IEEM2018
16-19 Dec • Bangkok, Thailand
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Paper Submission Closes 01 JUN
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CONFERENCE VENUE
SUNTEC Singapore
1 Raffles Boulevard, Suntec City,
Singapore 039593
Tel: +65 6337 2888
Dear Participants,

A very warm welcome to you to the 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM2017) to be held from 10-13 December 2017 in Singapore.

Some eleven years ago, the first IEEM was held in Singapore in 2007. We were encouraged by the support and enthusiasm of our colleagues in Asia and had organized the conference every year without fail since then. It has grown into a high-quality conference in the fields of industry engineering and engineering management, with participants from all corners of the world. For this, we are very grateful to authors, reviewers, participants, and also our co-hosts in Hong Kong, Macau, Bali, Bangkok and Kuala Lumpur during this period. We can now confidently say that IEEM brings together the community’s most innovative thinkers and dynamic researchers from around the world to share the latest research findings in industrial engineering and engineering management.

This year, IEEM2017 received nearly 1000 submissions from more than 50 countries. As in the past, each paper was sent to at least three reviewers. The acceptance decisions were based on at least two consistent recommendations, ensuring the quality and standard of the conference. These papers, organized around 20 topics, will be presented in oral and poster sessions. We are also privileged to have with us two distinguished speakers to deliver the keynote presentations:

Professor Andy Neely, Pro-Vice Chancellor, University of Cambridge, United Kingdom, will present on “Rethinking Operations Strategy in an Age of Digital Manufacturing”.

Professor Benjamin W. Wah, Provost and Wei Lun Professor, Chinese University of Hong Kong, China, will discuss on “Using Kernels to Harness the Complexity of Big Data.”

We are also honored to have Professor Jianjun Shi, editor-in-chief of IISE Transactions, who is also the Carolyn J. Stewart Chair and Professor at the H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, to run a workshop on “How to Publish in Top Journals”.

We would like to thank all authors and participants for their interests, contributions and continued support to IEEM. Lastly, we are also grateful to the technical program committee members and reviewers for their help in the review process.

Have a fruitful conference, and we hope that you will enjoy the cultural experiences of Singapore.

Arnoud DE MEYER, General Chair
Singapore Management University, Singapore

Kah Hin CHAI, Organizing Chair
National University of Singapore, Singapore

Roger JIAO, Organizing Chair
Georgia Institute of Technology, USA

Nan CHEN, Program Chair
National University of Singapore, Singapore

Min XIE, Program Chair
City University of Hong Kong, Hong Kong SAR
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Singapore Management University, Singapore

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Georgia Institute of Technology, USA

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National University of Singapore, Singapore
Zhisheng YE
National University of Singapore, Singapore

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Indian Institute of Management, India
Yihai HE
Beihang University (BUAA), China
<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
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<td>Yu-Hsiang HSIAO</td>
<td>National Taipei University, Taiwan</td>
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<td>Qingpei HU</td>
<td>Chinese Academy of Sciences, China</td>
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<td>Shinji INOUE</td>
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<td>Ville ISOHERRANEN</td>
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<td>Raja JAYARAMAN</td>
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<td>Parminder Singh KANG</td>
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<td>Muhammad Waris Ali KHAN</td>
<td>Universiti Malaysia Pahang, Malaysia</td>
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<td>Hadi KHORSHIDI</td>
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<td>Murat KUCUKVAR</td>
<td>Qatar University, Qatar</td>
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<td>The Chinese University of Hong Kong, Hong Kong SAR</td>
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<td>C.K. KWONG</td>
<td>The Hong Kong Polytechnic University, China</td>
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<td>Carmen Ka Man LEE</td>
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<td>Universiti Tun Hussein Onn Malaysia, Malaysia</td>
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<td>Virginia MACHADO</td>
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<td>Jukka MAJAVA</td>
<td>Industrial Engineering and Management / University of Oulu, Finland</td>
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<td>Viliam MAKIS</td>
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<td>Harekrishna MISRA</td>
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<td>Lars MOENCH</td>
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<td>Luis A. MONCAYO-MARTINEZ</td>
<td>Instituto Tecnologico Autonomo de Mexico (ITAM), Mexico</td>
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<td>Egon MUELLER</td>
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<td>Indrajit MUKHERJEE</td>
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<td>Ipseeta NANDA</td>
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<td>Malick NDIAYE</td>
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<td>Dinh Son NGUYEN</td>
<td>University of Science and Technology, The University of Danang, Vietnam</td>
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<td>Tatsushi NISHI</td>
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<td>Sanjay Kumar PALEI</td>
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<td>Naraphorn PAOPRASERT</td>
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<td>Jennifer PERCIVAL</td>
<td>University of Ontario Institute of Technology, Canada</td>
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<td>Alan PILKINGTON</td>
<td>University of Westminster, United Kingdom</td>
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<td>Jan Harm PRETORIUS</td>
<td>University of Johannesburg, South Africa</td>
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<tr>
<td>Kit Fai PUN</td>
<td>University of the West Indies, Trinidad and Tobago</td>
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<tr>
<td>Anisur RAHMAN</td>
<td>Griffith University, Australia</td>
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<td>Parthasarathy RAMACHANDRAN</td>
<td>Indian Institute of Science, India</td>
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<tr>
<td>R.M. Chandima RATNAYAKE</td>
<td>University of Stavanger, Norway</td>
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Organizers & Committees

