, Germany

The complexity of global distribution networks in the automotive industry and likewise the number of disruptions significantly increased throughout the last years. In order to monitor relevant processes and to optimize decision-making in case of disruptions, a concept for a decision support system (DSS) was introduced. For this purpose, the distribution process weaknesses of the German premium automotive company BMW were identified. The method used was a Failure Mode and Effect Analysis with operational managers and relevant process partners interviews. Based on the findings, performance indicators, thresholds, early warnings and options for action were specified. A big data platform supports the processing of the growing number of relevant data in real-time. In the long-term decision-making can be automated using machine learning algorithms. This paper proves that negative impacts of disruptions can be minimized, and the robustness of the process improved by anticipating and identifying deviations beforehand and in real-time. Hence, companies save money while strengthening customer satisfaction. The DSS can be seen as a necessary precursor of a digital twin.

IEEM20-P-0359/ Use of Analytical Hierarchy Process in Selecting the Optimum Equipment for Execution at a Construction Project

Kumar Gaurav Thakur¹, Arvind Keprate²

¹Project Management Institute, India

²Oslo Metropolitan University, Norway

There are plethora of issues associated with construction project management process, the most important being the selection of the optimum equipment for execution at a construction site. Different people have different choices based on their experience. Due to this Analytic Hierarchy Process (AHP) can contribute a lot to the resolution of this issue and many other Project Management issues where opinion

of everyone should be considered and given importance. This study uses AHP methodology to rank the most important criteria for equipment selection and then performs the cost-benefit analysis. Initially, weightage of each criteria is calculated which is later used for the calculation of total benefits of each equipment. Comparative assessment based on the analysis proposes the optimum equipment for construction project. An illustrative case study is performed within which the hierarchy tree format is developed. Thereafter, a questionnaire is prepared which takes expert judgment into account and finally the results of AHP analysis are coupled with cost benefit analyses to recommend the optimum machinery for construction projects.

IEEM20-P-0405/ The Influence of Macroeconomic Variables on Philippine Stock Market Indices: A Structural Equation Model Approach

Noime Fernandez¹, Richard Li²

¹Adamson University, Philippines

²De La Salle University - Manila, Philippines

Structural Equation Modeling was carried out in this study to investigate whether macroeconomic variables under Business Activity, Consumer Activity and Monetary Policy influence the performance of Philippine stock market indices. A proposed economic-based model was used to determine which set of variables has direct and indirect effect on the stock market for the period of 2006 to 2018. Results showed that Consumer Activity and Monetary Policy were the main drivers that influence the performance of all sectors in the Philippine Stock Market. Business Activity is also a significant factor but only for the Financial, Industrial, and Property Sectors. On the other side, Monetary Policy showed a significant direct effect on Financial, Holding Firms, Services, and Mining-Oil Sectors but no direct effect on the Industrial and Property Sector. The results conclude that stock performance is significantly determined by some fundamental macroeconomic variables such as money supply, interest rate, remittances, consumer spending, and industrial production index. These findings suggest that investors should pay close attention to consumer activity since an increase in stock market performance is mainly determined by this factor.

IEEM20-P-0443/ A Methodology for Value-oriented Strategic Release Planning to Provide Continuous Product Upgrading

Tarik Sahin, Tobias Huth, Joachim Axmann, Thomas Vietor

Technische Universität Braunschweig, Germany

Customers and potential buyers are increasingly demanding additional or improved product features. So which ones should finally be implemented in the next product release and why? Which features are not valuable enough and are better avoided or postponed? The planning of product upgrades by deciding which new features and releases to introduce when, is part of strategic release planning. In release planning there is a fine line between revenues by value provision, and cost effects. However, today's market-driven mechatronic and electronic products pose a challenge to current domain-specific and feasibility-driven planning concepts. Current practice and literature therefore highlights the need for operatively applicable methods to support strategic release planning with value-oriented and cross-domain views. Therefore, this paper aims to present a methodological concept to support value-oriented strategic release planning.

IEEM20-P-0418/ An Approach for Systematic Planning of Project Management Methods and Project Processes in Product Development

Julian Baschin, Tobias Huth, Thomas Vietor

TU Braunschweig, Germany

The development of modern products in mechanical engineering is characterized by a high degree of individuality. Different boundary conditions (project context) such as team size or budget result in a wide variety of development projects. The project leader is confronted with the challenge of selecting the suitable project management methods in order to ensure an effective development of the product. However, in most cases, the selected methods are not directly applicable. Therefore, the methods have to be tailored to the specific project context. In addition, project management methods have to be considered adequately in process planning for a problem-free execution. Hence, this paper presents an approach for a methodology to support the project leader in selecting and tailoring project management methods and project processes. Finally, the methods can be integrated into the project process in an appropriate way.

Session	Healthcare Systems and Management
Date	16/12/2020
Time	08:00 - 09:30
Chairs	Arnesh TELUKDARIE <i>University of Johannesburg</i> Tingyao XIONG <i>Radford University</i>

IEEM20-P-0037/ Community Operational Research (OR) and Design Thinking for the Health and Social Services: A Comparative Analysis

Desmond Wong¹, Yee Lin Hiew²

¹University of Hull, United Kingdom

²National University of Singapore, Singapore

This short paper provides a comparative analysis of community operational research (COR) and design thinking (DT) in the health and social services, from the perspective of co-generative learning between citizens, theory, and practice domains. Although COR and DT developed out of 'hard' operational research/management science (OR/MS), they are fundamentally different in their purpose, grounding, and historical-conceptual trajectories. COR needs a framework to challenge its pluralism, while DT's value as pedagogical concept, than methodology, is well worth revisiting in the spirit of the engineers who introduced OR/MS and systems science principles into contexts since displaced. There is potential alignment of COR and DT through a framework of analysis for meaning construction.

IEEM20-P-0154/ Healthcare Energy Management: A Digital Approach

Megashnee Munsamy, Arnesh Telukdarie

University of Johannesburg, South Africa

Healthcare is a sensitive sector with the potential risk to human life as a focus. Hospitals are an integrated and critical subset of healthcare services. The energy utilized at hospitals is critical and the ability to predict hospital energy utilization is important, most especially under constrained demand or to migrate to a renewable source. The energy demand at hospitals is dependent on various variables including climate, equipment, utilization (occupancy), technological enablement and other. The ability to model the entire hospital's energy demand inclusive of all activity, administrative, emergency, surgical, utilities, and testing makes for a significant challenge. This research renders the activity of the hospital via business processes. Adopts business processes to model all activities at a hospital and proceeds to adopt AI as a tool to develop a single objective function able to predict energy utilization at a hospital. The results provide for scenarios and model validation indicating a 98% accuracy.

IEEM20-P-0367/ A Systems Approach to a Sector Productivity Intervention in the Social Services: Report on Methodology

Desmond Wong¹, Yee Lin Hiew²

¹University of Hull, United Kingdom

²National University of Singapore, Singapore

This short paper documents a systems approach to a sector productivity intervention in the social services. Productivity is contextual, and interventions into such services are complicated by the asymmetric influence of guided competition and professional discourses on service delivery. To address this, Wong and Hiew's (2019) methodology from the health services was synthesized with capabilities, constraints, costing, and wider operational research (OR) theories. This could have been improved by incorporating throughput accounting to link strategy with financial sustainability. Key principles are also discussed, including the importance of boundary critique in public-plural services, where meaning is intersubjective. Relevant interventions must orient to the right strategic goal of social outcomes/externalities (not financial returns), flow efficiency (not resource efficiency), and informed choices on the flow and throughput units (never, arbitrary costs and lead times).

IEEM20-P-0378/ Evolutionary Game Analysis of the Quality of Elderly-care Services Based on Public-private Partnership Supply Pattern

Qiang Mu, Ding Wang, Xiaonan Wang

Northwestern Polytechnical University, China

Public-Private Partnership supply pattern have been widely employed to alleviate contradictions between supply and demand in elderly-care industry in China. Based on evolutionary game theory, this paper analyses the effects of supervision of government, service cost, consumers' initial state, consumers' cost and sense of acquisition of service on decision process for government, private investors and consumers in the three-dimension system. With simulation methodology applied, some results have been obtained: only the active supervision and small difference between costs of high-quality services and low-quality services can make private investors abandon the attempt of developing low-quality services at the early stage of strategy evolution. Furthermore, although choices of consumers often lags

behind the market, government's regulation of the elderly-care market can drive consumers to change their ideas and choose institutional care. Finally, we find that when consumers pay a certain cost, the higher the benefits (including happiness, pleasure degree, etc.) they get, the slower the evolution rate of the strategy towards institutional care.

IEEM20-P-0521/ The Impact of Social Media on the Quality of Doctor-Patient Interaction

Yasaman Asayesh, Keivan Sadeghzadeh
University of Massachusetts Dartmouth, United States

Doctor-Patient Interaction (DPI) is a prerequisite for starting a therapeutic process. As this interaction plays a key role in all steps such as a diagnosis, treatment, and recovery, the more efficient the DPI is, the more satisfied the patient is. From another standpoint, social media are conspicuously blending with different aspects of people's lives such as healthcare services. Social media provide people with the access to information and communication with other people across the world instantly. However, it is inevitable to face its downsides such as misleading information. This paper systematically reviews the influence of social media on DPI and patient's perceptions of the online information and discusses that DPI can be enhanced by using social media and public medical knowledge can be expanded by the dissemination of supervised information. These conclusions can be expected because people express concerns about the validity of the information, its sources, and their security in using social media, and therefore, they tend to put trust more in scientific-based information provided by doctors or healthcare providers rather than some random misleading information.