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Hui ZHANG
University of Chicago, United States

Linda ZHANG
IESEG School of Management, France
### Sunday, 10 December 2017
#### SUNTEC Singapore, Level 3

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<tr>
<td>09:00 - 13:00</td>
<td>Pre-Conference Tour “Singapore Ethnic Treasures” (Requires Advance Booking)</td>
<td>SUNTEC Big Screen, Level 1</td>
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<td>13:00 - 17:00</td>
<td>Registration</td>
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<td>13:30 - 15:30</td>
<td>Workshop (see also p8)</td>
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<td>Jianjun SHI - Carolyn J. Stewart Chair and Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology</td>
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<td>15:30 - 15:40</td>
<td>General Chair’s Welcome</td>
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<td>Arnoud DE MEYER - IEEM2017 General Chair</td>
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<td>President, Singapore Management University, Singapore</td>
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<td>15:40 - 17:00</td>
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### Monday, 11 December 2017
#### SUNTEC Singapore, Level 3

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<td>08:30 - 09:00</td>
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<td>09:00 - 09:15</td>
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<td>09:15 - 10:00</td>
<td>Keynote 1 (see also p9)</td>
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<tr>
<td></td>
<td>“Rethinking Operations Strategy in an Age of Digital Manufacturing”</td>
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<td>Andy NEELY - Pro-Vice Chancellor, University of Cambridge, United Kingdom</td>
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<td>10:00 - 10:45</td>
<td>Keynote 2 (see also p10)</td>
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<td>10:45 - 11:15</td>
<td>AM Coffee/Tea Break</td>
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#### Respective Rooms

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<td>Healthcare Systems and Management 1</td>
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<td>Service Innovation and Management 2</td>
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<tr>
<td>MR386</td>
<td>Operations Research 3</td>
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<td>MR387</td>
<td>Technology and Knowledge Management 2</td>
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<td>MR388</td>
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<td>MR389</td>
<td>Decision Analysis and Methods 1</td>
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<td>MR390</td>
<td>Manufacturing Systems 1</td>
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<td>MR392</td>
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<td>MR393</td>
<td>Big Data and Analytics 2</td>
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<td>MR394</td>
<td>Operations Research 2</td>
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<td>MR395</td>
<td>Engineering Education and Training 2</td>
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<td>MR396</td>
<td>Intelligent Systems</td>
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<td>MR398</td>
<td>Information Processing and Engineering 2</td>
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<td>MR399</td>
<td>Production Planning and Control 2</td>
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<td>MR400</td>
<td>Project Management 2</td>
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<tr>
<td>MR401</td>
<td>AM Coffee/Tea Break</td>
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</tbody>
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### Registration