IEEM20-P-1099/ Binary Sequences with Large SRS Contrast Ratios

Tingyao Xiong¹, Jonathan Hall²
¹Radford University, United States
²Michigan State University, United States

Stimulated Raman Scattering (SRS) is a very useful tool to extend the frequency range of fixed-frequency and tunable lasers. In particular, In the use of laser pulses to control chemical reactions, a successful management technique called pseudorandom binary phase shaping (BPS) have been used to achieve much cleaner coherent excitation of a Raman mode at certain frequency. A core technical problem in BPS is to find pseudorandom binary sequences with large SRS contrast ratios. In the past, with aid of more and more powerful computers, the main search methods for such 'ideal' sequences were conducting exhaustive search within a certain scope narrowed by experiences and some mathematical knowledge such as number theory. Our numerical analysis has shown that the SRS contrast ratios of the sequences investigated in this paper, are significantly larger than the results in existing documents.

Session	Engineering Education and Training 1
Date	16/12/2020
Time	10:00 - 11:30
Chairs	Zied HAJEJ LGIPM/Lorraine University Fitra LESTARI Industrial Engineering Department, Faculty of Science and Technology Sultan Syarif Kasim State Islamic University

IEEM20-P-0071/ A Research on the Training Status of EECS Students' Core Competency in University of Science and Technology

Jen-Chia Chang, Hsiao-Fang Shih, Kuang-Ling Chang
National Taipei University of Technology, Taiwan

The objectives of this study are to explore the core competency content of EECS (electrical engineering & computer science) students, as well as the current situation of training. In addition, first-year students from the college of electrical engineering & computer science of a university of technology underwent questionnaire surveys before and after the semester. There were 271 effective questionnaire copies, accounting for the effective recovery rate of 84.7%. Targeting the survey results, paired sample t-test analysis was carried out. Research findings show that the college of electrical engineering & computer science students showed remarkable improvement after the semester in terms of their competency in experiment design, execution competency, data analysis, and explanation. The results showed a considerable a little decrease but without significant difference in competencies such as professional ethics and social responsibility comprehension, work ethics and attitude cultivation, and mathematics, science, and engineering knowledge applications. We should assist students to strengthen these abilities.

IEEM20-P-0356/ Gamification in Assembly Training: A Systematic Review

Niko Uletika, Budi Hartono, Titis Wijayanto
Gadjah Mada University, Indonesia

In response to the advancement of digitalization technology, the future of assembly works and associated training methods seem to evolve. Gamification, i.e. the use of game design elements in nongame contexts seem to give a potential application for training procedures in the context of assembly work. However, the study on this field is still very limited. Thus, we investigate the following topics pertaining to assembly works and gamification: (a) how is the future of industrial assembly; (b) what methods are currently used to train the assembly workers; and (c) is gamification prospective for such training. From 20 out of 53 related studies, we eventually found the most relevant literatures. The results indicate that traditional training has not met the requirements of future trends, while augmented reality training methods, may offer extra benefits than the counterparts. The concept of gamification in which operators are directly involved, appropriate with skill-based assembly work requiring hands on experience. Further cognitive considerations and physiological measurements during experiment are required to improved HCI assembly work training systems design, especially within the gamification element context.

IEEM20-P-0412/ Simulation Paper Planes a Way to Teach Lean Production

Luis A. Salazar¹, Maria Del Pilar Revuelta Mendoza²
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²Universidad de los Andes, Colombia

This article contributes to efforts to teach new methodologies for Industrial Engineering and Engineering Management. Therefore, the creation of the Simulation Paper Planes is presented to teach the principles of Lean Production. The document details the basic rules, general instructions, materials, manufacturing drawings, key performance indicators, and rounds of this simulation. This simulation is a direct and straightforward way to explain and demonstrate the importance of applying the Lean Principles in projects and production processes anywhere in the world. Of the 14 Lean principles, the authors managed to get participants to use 11. As future research, the authors call teachers and consultants to apply this simulation to students (Civil, Industrial, and Construction Engineering) and professionals, to generate a more extensive database. Also, they propose a line of research regarding the level of education in Lean practices between different countries, because, in general terms, undergraduate students in Chile were at the level of graduate students in Colombia.

IEEM20-P-0541/ Independent Campus on Industrial Engineering Undergraduate Program in Indonesia: A Delphi Method

Fitra Lestari¹, Ismu Kusumanto², Salfen Hasri², Akmalulhadi³
¹Sultan Syarif Kasim State Islamic University, Indonesia
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The industrial engineering department needs to evaluate graduates who can adapt their expertise to the needs of the industry. The purpose of this study is to assess graduate skills through program educational objectives (PEO) and learning outcomes (LO) and propose an undergraduate student internship program by adopting the concept of an independent campus in Indonesia. Moreover, it also uses a three-round the Delphi method through the in-depth interviews with 128 alumni in 100 industries, focus group discussion with ten experts, and validation from the panelist consist of practitioner and academician. Findings presented that 3 PEO and 14 LO still relevant based on the industrial requirement. Then, this study found that there were two types of internship programs consisting of 18 skills of the internship program in the industry and 14 skills of the entrepreneurship program. The paper guides the industrial engineering department in charge of an undergraduate student internship program through a Delphi method.

Session	Safety, Security and Risk Management
Date	16/12/2020
Time	12:00 - 13:30
Chairs	Michel ALDANONDO <i>Toulouse University /</i> <i>IMT-Mines Albi</i> Dingcheng ZHANG <i>City University of Hong Kong</i>

IEEM20-P-0017/ An Investigation of the Perceived Adverse Impacts and Control of Construction Noise in China

Zhe Hu¹, Hao Hu¹, Weng Tat Chan², Feng Xu¹

¹Shanghai Jiao Tong University, China

²National University of Singapore, Singapore

Construction noise is harmful to not only workers' occupational health but also their work safety and productivity. But, workers' subjective evaluation of the impacts of construction noises have been less studied. This study investigated the adverse impact of construction noise from the perspective of the workers and analyzed their responses for the role of personal factor (i.e. noise sensitivity) in perceiving adverse impacts and the likelihood of making errors during work. The results showed that noise sensitivity was an important factor in the subjective evaluation of construction noise and the likelihood of making mistakes. With the increase of noise sensitivity, the relations among some factors are non-linear. It was found that psychological impacts were regarded more obvious than physiological impacts to workers. And there was a significant positive correlation between adverse impact and the likelihood of work error. Current noise control methods could be categorized into five types and mostly singly used. There were no significant differences among them indicating less efficiency. The findings can facilitate better working environment for on-site workers to promote both their physical and mental health.

IEEM20-P-0149/ Digital Twin for Legal Requirements in Production and Logistics based on the Example of the Storage of Hazardous Substances

Giuseppe Perez, Benjamin Korth

Fraunhofer Institute for Material Flow and Logistics IML, Germany

This paper aims to show a conceptual approach to audit and evaluate compliance with legal requirements in production and logistics using a digital twin. The adherence to compliance on an operative and strategic level is of particular importance since complex legal requirements are closely linked to many everyday production and logistics processes. Non-compliance can endanger employees and the environment as well as result in financial and reputational damage. Especially use cases with regard to handling and storing hazardous substances is characterized by a large number of different laws, administrative regulations, and safety requirements. In this context, it is particularly important to create a suitable database to comply with legal requirements and thus to provide managers and employees with appropriate instructions for action. We propose the concept of the digital twin for legal requirements in production and logistics and define relevant events to create a suitable database.

IEEM20-P-0198/ Frequency Probabilistic Risk Assessment Using Coloured Petri Nets for Telemedicine

Kenji Fujita, Kunihiro Hiraishi, Toshiaki Aoki

Japan Advanced Institute of Science and Technology, Japan

Recently, threats such as global warming and epidemics have become more serious. For chronic patients, it is desirable to evaluate the residual risks of telemedicine more accurately, including for combined hazards. However, such comprehensive evaluations are difficult to perform using existing risk assessment methods because telemedicine systems are distributed. To the best of our knowledge, existing research does not take the problem sufficiently into account. To assess the residual risk of telemedicine accurately, we study risk assessment using Coloured Petri Nets (CPN) for telemedicine, which is a formal modeling language that is well suited for modeling and analyzing complex systems. We evaluate the residual risks using simulation function by CPN Tools and obtain the residual risks more accurately. Given the results of an experiment we conduct using CPN for telemedicine, we can confirm the probability of not being able to consult telemedicine and other probabilities. Moreover, CPN is found to be well suited for assessing the combined hazards more accurately. This is the first paper of frequency probabilistic risk assessment using CPN for telemedicine.

IEEM20-P-1093/ Towards a Risk Engineering Knowledge Model for Technical System Offers in Engineer to Order Situations

Delphine Guillon¹, Rania Ayachi², Michel Aldanondo³, Elise Vareilles⁴,

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⁵Toulouse University, France

When preparing a commercial offer concerning technical systems, suppliers working in engineer to order can either make a detail design job or just decide key solution choices. With a detail design, If the customer accepts the offer, the supplier has a good confidence in his ability to provide a solution matching offer contents because requirements have been studied in detail. With key technical choices, it is not the case and the supplier takes the risk of not being able to provide an adequate solution because requirements have been just superficially studied. The goal of the communication is to propose and discuss the key elements of a knowledge model in order to manage this kind of supplier risk when preparing the offer. By management we mean, according to ISO 31000, identifying, assessing and processing risk. The proposed key knowledge elements are a risk taxonomy and a risk mitigation action taxonomy. Actually, risk management relies fully on the human expertise, these modeling elements will allow to design a knowledge-based system that can assist the human in charge and improve commercial offers quality.

IEEM20-P-0186/ Risk Assessment for Food Safety in Chicken Slaughterhouse Industry

Hana Wahyuni, Iwan Vanany, Udisubakti Ciptomulyono

Institut Teknologi Sepuluh Nopember, Indonesia

Food safety has become an important issue of end consumers, encouraging Indonesian government and food processing industry to fulfill the human health requirements. Risk assessment is key element of food management system to food safety. This study is aimed to develop risk assessment for food safety in slaughterhouse industry using Bayesian Network. Several stages are used in this study, such as identifying critical points in food safety, determining opportunities for food safety contamination as well as calculating and determining the priority of food safety critical points. Single case study was carried out in chicken slaughterhouse companies. The results showed that there were 8 critical points in the process of chicken slaughterhouse, with the main critical point being in the preparation process (raw material), especially in the risk of physical conditions (weak or unhealthy chickens).

Session	Manufacturing Systems 3
Date	16/12/2020
Time	14:30 - 16:00
Chairs	Hichem Haddou BENDERBAL IMT Atlantique Junfeng WANG Huazhong University of Science and Technology

IEEM20-P-0350/ Digital Twin-based Production Simulation of Discrete Manufacturing Shop-floor for Onsite Performance Analysis

Yufan Zhang, Yaoqi Shao, Junfeng Wang, Shiqi Li
Huazhong University of Science and Technology, China

In order to drive production performance analysis of discrete manufacturing system, it has become a widespread concern to realize accurate and rapid mapping from physical shop-floors to virtual shop-floors considering the characteristics of online production. A digital twin model framework for production performance analysis is proposed and details the function of each module in physical space and virtual space. A simulation model mapping scheme for discrete manufacturing shop-floors is presented and a complete simulation model is divided into a data model, a logic model and a visualization model, where the whole process of model mapping and fusion is elaborated. The case study of mechanical parts manufacturing workshop is carried out and the results show that the effectiveness of the simulation model mapping method and timely production performance analysis based on real data.

IEEM20-P-0357/ Development of a Lean Manufacturing and SLP-based System for a Footwear Company

Victor Paucar¹, Sergio Munive¹, Victor Nuñez², Eloy Marcelo Lastra², Jose C. Alvarez-Merino², S. Nallusamy³

¹Universidad Peruana de Ciencias Aplicadas, Peru

²Peruvian University of Applied Sciences, Peru

³Dr. M.G.R. Educational and Research Institute, India

This research article addresses one of the main problems in the footwear industry, namely the high order non-fulfillment rate. The case study suggests that the main causes of this problem are the increasing rate of defective goods, delays in the production process, and excessive time consumption in the movement of staff and materials. To face this issue, a proposal focused on the use of Lean Manufacturing, such as Systematic Design Planning (SLP) and Andon, is developed to increase productivity, as well as optimize and streamline production processes, considering Covid-19-related safety protocols. To validate the effectiveness of the proposal, an ARENA simulation system was used to establish a new scenario where the defective product indicator decreases by 3.13% and productivity improves by about 38%. In turn, the resulting increase in the number of orders enhances company sales and profits, as well as the ability to meet the customer demand in a timely manner.

IEEM20-P-0358/ Improving the Cutting Process Through Lean Manufacturing in a Peruvian Textile SME

Beckin Alanya, Emily Dextre, Victor Nuñez, Eloy Marcelo Lastra, Jose C. Alvarez-Merino

Peruvian University of Applied Sciences, Peru

It seeks to improve the fabric cutting process of cotton garment exporting mypes by identifying and eliminating waste, defined as processes or activities that do not add value, specifically in the cutting area of a textile company. In addition, this improvement will occur under the application of the Lean Manufacturing philosophy through the tools of VSM, SMED and standardization of work, which is supported by data analysis, economic validation and simulation through the use of historical data from the company under study. Likewise, through the study carried out, it was possible to reduce reprocessing by default from 13.12% to 4.23%, delayed processes have been reduced from 18.49 to 9.61% and the productivity index of the cutting area increased from 0.38 to 1.16.

IEEM20-P-0372/ Manufacturing Cloud Service Composition Based on the Non-Cooperative and Cooperative Game Theory

Ehsan Vaziri Goodarzi¹, Mahmoud Houshmand², Omid Fatahi Valilai³, Vahidreza Ghezavati¹, Shahrouz Bamdad¹

¹Islamic Azad University, Iran

²Sharif University of Technology, Iran

³Jacobs University Bremen gGmbH, Germany

The production environment and its related supply chain have faced with enormous changes by Industry 4.0 (I4.0) emergence. Cloud Manufacturing (CM) is one of the paradigms of I4.0. Composition of Manufacturing Cloud Service (MCS) is an approach for developing the composite services in Cloud Manufacturing System (CMS) considering the MCS providers. Game theory is considered as an effective approach for developing models according to real-world conditions for MCS providers' cooperation and competition. This research proposes a profit function and then develops a mathematical model for MCS composition using game theory and the proposed function. The MCS providers compete with each other in non-cooperative and cooperative games according to the proposed mathematical model. The result of research demonstrates that the cooperation game is more profitable than the non-cooperative game based on the formal cooperation among the MCS providers. Therefore, the payoff of players in the cooperative game is higher than the non-cooperative game. Also, the level of Quality of Service (QoS) in the cooperative game is greater than the game type of non-cooperative. Therefore, the model of cooperative game satisfies the consumers and the MCS providers mutually. The paper recommends applying the cooperation game to service composition in the CMS.

IEEM20-P-0376/ Reengineering Workflow for Planned Reuse of IEC 61131-3 Legacy Software

Juliane Fischer¹, Birgit Vogel-Heuser¹, Fabian Haben¹, Ina Schaefer²

¹Technical University of Munich, Germany

²Technical University of Braunschweig, Germany

In automated production systems, an increasing proportion of functionality is implemented by control software. However, currently most companies do not implement variant and version management for their control software and, thus, lack a global knowledge base on existing software variants and versions. Further, despite its known drawbacks, i.e., low maintainability, the reuse strategy copy, paste & modify is commonly applied, leading to an even higher amount of unmanaged, historically grown software variants and versions. Since the resulting control software contains a vast amount of essential domain knowledge, strategies for its planned reuse are required. Therefore, this paper presents a workflow to enable the transfer from copy, paste & modify to planned reuse by analyzing the historically grown control software variants and deriving reusable library modules from them. For the library module development from multiple sources, an interaction concept is proposed, which has been evaluated partially through a prototypical implementation.

IEEM20-P-0495/ Goal-Lever-Indicator-Principle to Derive Recommendations for Improving IEC 61131-3 Control Software

Birgit Vogel-Heuser, Juliane Fischer, Eva-Maria Neumann

Technical University of Munich, Germany

In the domain of automated Production Systems (aPS), control software implements an increasing amount of functionality. Thus, its importance is steadily growing and the reuse of high-quality software solutions becomes more and more essential to compete in the global market. For this purpose, the use of modular design principles has been identified as a success factor for the planned reused of software parts. To assess and improve the modularity of existing control software solutions, software quality measures are adopted from computer science for their use in the aPS domain, e.g., static code analysis and software metrics. However, domain experts lack experience in applying these measures target-oriented and in understanding as well as interpreting the analysis results, which is mandatory for the measures' successful application. To bridge this gap, this paper introduces the Goal-Lever-Indicator-Principle to support experts in understanding analysis results by presenting concrete recommendations for actions derived from them. The approach is demonstrated with an industrial use case.

Session	Operations Research 3
Date	16/12/2020
Time	16:30 - 18:00
Chairs	Philipp BAUMANN <i>University of Bern</i> Ripon CHAKRABORTTY <i>UNSW Canberra at ADFA</i>

IEEM20-P-0254/ A Multi-Round Auction for Staff to Job Assignment Under Myopic Best Response Dynamics

Felix Merz, Christoph Schwindt, Stephan Westphal, Juergen Zimmermann
Clausthal University of Technology, Germany

Many production systems still rely on human workers, who—unlike machines—have individual preferences and private information to be taken into account when assigning staff to jobs. We propose a multi-round auction where workers bid their work rate on jobs trying to receive the jobs they prefer. The workers use a bidding strategy based on the myopic best response rule. The factory assigns the jobs to the workers while trying to maximize its production rate. To cope with the multiplicity of optimal assignments, the workers apply the Hurwicz criterion combining the best and worst possible outcomes. We evaluate our auction mechanism by examining the workers' utilities and the factory's production rate on generated problem instances and compare the results to a similar smart market mechanism for procurement and to the well-known Vickrey-Clarke-Groves auction. Our auction allows the factory to receive information about the maximum work rate of the workers. In return, the workers participate in the job assignment and can incorporate their preferences.