- SUNTEC Big Screen, Level 1
- Foyer 5
- Summit 2
- Nicoll 1-2
**Overview**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
<th>Venue</th>
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<tbody>
<tr>
<td>08:00 - 18:30</td>
<td>Registration</td>
<td>Foyer 5</td>
</tr>
<tr>
<td>08:30 - 09:00</td>
<td>Morning Refreshments</td>
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<tr>
<td>09:00 - 10:45</td>
<td>MR08: Reliability and Maintenance Engineering 2 (see also p93)</td>
<td>MR09: Service Innovation and Management 2 (see also p92)</td>
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<tr>
<td></td>
<td>MR30: Systems Modeling and Simulation 3 (see also p85)</td>
<td>MR327: Operations Research 4 (see also p81)</td>
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<td></td>
<td>MR32: Supply Chain Management 4 (see also p86)</td>
<td>MR33: Decision Analysis and Methods 2 (see also p88)</td>
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<td>MR330: Manufacturing Systems 2 (see also p89)</td>
<td>MR334: Manufacturing Systems 3 (see also p90)</td>
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<td>MR335: Quality Control and Management 3 (see also p91)</td>
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<td>10:45 - 11:15</td>
<td>AM Coffee/Tea Break</td>
<td>Nicoll 1-2</td>
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<td>11:15 - 12:45</td>
<td>MR08: Reliability and Maintenance Engineering 3 (see also p103)</td>
<td>MR09: Service Innovation and Management 3 (see also p102)</td>
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<td>MR327: Operations Research 5 (see also p104)</td>
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<td>12:45 - 13:15</td>
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<td>MR08: Reliability and Maintenance Engineering 4 (see also p113)</td>
<td>MR09: E-Business and E-Commerce (see also p112)</td>
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<td>MR330: Engineering Economy and Cost Analysis (see also p110)</td>
<td>MR334: Project Management 3 (see also p111)</td>
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<tr>
<td>15:30 - 16:00</td>
<td>Closing &amp; Award Presentation</td>
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<td>16:00 - 18:00</td>
<td>Poster Session &amp; Chill-Chat-Connect! (see also p114)</td>
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<tr>
<td>18:00 - 18:30</td>
<td>Poster Teardown</td>
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<tr>
<td>18:30 - 22:00</td>
<td>Conference Dinner - 18:30 to 20:30</td>
<td>The Edge, Pan Pacific Hotel</td>
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<td>Open Top Bus Experience - 20:30 to 22:00</td>
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<td>Ticketed Event - 1 Ticket Admits ONE Person Only (see also p12)</td>
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**Tuesday, 12 December 2017**

SUNTEC Singapore, Level 3

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<th>Time</th>
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**Wednesday, 13 December 2017**

Gather at SUNTEC Big Screen, Level 1

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<tr>
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<tr>
<td>08:30 - 13:00</td>
<td>Advanced Remanufacturing and Technology Centre (ARTC) and Air Traffic Management Research Institute (ATMRI) Technical Visit (Requires Advance Booking)</td>
<td>Gather at SUNTEC Big Screen, Level 1</td>
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</table>
ABSTRACT

This workshop will discuss how to identify promising research topics, and how to publish papers in top Journals. Publishing in top international journals is important to many researchers in educational and research institutions. This presentation will discuss various topics important for research and paper writing, including
- How to judge if a journal is among the top ranking?
- How to select and define a research topic?
- How to organize and write a paper?
- What is the reviewing and publishing process for a paper?

The presentation will highlight the “dos and don’ts”. In addition, a “methodology tree” strategy will be introduced based on my experience of research and supervision of Ph.D. students. The “methodology tree” is a systematic strategy that can be used to organize the literature reviews, evaluate contributions of a research topic, facilitate communications among researchers, and provide a big picture of research problems involved.

The workshop should help scholars to reflect on their own experiences as researchers, authors, and reviewers. It will be interactive and tailored to the interests of those attending. Do bring along your questions and comments.

ABOUT THE SPEAKER

Dr. Jianjun Shi is the Carolyn J. Stewart Chair and Professor in H. Milton Stewart School of Industrial and Systems Engineering, with joint appointment in the George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology. Prior to joining Georgia Tech in 2008, he was the G. Lawton and Louise G. Johnson Professor of Engineering at the University of Michigan. He received his B.S. and M.S. in Electrical Engineering from the Beijing Institute of Technology in 1984 and 1987, and his Ph.D. in Mechanical Engineering from the University of Michigan in 1992.

Dr. Shi is an early pioneer in the development and application of data enabled manufacturing. His methodologies integrate system informatics, advanced statistics, and control theory for the design and operational improvements of manufacturing and service systems.

Dr. Shi is the founding chairperson of the Quality, Statistics and Reliability (QSR) Subdivision at the Institute for Operations Research and Management Science (INFORMS). He is currently serving as the Editor-in-Chief of the IISE Transactions, the flagship journal of the Institute of Industrial and Systems Engineers. He also serves as Focus Issue Editor of IISE Transactions on Quality and Reliability Engineering, Editor of Journal of Systems Science and Complexity, Advisory Editor of International Journal of Quality Technology and Quantitative Management; Senior Editor of Chinese Journal of Institute of Industrial Engineering. He is a Fellow of the Institute of Industrial Engineering (IIE), a Fellow of American Society of Mechanical Engineering (ASME), a Fellow of Institute of Operations Research and the Management Science (INFORMS), and an Academician of the International Academy for Quality.

Dr. Shi received various awards for his research and education, including the IISE David F. Baker Distinguished Research Award (2016), the IIE Albert G. Holzman Distinguished Educator Award (2011), Forging Achievement Award (2007), Monroe-Brown Foundation Research Excellence Award (2007) and the 1938E Award (1998) at The University of Michigan (2007).
KEYNOTES

Mon - 11 Dec | 09:15 - 10:00 | Summit 2
“Rethinking Operations Strategy in an Age of Digital Manufacturing”

Andy NEELY
Pro-Vice Chancellor
University of Cambridge, United Kingdom

ABSTRACT

In the late 1960s Wickham Skinner wrote a classic article - Manufacturing: The Missing Link in Corporate Strategy. Published in the Harvard Business Review, this article heralded a stream of research on manufacturing strategy, much of which was devoted to the question of how leaders of manufacturing firms can ensure they configure their manufacturing operations appropriately. While there are different perspectives and nuances, in essence the literature introduced three key concepts: (i) competitive priorities; (ii) manufacturing decisions areas – which in turn as sub-categorised as structural and infrastructural decision areas. At its heart the literature on manufacturing strategy argued that investments in manufacturing (typically in the manufacturing decision areas) resulted in manufacturing operations building capabilities which in turn allowed them to deliver against their competitive priorities. If, for example, a manufacturing firm was trying to compete on cost, then investments would be needed to drive productivity and efficiency. If the firm was competing on quality, then investments would be needed to ensure processes operated smoothly and quality was assured. Generally the competitive priorities were defined in terms of quality (doing things right), speed (doing things quickly), dependability (doing things as promised), flexibility (changing what you do) and cost (doing things cheaply).

This presentation will explore the implications of digital technologies for the traditional manufacturing decision areas (and hence for manufacturing strategy). What, for example, does the industrial internet mean for how supply chains are managed? What do new technologies – such as additive manufacturing – mean for location and capacity decisions? How can platforms, including crowdfunding platforms such as kickstarter, be used to inform the new product development process? What does the gig economy mean for employment and staffing? How do platform businesses like Uber and Deliveroo manage quality when they don’t own or directly control many of their operational resources?

Wherever you look in the manufacturing decision areas it becomes clear that digital technologies fundamentally change the nature of the choices that manufacturers face as they seek to build organisational capabilities.

ABOUT THE SPEAKER

Professor Andy Neely is Pro-Vice-Chancellor: Enterprise and Business Relations at the University of Cambridge, Head of the Institute for Manufacturing (IfM) and Head of the Manufacturing and Management Division of Cambridge University Engineering Department. He is a Fellow of Sidney Sussex College and Founding Director of the Cambridge Service Alliance. He is widely recognized for his work on the servitization of manufacturing, as well as his work on performance measurement and management. Previously he has held appointments at Cranfield University, London Business School, Cambridge University, where he was a Fellow of Churchill College, Nottingham University, where he completed his PhD and British Aerospace. He was Deputy Director of AIM Research – the UK’s management research initiative – from 2003 until 2012 and was elected a Fellow of the British Academy of Management in 2007, a Fellow of the Academy of Social Science in 2008 and a Fellow of the European Operations Management Association in 2009.
ABSTRACT