IEEM20-P-0289/ Simulated Annealing Algorithm Performance on Two-Echelon Vehicle Routing Problem-Mapping Operation with Drones

Rahmad Inca Liperda¹, A. A. N. Perwira Redi², Nandini Niramaya Sekaringtyas¹, Handina Boedhy Astiana¹, Bertha Maya Sopha³, Anna Maria Sri Asih³

¹*Universitas Pertamina, Indonesia*

²*Bina Nusantara University, Indonesia*

³*Universitas Gadjah Mada, Indonesia*

Flood is one of the most threatening hazards in Indonesia. The disaster may affect road disruptions. Disaster mapping with the combination of ground vehicles and drones would be a possible way to respond to flood disasters. The study aimed to determine parameter values that generate the best solution by metaheuristics algorithm and compare each method's solution values. The modeled problem was solved by the exact method using AMPL and the Simulated Annealing algorithm using the C# programming language, and the parameters tuning process was performed before the implementation of the metaheuristic algorithm. The results show that there are 4.28% differences between the optimal solution generated by AMPL and Simulated Annealing.

IEEM20-P-0414/ A Relax-and-Solve Algorithm for the Ordered Flow-Shop Scheduling Problem

Mostafa Khatami, Amir Salehipour
University of Technology Sydney, Australia

In the ordered flow-shop scheduling problem the processing times follow specific structures. We propose a relax-and-solve matheuristic for the ordered flow-shop problem to minimize the makespan, which is proven to be NP-hard. We compare the performance of our method and that of the state-of-the-art methods, and show that the proposed method is capable of reporting new best solutions for a large number of instances, and has the average gap of as low as 0.046% from the best known solutions.

IEEM20-P-0441/ A Stochastic Programming Approach for Configuration Optimization of Reconfigurable Manufacturing Systems

Feng Cui, Na Geng, Zhibin Jiang, Xin Zhou
Shanghai Jiao Tong University, China

As a new manufacturing paradigm, Reconfigurable Manufacturing System (RMS) has a modular structure, which can greatly improve the responsiveness and flexibility by adding or removing the modules of the reconfigurable machine tools (RMTs). However, the uncertain demand makes it difficult and challenging to configure the RMS. To deal with this problem, we propose a multi-period stochastic programming model to optimize the configuration of RMS in each period by considering the uncertain demand. The objective is to maximize total costs. Production planning related decisions are considered to better handle the unpredictable demand fluctuation. Numerical experiments compare the solutions by solving the proposed stochastic programming model and those by solving the deterministic linear model without considering production planning decisions. The results show that our model can provide a better solution in terms of the configuration and reconfiguration cost and total costs under the consideration of uncertain demand.

IEEM20-P-1129/ Estimation of Weights for Multi-objective Production Scheduling Problems - An Inverse Optimization Approach

Kohei Asanuma¹, Tatsushi Nishi²

¹*Osaka University, Japan*

²*Okayama University, Japan*

We propose an inverse optimization approach for estimating weights in the multi-objective scheduling problems. We propose two types of estimation methods for multi-objective function from input-output data of parallel-machine scheduling problems. One is a machine-learning based on random forest, and the other one is based on an inverse optimization. The proposed methods are applied to multi-objective parallel machine scheduling problems with three objective functions. We compare each estimation accuracy of machine learning and inverse optimization methods. A surrogate model is proposed to reduce the computation time of the inverse optimization method in order to estimate models more effectively. Computational results show that input-output data involving up to 3 machines and 7 jobs can be solved using the proposed methods.

IEEM20-P-0457/ Robust Optimization Based Heuristic Approach for Solving Stochastic Multi-Mode Resource Constrained Project Scheduling Problem

Ripon Chakraborty, Michael Ryan
University of New South Wales, Canberra, Australia

To deal with uncertain or stochastic durations in a Stochastic Multi-Mode Resource-Constrained Project Scheduling Problem (SMRCPSP), this paper proposes a robust optimization (RO) approach, which is claimed as the second research work in this similar research paradigm. When compared with the only other available approach in the literature, the applicability and uniqueness of the proposed RO approach are clearly demonstrated by the solution methodology and uncertainty considerations. Depending on different uncertainty characteristics of stochastic durations, different deterministic constraints or equivalent counterparts are generated in a RO framework, which is later solved by an updated modified variable neighbourhood search heuristic (MVNSH). Several standard instances and a real-life case study are solved to demonstrate the efficacy of the proposed solution approach. After a careful observation among different uncertainty types, several key strategic decision points are also highlighted for managerial implications.

Session	Operations Research 4
Date	16/12/2020
Time	19:00 - 20:30
Chairs	Ripon CHAKRABORTTY <i>UNSW Canberra at ADFA</i> Oliver STRUB <i>University of Bern</i>

IEEM20-P-0460/ A Matheuristic for Practical Flights Arrival and Departure Scheduling

Mohammad Mahdi Ahmadian, Amir Salehipour
University of Technology Sydney, Australia

Delays in flights arrival and departure are costly because they adversely impact the passenger experience and result in significant operational costs. Effective management of runways considerably contributes to minimizing such delays. In this paper, we propose an efficient matheuristic algorithm, namely the relax-and-solve (R&S), for the problem of scheduling flights arrival and departure on airport's runway with the objective function of minimizing the weighted delays, where delay is measured by the total deviation from the target arrival and departure times. We test the proposed R&S on two sets of 27 real-world instances for Milan international airport, and compare the results of our R&S and the optimal solution of the same instances. We show that our proposed algorithm obtains almost all the best-known solutions within one minute, even for the largest instances including 170 aircraft. Those characteristics of the proposed R&S algorithm are very important for practical settings, particularly, the typical short time window available for planning the aircraft landings and departures at busy airports demands for quick delivery of quality schedules (or updating the current schedule), and fast and effective algorithms are therefore paramount.

IEEM20-P-0497/ Flying Sidekick Traveling Salesman Problem with Pick-Up and Delivery and Drone Energy Optimization

John Francis Gacal, Marco Lorenzo Urera, Dennis Cruz
De La Salle University, Philippines

This paper considers a mixed integer linear programming model that aims to minimize the total cost of routing a truck-drone tandem while considering pickup and delivery operations. In addition, the model proposes a new approach for battery swapping that optimizes drone energy replenishment. The model is validated through different scenarios with varying cost and network parameters to observe whether the corresponding changes in the system are logical. The results were able to show that the proposed battery swap approach improved the solution obtained in the context of a min-cost model. In addition, increasing the drone-truck speed ratio was observed to reduce the total cost incurred in routing the truck-drone tandem on a network.

IEEM20-P-0502/ Multi-objective Optimization for Mixed-model Assembly Line Sequencing and Balancing in the Context of Industry 4.0

Mehran Majidian-Eidgahi¹, Armand Baboli¹, Reza Tavakkoli-Moghaddam²

¹*University of Lyon, France*

²*University of Tehran, Iran*

During the last decade, customers' demands have been transformed significantly and are becoming more and vaster. To answer this transformation, a new production approach, called customized mass production, is introduced. All kinds of production systems are concerned by this transformation; however, we focus mainly on mixed-model assembly lines having a brilliant role in producing a vast variant of products at a low quantity. One of the most important challenges in assembly lines is concerned with the determination of production sequence. In customized mass production, operation time can be varied from one product to the next one, and therefore, we generate an unbalancing between several workstations. Then, for customized mass production, we are obligated to solve the sequencing and line balancing problem simultaneously. This study proposes a new multi-objective mathematical model for this problem. Since the objective functions are conflicting with each other, the augmented ϵ constraint (AUGMECON) method is used to solve the problem. Knowing that after the resolution of the given problem, this method can create several alternative solutions, and a multi-criteria decision-making tool is used to rank these alternatives solutions.

IEEM20-P-0540/ An Immune Genetic Algorithm for Resource Constrained Project Scheduling Problem with Discounted Cash Flows

Md Asadujjaman, Mohammad Humyun Fuad Rahman, Ripon Chakrabortty, Michael Ryan
University of New South Wales, Canberra, Australia

The resource constrained project scheduling problem with discounted cash flows (RCPSPDC) is a well-known complex optimization problem. In this paper, an immune genetic algorithm (IGA) is proposed to solve the RCPSPDC with the objective of maximizing the net present value (NPV) to ensure project profitability. Hybridizing a genetic algorithm with immune algorithm enhances the overall performance of the IGA. The performance of the proposed algorithm has been evaluated by solving 2,160 problem instances from the standard benchmark dataset and the results have been compared with existing state-of-the-art algorithms. Extensive experiments demonstrate that the overall performance of the IGA is quite satisfactory for 50 activities dataset.

IEEM20-P-0546/ A Hybrid Community-based Simulated Annealing Approach for Influence Maximization in Social Networks

Tarun K. Biswas, Alireza Abbasi, Ripon Chakrabortty
University of New South Wales, Canberra, Australia

Influence maximization (IM) in social networks aims to figure out the best subset of seed nodes which have maximum cascading influence under a diffusion model. This paper proposes a hybrid Community-based Simulated Annealing (ComSA) approach for the IM problem. A community detection algorithm is employed to segregate the entire social network structure into some more deeply clustered communities. Thereafter, a degree based metric has been used to select the candidate pool from each community by excluding less influential nodes at the preliminary data preprocessing phase. A community-based seed initialization and neighborhood search technique have been proposed. To speed up the convergence of stable solutions in Simulated Annealing approach, a greedy hill climbing strategy is also implemented instead of using probabilistic based solution acceptance processes. Experimental results on four real-world datasets show that our proposed algorithm has comparable solution with greedy and outperforms the other existing meta-heuristic approaches.

IEEM20-P-0430/ Application of Fault Tree Analysis and Petri Net Modeling in Perishable Product Supply Chain

Manisha Bhardwaj, Rajat Agrawal
Indian Institute of Technology Roorkee, India

In this paper, fault tree analysis (FTA) has been conducted to identify uncertainties in perishable product supply chain (PPSC). Supply chain of these products are complex in nature due to short-life cycle and uncertain behavior. Fault tree is a top-down approach and based on structural analysis we identified the basic events for uncertainty occurrence that leads to failure in PPSC. There are anomalies in FTA such as data explosion and non-diagnosis of dynamic nature. Petri Net (PN) modelling addresses these issues. Relational matrix analysis is applied to evaluate minimal cut sets (MCS) in fault tree which identifies the uncertainty in PPSC. PN establish state equation and initial token to identify faults mathematically and to improve efficiency of PPSC. Finally, using PPSC as an example, the proposed method proved to be effective.

Session	Reliability and Maintenance Engineering 2
Date	16/12/2020
Time	08:00 - 09:30
Chairs	Zied HAJEJ LGIPM/Lorraine University Kuo-Wei WU National Taiwan University

IEEM20-P-0035/ Jump Diffusion Process Model Considering Component Dependency in Open Source Project for Development Effort Management

Yoshinobu Tamura¹, Sugisaki Kodai¹, Shigeru Yamada²

¹Tokyo City University, Japan

²Tottori University, Japan

This paper focuses on component dependency in the project of open source software (OSS) for development effort management. Especially, we use a Wiener process to consider the component dependency of cross-interaction under the operation of OSS. Then, we derive a stochastic model of project management based on the Wiener process composing the irregular situations in component dependency for OSS operation. It will be useful to assess the development effort expenditures with OSS component-collision under the OSS project operation. Moreover, the web-based data sets are analyzed to illustrate numerical examples of our method discussing the OSS component-collision.

IEEM20-P-1039/ Exact Method and Approximated Method for Redundancy Allocation Problem of Multi-state Series-parallel System

Hanxiao Zhang, Yan-Fu Li

Tsinghua University, China

In this paper, we study the two typical formulations for redundancy allocation problem (RAP). One is to maximize the system reliability given the cost constraint and the other is to minimize the system cost with the reliability constraint (other constraints, e.g. weight, remain the same). In literature, there is no exact algorithm for these two formulations for multi-state series-parallel systems (MSSPS). In this work, we illustrate the relationship and the conversion rule between these two formulations. Based on this relation, we propose an exact algorithm, Reduced Multiple Objective Dynamic Programming (RMODP), for homogeneous and heterogeneous MSSPS RAP. We also propose an approximated method for MSSPS RAP under a provable absolute error to improve solving efficiency. All the proposed algorithms are validated on five benchmarks and a newly generated instance with a larger number of subsystems. The comparisons show that RMODP algorithm has successfully achieved the exact solutions on all test cases and three exact solutions not seen in publications are newly found. The results show that the approximated solutions have a good precision under a given error.

IEEM20-P-0235/ High-Fidelity Finite Element Modelling and Simulation of Solid Resilient Tire: Application to Forklift Solid Resilient Tire

Aruna Premarathna¹, Supun Jayasinghe¹, Kushan Wijesundara¹, Pramila Gamage¹, Sisira Ranatunga²

¹University of Peradeniya, Sri Lanka

²Elastomeric Engineering (Co) Ltd., Sri Lanka

Solid tires are utilized for excessive material handling purposes. They experience excessive stresses and high internal energy generation. These factors are not easy to be captured using experimental methods due to complex experimental setup and high cost. Hence, this study is focused on development of a detailed three-dimensional (3D) Finite Element (FE) model of a three-layered forklift solid resilient tire to investigate its characteristics at static conditions. Mooney-Rivlin, Ogden and Yeoh materials model were identified as the best suited hyper-elastic material models that have good agreement with base, cushion and tread of this tire respectively. The developed FE model was validated and its characteristics were investigated at different loads and grade levels of ramp. The results emphasized that, localized high stresses are mainly distributed in the base layer and reinforcements. Cushion layer was identified as the highest energy dissipation area. Furthermore, Forklift gradeability analysis results show that higher-grade values lead to poor tire performances with high wear rate. This study can be further extended to investigate the dynamic behavior of the solid resilient tire.

IEEM20-P-0413/ Integrated Preventive Maintenance Improvement and Spare Part Ordering Strategy for Age Deterioration Components

Danping Lin¹, Carman Ka Man Lee², Wenyan Guo¹

¹Shanghai Maritime University, China

²The Hong Kong Polytechnic University, China

We consider the integrated preventive maintenance and spare part ordering strategy problem for age deterioration components in which there are distinguishing critical and non-critical components. The component deterioration process is modeled as a three-stage failure process in which multiple maintenance modes are conducted to restore the machines after periodical inspection. Some spare parts are stored based on historical repair records while certain spare parts are ordered alternatively whenever necessary. The influence of spare parts ordering associated with cost and fulfillment of maintenance mode. Our objective is to minimize the expected total cost per unit time. We formulated the model based on the renew theory and characterize the scenarios of combinations of maintenance mode selection and spare parts ordering strategy. Numerical experiments of a case study showed that the cost-saving obtained by integrated optimization of maintenance mode selection and spare parts ordering decisions are significant.

IEEM20-P-0417/ Health State Prognostics Study Based on Extreme Learning Machine

Wenqin Zhao, Yaqiong Lv, Qianwen Zhou

Wuhan University of Technology, China

As smart manufacturing's booming, prognostics and health management of equipment becomes more and more important which has emerged as an intelligent support to improve the availability of manufacturing system. Industry equipment consists of many mechanical components, and rolling bearing is one of the most generally applied vital parts in rotating machinery. The smooth operation of the whole system relies on the health of every single part in the system like rolling bearings. Therefore, it is crucial to monitor the health status of key mechanical components of a system. In this paper, a health study of rolling bearing is proposed where ensemble empirical mode decomposition (EEMD) is selected as the signal process method for feature extraction and extreme learning machine (ELM) neural network is implemented for health status prediction. To validate the proposed approach corresponding experimental study is carried out and the results prove the feasibility.

IEEM20-P-0163/ Integrated Production, Maintenance and Control Chart of Supply Chain Management Under Quality Constraint

A. S. Abubakar, Ame Nyongue, Zied Hajej

University of Lorraine, France

This paper develops a joint control of production, maintenance, and quality for a supply chain management system. The manufacturing system is subjected to a random failure that directly affects the quality of the products. the degradation of the manufacturing system is impacted by the variation of the production and its use. The control of the process and the quality of the products is carried out using statistical process control (SPC) and its tool "control chart of average". The problem consists of several warehouses allow satisfying random demands during a finite horizon, under quality level. The goal of this study is to establish an optimal production planning and maintenance strategy, taking into account the influence of the production rate on the system degradation and according to the average of the measures of the quality indicator x compared to the control limits, which minimize the total cost.

Session	Quality Control and Management
Date	16/12/2020
Time	12:00 - 13:30
Chairs	Zied HAJEJ LGIPM/Lorraine University Danping LIN Shanghai Maritime University

IEEM20-P-0114/ Development and Validation of a Failure-Cause-Searching and Solution-Finding Algorithm Based on Complaint Information from the Use Phase

Amirbabak Ansari, Nadine Schlueter, Marius Heinrichsmeyer, Manuel Loewer

University of Wuppertal, Germany

The increasing complexity of customer requirements, production systems, and new products influences the processes of complaint management in terms of decision-making time and resource expenditure. In literature, there are various approaches to support complaint management. An analysis of these approaches shows that the state of the art reaches its limits regarding complexity. To master this problem, the department "Product Safety and Quality Engineering" has developed an algorithm for failure cause searching and solution finding. This algorithm is based on a conceptual model and a prototype was programmed in Visual Basic for Applications (VBA). The algorithm is validated using cases from stamping and forming process. The algorithm itself, the results of the validation, the critical observations, and the lessons learned are reported in this paper.

IEEM20-P-0148/ A Failure Handling Process Model for Failure Management in Manual Assembly

Robin Exner, Quoc Hao Ngo, Junjie Liang, Max Ellerich, Robin Günther, Sebastian Schmitt, Robert Schmitt

RWTH Aachen University, Germany

The objective of this paper is the optimization of failure management in production. For this purpose, the failure management process was considered in terms of its interaction with the operational activities in an assembly line. The process for production-related failure management is sufficiently described in the literature, but so far only a few approaches exist that analyze the interactions between production and quality processes in a dynamic model. In this paper, an existing model was taken up and further developed to represent individual assembly lines. The further developed model was programmed as a System Dynamics model that is provided in this paper.

IEEM20-P-0251/ The Implementation of ISO 9001:2015 to Improve Quality Service: A Descriptive Study on a South African Service Organization

Marabe Hotpower Magana, Eric Mikobi Bakama, Sambil Charles Mukwakungu, Nita Sukdeo

University of Johannesburg, South Africa

The study emphasizes on the execution of ISO 9001: 2015; within a South African service origination that provides learning programs in engineering industries. This study analyses the implementation of ISO 9001:2015 within the service organization. The rationale behind the study is to aid management to understand ISO 9001:2015 and align it with the organization's mission to attain optimum performance while providing the stakeholders with pinnacle quality. A descriptive approach using both quantitative and qualitative methods were utilized to analyze the data gathered from respondents (70 customers). The data was collected within the organization based on the business experience of the respondents. The analysis showed that many complaints from customers on the quality of the service delivered were recorded highlighting that the service company needs improvement in the central administration department and improves the efficiency of the learner's registration. The complaints management graph highlights that the organization needs improvement in the communication process with learners. Nevertheless, it was concluded that some learners are also satisfied with the call center personnel and the service they receive from them.