Big Data is emerging as one of the hottest multi-disciplinary research fields in recent years. Big data innovations are transforming science, engineering, medicine, healthcare, finance, business, and ultimately society itself. In this presentation, we examine the key properties of big data (volume, velocity, variety, veracity, and value) and their relation to some applications in science and engineering. To truly handle big data, new paradigm shifts will be necessary. Successful applications in big data will require in situ methods to automatically extracting new knowledge from big data, without requiring the data to be centrally collected and maintained. Traditional theory on algorithmic complexity may no longer hold, since the scale of the data may be too large to be stored or accessed. To address the potential of big data in scientific discovery, challenges on data complexity, computational complexity, and system complexity will need to be solved. We propose a new approach based on identifying kernels to harness the complexity of big data applications. Kernel data is a compact and manageable representation of the original data, with similar structure, data properties, or meta-properties. We illustrate these challenges and approaches by drawing on examples in various applications in science and engineering.

ABOUT THE SPEAKER

Benjamin W. Wah is currently the Provost and Wei Lun Professor of Computer Science and Engineering of the Chinese University of Hong Kong, as well as the Chair of the Research Grants Council of the University Grants Committee, Hong Kong, and the Franklin W. Woeltge Emeritus Professor of Electrical and Computer Engineering, University of Illinois, Urbana-Champaign. Before then, he served as the Director of the Advanced Digital Sciences Center in Singapore, as well as the Franklin W. Woeltge Professor of Electrical and Computer Engineering and Professor of the Coordinated Science Laboratory of the University of Illinois, Urbana-Champaign, IL. He received his Ph.D. degree in computer science from the University of California, Berkeley, CA, in 1979. He has received numerous awards for his contributions, which include the IEEE CS Technical Achievement Award (1998), the IEEE Millennium Medal (2000), the IEEE-CS W. Wallace-McDowell Award (2006), the Pan Wen-Yuan Outstanding Research Award (2006), the IEEE-CS Richard E. Merwin Award (2007), the IEEE-CS Tsutomu Kanai Award (2009), and the Distinguished Alumni Award in Computer Science of the University of California, Berkeley (2011). Wah’s current research interests are in the areas of big data applications and multimedia design and processing.

Wah cofounded the IEEE Transactions on Knowledge and Data Engineering in 1988 and served as its Editor-in-Chief between 1993 and 1996. He currently serves as the Honorary Editor-in-Chief of Knowledge and Information Systems and is on the editorial boards of Information Sciences, International Journal on Artificial Intelligence Tools, Journal of VLSI Signal Processing, World Wide Web, and Journal of Computer Science and Technology. He has served the IEEE Computer Society in various capacities, including Vice President for Publications (1998 and 1999) and President (2001). He is a Fellow of the AAAS, ACM, and IEEE.
**Presenter Guides**

**Presenter Guide – Oral**

1. **Prepare Your Presentation**
   Length of presentation material should be in accordance with your time allotted. Total duration including Q&A and speaker changeover is 15 minutes for each talk. Please refer to the Final Schedule for actual presentation times. You are kindly requested to be at the presentation room at least 15 minutes before the session starts.

2. **Determine Your Audio-Visual Needs**
   Each meeting room comes equipped with a laser pointer and clicker, computer, LCD projector and screen. The computers in the meeting rooms are being provided to Windows-based PC users. The PC will be configured with Microsoft Windows operating system. Please bring your presentation files in Thumb drives only. For MAC-laptop users, please bring your own VGA adapter cable.

3. **Create a Backup Copy of Your Presentation**
   We recommend that you bring at least 2 copies of your presentation to the meeting for backup purposes. Only thumb drives are acceptable.

4. **Give Your Presentation**
   Be considerate to the other speakers and audience by staying within your allocated time. The allocated time for your presentation includes a discussion and a changeover to the next speaker. Session Chairs will hold you to the allotted time. This is essential to ensure adequate time for questions and discussion as well as adherence to the schedule. Please discuss the same material as reported in your abstract submission. At the end of the meeting, all presentation files will be destroyed.

**Presenter Guide – Poster**

Poster presentations will be held on Tuesday – 12 Dec 2017 in Nicoll 1-2 (Level 3). Poster boards are pre-assigned and marked with your Paper ID. Please feel free to approach the Poster Help Desk for assistance.