IEEM20-P-0288/ The Relationship Between the Implementation of Quality Management Practices and Service Quality in the South African Financial Service Industry

Kuthula Ntanz, Alice Kabamba Lumbwe, Sambil Charles Mukwakungu, Nita Sukdeo

University of Johannesburg, South Africa

The purpose of this study is to evaluate the effect of quality management practices on customers, employees and service quality in the financial service industry. The sample of 30 customers and 30 employees were selected based on stratified and snowball sampling procedures respectively. This research used a mixed approach to collect data. The study was conducted by engaging with customers (business owners, students and the working class) in the form of interviews and questionnaires, and by using secondary data. The main quality principles was mainly based on employee satisfaction, customer focus and continual improvement to establish how customers choose the bank they bank depending on their different classes. The results reveal that employee satisfaction had a direct relationship with the level of quality the organization produced. In addition, business owners and the working class were more likely to consider the service quality of the organization before they decide to bank with them. This research shows the significance of the implementing quality practices in the financial service industry in order to gain or retain customers.

IEEM20-P-0344/ An Integrated Modeling Framework for Multivariate Poisson Process with Temporal and Spatial Correlations

Cang Wu, Shubin Si

Northwestern Polytechnical University, China

Multivariate Poisson (MP) counts are common in the course of manufacturing and service process. It is significant to monitor the MP counts and judge whether the process is in control or not. Most of the previous researches assumed that the variables of each univariate Poisson process are independent. Taking the temporal and spatial correlations into account, this article proposes an integrated model based on copula model and autoregressive (AR) process. Furthermore, the inference functions for margins (IFM) method and the expectation maximization (EM) algorithm accompanied by sequential importance resampling (SIR) method, provide satisfactory estimators in the proposed model.

IEEM20-P-0431/ Total Quality Management & Customer Satisfaction in Public Hospitals in Sri Lanka

Pemal Daksith, Uthpalee Hewage

University of Moratuwa, Sri Lanka

The main objective of this study is to evaluate the relationship between Total Quality Management (TQM) principles and Customer Satisfaction of Out Patient Department (OPD) in Sri Lankan public hospitals. A questionnaire survey has been conducted to examine the correlation between TQM principles and Customer Satisfaction involving both employees and patients by using Structural Equation Method. Survey has been conducted with the participation of both employees (managers, doctors, nurses and attendants) and patients in the OPD. Result of the analysis reveals that "Information Analysis and Knowledge Management, Process Management and Customer Focus" have a significant positive impact on Customer Satisfaction in the OPD process in public healthcare. This study explains the gravity of TQM in contributing to Customer Satisfaction in the public service sector which has not been investigated in many past empirical studies. As Sri Lanka is a developing country which has more potential strength towards improving service sector rather than the manufacturing sector, this study will help for any public organizations to adopt to TQM principles in order to achieve their ultimate goal of increasing their customer satisfaction.

Session	Engineering Economy and Cost Analysis
Date	16/12/2020
Time	14:30 - 16:00
Chairs	Kah Hin CHAI <i>National University of Singapore</i> Leif OLSSON <i>Mid Sweden University</i>

IEEM20-P-0009/ Operating Expense Budgeting Using Standard Activity Measurement Plan

Romeo G. Manalo¹, Marivic V. Manalo²

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²*De La Salle University, Philippines*

This paper is about an implementation framework of Standard Activity Measurement Plan (StAMP) in Operating Expenses (OPEX) budgeting. StAMP is a modified version of Activity-Based Costing (ABC). Activities are given predefined unit costs based on the direct costs of each cost center. The basis of the unit costs is the previous year's actual expenses. The direct expenses are spread to all activities. The cost center will have to define the activity driver or the mechanism to accomplish the work or activity output. If the cost center can identify the volume or frequency of the activity driver for a given period (such as annual or one quarter of a year), the expected costs can be computed. This can be a basis for the budget as well which is linked to the goals/objectives/activities of the cost center. Another feature of the StAMP is the Full-Time Equivalent (FTE) analysis. Since the processing time per activity will be initially identified, simply multiply the activity driver volume to the total time per activity to establish the FTE per activity or total FTE per cost center. This can be used for manpower planning and performance measurement as well.

IEEM20-P-0146/ Time-related Differentiation of Complexity Costs Using Process Data Mining

G. Schuh, Christian Dölle, Maximilian Kuhn, Jan Koch, Alexander Menges, Christina Ruschitzka

RWTH Aachen University, Germany

In the recent years, manufacturing companies extended their product portfolio with numerous product variants, accompanied by an increase in process variants and indirect costs. Many companies are not aware of the negative financial effects of a large product portfolio. Existing methods, such as activity-based costing or process costing, focus on a cause-related allocation of costs to products. Additionally, approaches use the separation of complexity costs into initial and running costs in order to determine a more accurate differentiation of cost effects. However, these approaches are based on primarily manually gathered data and are thereby time and cost intensive. In the course of digitalization and the use of business information systems, new possibilities arise to obtain cost relevant data efficiently. Nevertheless, current research does not provide a holistic databased approach separating initial and running costs. This paper presents a methodology focusing on this differentiation using data from information systems to increase the transparency in cost accounting. The result is a methodology validated within an automated tool using process data mining for a targeted analysis of complexity costs for product portfolio evaluation.

IEEM20-P-0363/ The Effect of Geographical Factor on the Use of Combinable Containers

Haruki Ogawa¹, A. Imai², K. Shintani³, E. Nishimura²

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²*Kobe University, Japan*

³*Tokai University, Japan*

This paper analyzed the use of combinable containers which can be de/coupled and used as a 20ft and 40ft size container. Based on a model by [6], our model considered a geographical factor in a trade zone with the huge hinterland. The experimental result showed that the ratio of combinable in use was higher among all the container types for distant owners to facilitate an efficient use of a whole container fleet to minimize the transportation cost.

IEEM20-P-1083/ EV Diffusion Model Considering Differences in Network Externalities Structure

SangWoo Yun, Deok-Joo Lee

Seoul National University, South Korea

In this study, the diffusion model of EV was constructed using the concept of fermi-process and square-lattice network. In particular, the network externality effect was considered in constructing the diffusion model. Unlike the previous studies, the network externality effect was divided into 'generalized network externality' and 'localized network externality' to further improve the diffusion model. Through this diffusion model, the extent of future EV diffusion at the current level of government subsidy policies was estimated and then the effectiveness of some policies such as subsidies were analyzed.

Session	Engineering Education and Training 2
Date	16/12/2020
Time	16:30 - 18:00
Chairs	Leif OLSSON <i>Mid Sweden University</i> Yogi Tri PRASETYO <i>School of Industrial Engineering and Engineering Management, Mapua University</i>

IEEM20-P-0122/ The Impact of SARS-CoV-2 on Engineering Education: Student Perceptions from Three Countries

Per Åhag¹, Ying Jui Hsu², Leif Olsson³, Leif Sundberg³

¹*Umeå University, Sweden*

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³*Mid Sweden University, Sweden*

The outbreak and rapid spread of SARS-CoV-2, commonly known as COVID-19, has led to a loss of life, widely spread economic consequences, and changed behavior in many, if not all, sectors of society. One such sector is institutes for higher education. Against this backdrop, in this paper, we aim to study how engineering training was affected at the beginning of this global pandemic. The point of departure in the paper is the students' perceptions. Our study is based on survey responses from students from Singapore, Sweden and Taiwan. Three themes were identified in the results: a) issues related to transitioning from the physical classroom to an online environment, b) examination activities, and c) perceptions about the future. As such, this paper contributes with first-hand experiences and reflections on engineering training during a global crisis.

IEEM20-P-0331/ Blackboard E-learning System Acceptance and Satisfaction Among Filipino High School Students: An Extended Technology Acceptance Model (TAM) Approach

Yogi Tri Prasetyo, Simeon Arnold R. Tumanan, Lance Allen F. Yarte, Mhel Cris C. Ogoy, Ardivin Kester S. Ong

Mapúa University, Philippines

Blackboard E-Learning System has been utilized by many top schools in the Philippines. The purpose of this study was to evaluate Filipino high school students' acceptance and satisfaction of Blackboard E-Learning System by utilizing an Extended Technology Acceptance Model (ETAM). 8 latent variables were utilized in this study: Perceived Ease of Use (PEOU), Perceived Interactivity (PI), Attitude (A), Actual Use (AU), Perceived Usefulness (PU), Feature (F), Behavioral Intention (BI), and Satisfaction (S). An online questionnaire was conducted at Senior High School Mapúa University and a total of 200 respondent data were analyzed. The results indicated that AU is the most significant factor affecting S, followed by F, PU, PEOU, A, and PI. This study is the first study that investigated the Blackboard acceptance in the Philippines. The results would be very beneficial for educators, IT engineers, and even policymakers.