1. **Poster Display and Viewing**
   **Tuesday – 12 December 2017**
   
<table>
<thead>
<tr>
<th>Poster Set-up</th>
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<tbody>
<tr>
<td>From 13:45 to 15:30</td>
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<tr>
<td>Poster Session (Presenter Attendance Required)</td>
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<td>From 16:00 to 18:00</td>
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<tr>
<td>Poster Tear-down</td>
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<td>By 18:30 latest</td>
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</tbody>
</table>

2. **Prepare Your Poster**
   Each presenter is provided with a 1m x 2.5m high poster panel. The presentation must cover the same material as the paper submitted. The poster should be 1 x A0 size in vertical/portrait format, measuring 841 mm length x 1189 mm height maximum.
   a. Place your Paper ID, Paper Title and Authors’ names prominently at the top of the poster to allow viewers to identify your abstract easily.
   b. Presenter’s Name must be underlined and in Bold Letterings.
   c. Author’s names, e-mails and address information must be provided in case the viewer is interested in contacting you for more information.
   d. You have complete freedom in displaying your information in figures, tables, text, photographs, etc in the poster.
   e. A successful poster presentation depends on how well you convey information to an interested (but not expert) audience. You may wish to structure your poster by including the background of your research followed by results and conclusions.

3. **Set Up Your Poster (See also 1 above)**
   a. Posters should be set-up by the allocated timing of the assigned day.
   b. Your poster presentation time is as shown in the session schedule and presenters are required to be at their posters during the poster viewing times.
   c. Adhesive tapes and scissors are available at the Poster Help Desk, nearby the poster boards. If you have any special needs for your poster presentation, please bring those supplies with you to the meeting.

4. **Remove Your Poster**
   a. Posters must be removed after the viewing time by 18:30 latest.
   b. After this time, posters remaining on the boards will be removed and discarded. IEEM2017 will not be responsible for posters and materials left on poster boards after the stated hours.
Join us this year at the IEEM 2017 conference dinner for an unforgettable evening and dining experience.

Located within the Pan Pacific Hotel and renowned as one of the best buffets in Singapore, Edge serves a plethora of Asian and Pacific delicacies that is guaranteed to leave you satisfied. Aptly named the “food theatre”, you will be treated to a visual extravaganza as masterful chef prepares your meal right before your eyes in their various theatre kitchens.

With your bellies filled, a special tour will be arranged for you where you get to experience the city of Singapore in a whole different light (pun intended)! For six weeks every year from November to January, Orchard Road (a popular shopping boulevard) transforms into a Christmas wonderland, as countless glittering lights and beautifully decorated arches line the streets for 2.88 kilometers. So whip out your smartphones, put on your best smiles, and delve into the heart of Orchard Road as we bring you onboard a tour on open-top double decker buses!

We sincerely look forward to you joining us for the IEEM 2017 Conference Dinner, for an evening of delicious food and awesome company. See you in Singapore!
Sessions

Operations Research 1
11/12/2017 11:15 - 12:45
Room: MR327
Chairs: Kaushik NAG, American University of the Middle East
        Sudhir YADAV, Pandit Deendayal Petroleum University
Abstracts: see page 47

IEEM17-P-0808
Evaluating Erlang C and Erlang A Models for Staff Optimization: A Case Study in an Airline Call Center
Kaushik NAG, Magdy HELAL
American University of the Middle East, Kuwait

IEEM17-P-0068
Analyzing the Effectiveness of Lean Manufacturing Practices in Indian Small and Medium Sized Businesses
Saumyaranjan SAHOO, Sudhir YADAV
Pandit Deendayal Petroleum University, India

IEEM17-P-0370
Robustness Through Possible Crew Swaps in Airline Operations
Ian Frederic ILAGAN, Charille SY
De La Salle University, Philippines

IEEM17-P-0210
A Mixed Integer Programming Optimization of Bundling and Pricing Strategies for Multiple Product Components with Inventory Allocation Considerations
Paul Siegfried BARRIOS, Dennis CRUZ
De La Salle University, Philippines