IEEM20-P-0420/ Checklist as an Effective Means of Information Delivery in On-Demand Learning

Anand Konjengbam, Sanetake Nagayoshi

Shizuoka University, Japan

On-demand classes have become popular in the last decade due to their convenience and asynchronous nature of teaching. However, due to the lack of precise communication and effective information delivery, students need to put a significant effort to follow and comprehend on-demand lectures. In this paper, we investigate the practicability of using checklists to improve information delivery in on-demand learning. A case study is conducted on six on-demand lectures covering three lecture topics. We assess the report writings of over 141 student participants, divided into experimental and controlled groups. Natural Language Processing (NLP) and part-of-speech segmentation are used to analyse survey responses. The findings indicate a statistically significant difference in performance between instructions delivered through a checklist and simple text. At an average, 18% of the students avoid making mistakes when a checklist is used as the mode of instruction delivery. Our pilot study proves checklists' potential as a feasible and effective tool for information delivery in on-demand education.

Session	Poster Session 3
Date	16/12/2020
Time	10:00 - 11:30
Chairs	Wen WANG <i>Shanghai Jiao Tong University</i> Min XIE <i>City University of Hong Kong</i>

IEEM20-P-0409/ Optimization of Multiple Products Transportation Under the Background of Industrial Symbiosis Network

Na Gao, Yuting Li, Yuxi Mai, Haoxuan Xu
Northwestern Polytechnical University, China

Starting from the hotspots of solid waste recycling and reuse, and considering the characteristics of waste transportation in eco-industrial symbiotic network, this paper takes the transportation and distribution process of waste and by-product recycling and reuse in upstream and downstream enterprise clusters as the research object. Different from the traditional transportation research which a single goal-oriented and multi-product independent, Considering model the economic cost performance and environmental performance, as well as the "transport price correlation" between various wastes, this paper constructs a multi-objective transport planning model of Interacted multi-product. Finally, on the basis of the multi-product and multi-objective model, the paper refers to the related method theory of the second generation fast non-dominated sorting genetic algorithm (NSGA-II) which based on the elite selection strategy. By carrying out calculation and result analysis on the basis of algorithm implementation, the paper verifies the effectiveness of the model and algorithm.

IEEM20-P-0029/ Process Capability Index Under Simultaneous Effects of Process Deterioration and Learning Process

Angus Jeang¹, Chien-Ping Chung², Zih-Huei Wang¹
¹Feng Chia University, Taiwan
²MingDao University, Taiwan

Process Capability Index (PCI) is often applied to measure the process's ability of performance within functional specifications under controlled conditions. Thus, PCI can be used to evaluate the manufacturability of the product with given processes; namely, given its process setting and natural variation. However, initial process setting may become false setting and process variance may decrease because process deterioration and learning process respectively. These two effects may occur simultaneously and could be dependent for some case. In these regards, this research presents PCI expression which considers process deterioration and learning effect concurrently. The possible applications for presented PCI expression should not limit only for on-line process evaluation but also for off-line product and process design.

IEEM20-P-0102/ Advanced Planning and Scheduling System Based on Multi-resource Closed-loop Management

Xin Yuan¹, Yiwen Chen², Bo Liu¹, Xinguo Ming¹
¹Shanghai Jiao Tong University, China
²National University of Singapore, Singapore

Recently, advanced planning and scheduling system (APS) has drawn wide attention. In this paper, we proposed an APS system that fully coordinates human management, equipment management, material management, logistics management, process management. It covers these five areas to make production plans and achieve higher levels of lean production management goals, simultaneous and parallelize planning, better efficiency, process optimization and closed-loop management. It performs better global optimization by coordinating all the sub-components rather than using only MES, WMS or PCS.

IEEM20-P-0322/ Influence of Six Sigma DMAIC to Reduce Time Wasting of Line Supervisor in Production Manufacturing

Kabuya Kanyinda, Ian Lazarus, Oludolapo Olanrewaju
Durban University of Technology, South Africa

The Fast-growing global competition faced by organization forced different manufacturing industries to develop various process improvement approaches to respond efficiently to the challenges such as lead-time. Six-sigma DMAIC (Define, Measure, Analyze, Improve and Control) approach is an example in this part of manufacturing strategies. This paper aims to prove the practical application of Six Sigma DMAIC to reduce time wasting of line supervisor in Aluminum car parts manufacturer. The study used statistical tools and technique to identify the problem, find the root-cause of variation, reduce the time wasting, and provide solution. The analysis of planned and actual work tasks of the line supervisor revealed the time wastage of 49% called gap or breach. During different phases of this study, improvements implemented reduced time wasted from 49% to 16.3%. Pareto chart shows that the Line supervisor wasted more time in meetings followed by scanning.

IEEM20-P-0303/ Digital Twin-based Framework for Green Building Maintenance System

Wen Wang, Hao Hu, JiaChun Zhang, Zhe Hu
Shanghai Jiao Tong University, China

This study analyses the characteristics and theoretical basis of green building maintenance system (GBMS) and proposes a digital twin(DT)-based framework for GBMS (DT-GBMS). This framework helps operation teams solve the problem of insufficient informatization and automatic management ability of green building maintenance. Besides, the structure of DT-GBMS is designed in detail according to practical usage. Finally, a prototype based on Bentley Systems software is developed by using 3D laser scanner and sensors to verify the feasibility of the proposed framework. The results indicate that the DT-GBMS can reflect the accurate and real-time status of green buildings and is able to improve the efficiency of green building maintenance by automatic management.

IEEM20-P-1164/ A Model of Adding Relations with Short Communication Lengths in Two Levels of a Complete K-ary Linking Pin Organization Structure

Kiyoshi Sawada
University of Marketing and Distribution Sciences, Japan

A linking pin organization structure is a structure in which relations between members of the same section are added to a pyramid organization structure where there exist only relations between each superior and his direct subordinates. This study proposes a model of adding close relations between all members of each of two levels in a complete K-ary linking pin organization structure where every pair of nodes which have the same parent in a complete K-ary tree is adjacent. When edges with lengths L which is less than 1 are added between every pair of nodes with depth M and between every pair of nodes with depth N which is greater than M in a complete K-ary linking pin organization structure of height H where lengths of all edges are 1, the total shortening distance which is the sum of shortening lengths of shortest paths between every pair of all nodes by adding edges is formulated for obtaining an optimal pair of depth M and N.

IEEM20-P-1041/ How Far We Moved and How Long the Road Ahead? On the On-road Testing of Prototype Automated Driving Systems

Kuo-Wei Wu, Chung-Chih Liao, Wen-Fang Wu
National Taiwan University, Taiwan

Annual California DMV (Department of Motor Vehicles) road test reports are currently the most reliable documents related to testing results of automated driving system (ADS). By analyzing the reports, we may disclose how far an ADS on-road test is enough before the product can be launched into the market. We may also deduce means for developers to improve the reliability of their products of ADS. For the first purpose, we summarize 2014-2019 California DMV road test reports and calculate the fatal, injury, and property-only damage (POD) rates of ADS of several developers. We compare the results with equivalent values of US human drivers recorded by California DMV in 2017, and calculate accordingly the minimum mileages needed for ADS to advance to the same reliability of human drivers. For the second purpose, we develop a risk assessment method which has been applied to aero industry before to find out major weaknesses affecting the reliability of ADS. If ADS developers improve those weaknesses, they may increase significantly the reliability of ADS they are developing.

IEEM20-P-0416/ Safety and Security Study for Shore Power System: State-of-the-Art

Yaqiong Lv¹, Xiaohua Cao¹, Qianwen Zhou¹, Wenqin Zhao¹, Kai Ding²
¹Wuhan University of Technology, China
²State Grid Hubei Electric Power Research Institute, China

Over the years, the shore power technology of ships has become one of the most important measures for energy saving and emission reduction in ports, and it has been paid more and more attention by governments around the world. Shore power technology is to stop the use of auxiliary machinery while the ship is at the dock, and switch to shore power supply to obtain the power required by its pump set, ventilation, lighting, communication and other facilities. The shore power supply system mainly includes the transformation and frequency conversion of the power supply with the connection between the shore power supply system and the ship. While shore power technology is becoming more and more widely used, we must also begin to pay attention to the safety requirements of shore power applications, to ensure the reliability and stability of shore power facilities and equipment, and to ensure the safety of operators and users. This article summarizes the safety and security application methods of shore power system from three aspects: insulation monitoring, shore power equipment safety improvement technology, and fault diagnosis.

Session	Poster Session 4
Date	16/12/2020
Time	19:00 - 20:30
Chairs	Tahir MAHMOOD <i>Department of Technology, School of Science and Technology, The Open University of Hong Kong, Kowloon, Hong Kong</i> Omid Fatahi VALILAI <i>Jacobs University Bremen gGmbH</i>

IEEM20-P-0304/ Joint Strategy of Advance Selling and Resalable Returns for Fashion Products

Xiaowen Sun, Yan Chen

Macau University of Science and Technology, China

Advance selling strategy is often adopted by retailers to encourage customers to make pre-order to avoid the risk of out of stock. However, during advance selling, customers can only estimate the actual value of the product perceived at the time of receipt. This uncertainty about the actual value of the product may prevent customers from buying in advance. This paper proposes a joint strategy of advance selling and resalable returns for retailers to encourage customers to make pre-orders, where both customers' estimated values and realized values are heterogenous. The optimal advance selling price and buy-back price are derived. The expected profits resulted from the proposed joint strategy and that from a single advance selling strategy are compared. Moreover, conditions in which the proposed joint strategy outperforms the single advance selling strategy are identified.

IEEM20-P-0432/ Research on Tourism Supply Chain Coordination Under the Background of Low-Carbon Tourism

Xiangping Wang, Huajun Tang

Macau University of Science and Technology, China

In the context of low-carbon tourism, the effective cooperation of the members of the tourism supply chain is conducive to improving the low carbonization of the entire supply chain to achieve sustainable development. This article discusses the sales prices of tourism products under centralized and decentralized tourism supply chain, as well as the low-carbon level of tourism suppliers and the level of promotion efforts of travel agents. Pareto improvement of the tourism supply chain can be achieved by conducting comparative analysis of the profit level under centralized and de-centralized decisions and formulating profit distribution ratio.

IEEM20-P-0018/ Evaluation of Integrated Configuration: Cost and Time Models

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²*The Hong Kong Polytechnic University, China*

³*University of Aberdeen, United Kingdom*

By determining sales, product, and process configuration alternatives, the integrated sales, product and production configuration can help companies configure customized products from a holistic view. This study addresses the evaluation of product and production process alternatives configured in the integrated configuration. Because in practice, cost and time are two important performance measures, we develop evaluation models to minimize production costs and completion time. In addition, to provide companies with better decision-making support in selecting product offerings, the configuration evaluation proposed computes the differences in terms of cost and time among all product and process configuration alternatives. With these differences, companies can select suitable ones with respect to either time or cost and/or other factors, e.g., strategic objectives. A case application of temperature controllers is utilized to demonstrate the proposed evaluation of the integrated configuration.

IEEM20-P-0187/ Concept Design of a System Architecture for a Manufacturing Cyber-physical Digital Twin System

Weidong Lin, Malcolm Yoke Hean Low

Singapore Institute of Technology, Singapore

This paper discussed a concept design of a system architecture for a manufacturing cyber-physical digital twin system. It firstly described the overall concept of the system architecture consisting of various sub-modules. These sub-modules include digital twin dashboards, digital twin E-scheduler, digital twin wireless modular tracking, and digital twin simulation. In addition, it highlighted the schema of the digital twin database module design which enables the switching between a production database and a simulation database. Some prototyping work of the sub-systems are introduced individually. A complete proof of the concept prototype is being developed to demonstrate the complete features and functionalities of the entire manufacturing cyber-physical digital twin system.

IEEM20-P-0456/ Profit-driven Maintenance in Process Industries

Lucas Correa Lemes, Lars Hvam

Technical University of Denmark, Denmark

Process industries still mainly approach maintenance in terms of cost, in which the goal is to achieve lowest possible costs. Since the 1970s, literature advocates for a profit-driven approach for maintenance. A profit-driven maintenance approach enables companies to improve operations as it covers the impact from maintenance on the revenue and contribution margins in the company, e.g. by assessing the value of increased or decreased output on the production. In case the industry faces drastic changes due to technological advances—such as increase in automation, Industry 4.0, Big Data, and Internet of Things—and instability on the market, reducing costs of maintenance without considering impact on profit could potentially lead to lost revenue. Without a clear definition of the profit-driven approach—and how to achieve it—both researchers and managers run the risk of losing profitable opportunities. This paper presents characteristics of cost and profit-driven approaches for maintenance activities, shows KPIs associated with profit centers, and lists maintenance enablers for the transition to profit center.

IEEM20-P-0392/ A Simulation Study of Strategic Consumer Purchases

TianYi Guo, SiHan Wang, Yan Chen

Macau University of Science and Technology, China

Strategic consumer behavior has been observed and reported in various business environments. Previous studies revealed that ignoring consumers' strategic behavior may lead to negative impacts on retailers' business performance. Therefore, different strategies in terms of pricing, information release, and inventory are proposed for retailers to mitigate adverse impacts resulted from consumers' strategic waiting. However, effects of these strategies have not been examined. In this study, using simulation experiments, we investigate factors (product features, customer characteristics, and retailers' strategies) that impact consumers' strategic waiting and how corresponding sales revenue are affected. Our results indicate that with the presence of strategic consumers, the retailer's benefits attained from price discrimination become less due to consumers' strategic waiting. Meanwhile, the benefit from early discounts become more significant. Especially when the depreciation rate of products is slow or consumers' evaluation is highly heterogeneous, retailers can discount early to obtain more profits.

IEEM20-P-0567/ Simulation Modeling for Inventory Planning and Control in Maintenance Systems Using Lot-for-Lot Reordering Strategy

Mojahid Saeed Osman

American University of Sharjah, United Arab Emirates

The inventory control of repairable items in maintenance systems is a managerial function that requires integrating all information concerning the processing of new and repaired items and their on-hand inventories. The paper prescribes the development of a simulation-based modeling for managing the inventory of repairable items where production systems send faulty items to a repair site considering the probabilistic behavior of failure, repair and lead times. The proposed model aims at investigating the use of Lot-for-Lot ordering strategy for replenishing the inventory of repairable items in a risk-free and flexible manner. This paper illustrates the effectiveness of the prescribed simulation model using a demonstrative case problem. The developed model can be relied on as a tool for estimating a healthy on-hand inventory of new and repaired items, and backordered items due to unavailability of repaired items. These managerial insights are essential for achieving minimum inventory costs and maximum service levels.

IEEM20-P-0137/ Developing Knowledge Management System for Supporting Learning Activity in the Ceramics Craft Education

Tzu-Yun Hsu, Hsien-Jung Wu

National Taichung University of Science and Technology, Taiwan

Traditional craft education greatly relies on teacher-student relationship that transmits knowledge of skills and processes through demonstration. This way of distributing craft knowledge decreases the learning effectiveness for lack of methodical knowledge retrieval and sharing approach. This paper presents a knowledge management system that transfers tacit knowledge of the craft practitioner in collaboration with the teacher's pedagogy in the craft education. Initially, a protocol analysis is used to capture the tacit knowledge from the external expert of craft practitioner and paired with the teacher's pre-class preparation stored in the current teaching archive. Focused on the procedural type of knowledge, the proposed knowledge management system is examined in a ceramics craft course offered in the author's department. This paper illustrates the picture of linking KM system with craft teaching scenario. Through the aid of multimedia learning environment, students show encouraging progress in their creative works based on the support of the knowledge management system.

IEEM20-P-0373/ Digital Maturity in Theory and Practice: A Case Study of a Swedish Smart-Built Environment Firm

Jonathan Strömberg, Leif Sundberg, Annika Hasselblad

Mid Sweden University, Sweden

Digital maturity in organizations has become a popular subject for research the last decade. However, while digital maturity models are common in literature, studies of how they compare against practice are sparser. Against this backdrop, the purpose with this study is to study how digital maturity is translated into practice. To study this, factors on digital maturity is extracted from the literature, and then analyzed through a case study in a Swedish smart-built environment firm. The results revolve around four factors associated with digital maturity: strategy, technology, culture and leadership. The findings of the study reveal a contrast between vague statements about high digital maturity, and the daily practice in the studied firm. Digital maturity in the firm becomes "business as usual", translated as standardized technologies, and methods for project management. Hence, in line with prior research, this study suggests that stage models for digital maturity may be equally vague in practice as they are in theory. Further research could remedy this situation by conducting empirical studies of how (and if) the stages of maturity models are linked together.

IEEM20-P-1148/ 3D Printed Strain Gauge Sensor For Transport Rail Structural Monitoring - A Proof-of-Concept Study

John Jie Ming Ying¹, Joonphil Choi², Seung Ki Moon², Haining Zhang², Noori Kim³

¹*Singapore Institute of Technology and Newcastle University in Singapore, Singapore*

²*Nanyang Technological University, Singapore*

³*Newcastle University in Singapore, Singapore*

Aerosol Jet Printing (AJP) is an emerging additive manufacturing technology for 3D printed electronics. In recent years, due to its high flexibility and the compatibility between many types of substrates and inks, AJP technology has gained considerable attention in the electronic manufacturing industry. It has been widely adopted for the fabrication of customized electronic designs. In this study, we design a strain gauge sensor for structural health monitoring of a rail transport system. Then, the designed sensor is optimized and printed based on AJP technology. The experiments demonstrate the validity of the designed sensor, and methods to develop and optimize a strain gauge sensor using AJP are also systematically reviewed.

IEEM20-P-0181/ The Process-Ranking Benchmarking (PRB) Model: Simplifying the IT-Procurement Decisional Process

Simon Olofsson, Annika Hasselblad, Leif Olsson

Mid Sweden University, Sweden

The decisional process involved in IT procurement is complex, largely because it entails a large investment and because it takes time to make the decision. Another layer of complexity arises from the fact that the decision will influence every employee working in the environment supported by the system. This increases the importance of choosing an IT system that improves rather than hinders productivity. The supplier of the IT system can also influence the success of IT procurement, but this aspect is often left out of the equation. This study presents an approach that simplifies the complex decisional process regarding IT procurement. This approach considers not only the IT system to be purchased but also the supplier of the system. The approach combines process mapping of the IT systems (Business Process Modelling and Notation), ranking aggregation of desirable characteristics of the IT systems (Kemeny-Young) and benchmarking through data envelopment analysis. Together, these methods constitute the process-ranking benchmarking model, which is shown to enable a fictional group of decision-makers to reduce the number of prospective IT systems from 10 to just one, thus greatly simplifying their task.

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