IEEM17-P-0211
A Tool for Selecting Optimal Emergency Response Unit Locations Using an Integrated AHP-MILP Approach
Jayne Lois SAN JUAN, Christine FERNANDEZ, Bryanne LIM, Erika LIM, Richard LI
De La Salle University, Philippines

IEEM17-P-0241
Positive Behaviour Changes Through Learn-Practice-Implement Leadership Behavioural Standards
Bin MA, Roland LIM, Ming Hon TOH, Huey Yuen NG
Singapore Institute of Manufacturing Technology (SIMTech), Singapore

IEEM17-P-0630
Joint Decision Making About Price and Duration of Discount Airfares
Yanli FANG, Yan CHEN, Xin LI
Macau University of Science and Technology, China

Engineering Education and Training 1
11/12/2017 11:15 - 12:45
Room: MR328
Chairs: Margaret MORGAN, Ulster University
        Miwa NISHINAKA, The Graduate University for Advanced Studies
Abstracts: see page 48

IEEM17-P-0229
Engaging with Industry to Improve Student Learning on Undergraduate Engineering Programmes
Margaret MORGAN, Pearse O’GORMAN
Ulster University, United Kingdom

IEEM17-P-0345
Analysis of the Stakeholders of Engineering Education System to Improve the Creativity of Engineering Education
Rufaidah Y. ALMAIAN
Kuwait University, Kuwait

IEEM17-P-0523
Towards the Best Method of Cross Cultural Training for IT Engineering Graduates from Eastern Indonesia Region: Ready to be Global Engineers
Agung PRABOWO1, Sulistyowati SULISTYOWATI1, Ika WINDARTI1
1STMIK Palangkaraya, Indonesia
2Tridharma University, Indonesia

IEEM17-P-0845
Development of Needham Model Based e-Module for Electromagnetic Field & Wave
M.F. LEE, N.A. ZAINAL
Universiti Tun Hussein Onn Malaysia, Malaysia

IEEM17-P-0007
Industrial IoT Business Workshop on Smart Connected Application Development for Operational Technology (OT) System Integrator
Satoshi GOTO, Osamu YOSHIE, Shigeru FUJIMURA
Waseda University, Japan

IEEM17-P-0295
How to Improve Employee Education - Methodological Approach to Structure Specialist and Interdisciplinary Requirements
Barbara Theresia WULFKEN1, Egon MUELLER1
1Volkswagen Sachsen GmbH, Germany
2Technische Universität Chemnitz, Germany
### Intelligent Systems

**11/12/2017 11:15 - 12:45**  
**Room: MR329**  
**Chairs:** Arnesh TELUKDARIE, University of Johannesburg  
Abdul-Wahid SAIF, King Fahd University of Petroleum & Minerals  

**Abstracts:** see page 49

| IEEM17-P-0184 | Implementation of Industry 4.0 Technologies in the Mining Industry: A Case Study | Michael N. SISHI, Arnesh TELUKDARIE  
University of Johannesburg, South Africa |
|--------------|--------------------------------------------------------------------------------|---------------------------------|
| IEEM17-P-0264 | Application of the Agile Energy Model to the Procure to Pay Process | Megashnee MUNSAMY¹, Arnesh TELUKDARIE²  
¹Mangosuthu University of Technology, South Africa  
²University of Johannesburg, South Africa |
| IEEM17-P-0641 | Usage Frequency of Product Configuration Systems Relative to Integrations and Fields of Application | Sara SHAFIEE, Kairrín KRISTJANSDOTTIR, Lars HVAM, Loris BATTISTELLO, Enrico SANDRIN  
¹Technical University of Denmark, Denmark  
²University of Padova, Italy |
| IEEM17-P-0278 | Chatbots and Conversational Agents: A Bibliometric Analysis | Hio Nam IO, Chang Boon LEE  
University of Macau, Macau |
| IEEM17-P-0760 | Evaluation of Knowledge Acquisition from Document Clustering Based on Information Retrieval Scales | Shu OCHIKUBO, Kano KOMIYA, Fumiaki SAITOH, Syohei ISHIZU  
Aoyama Gakuin University, Japan |
| IEEM17-P-0777 | Extraction of Customer Satisfaction Topics Regarding Product Delivery Using Non-Negative Matrix Factorization | Tokuhiro KUJIRAOKA, Fumiaki SAITOH, Syohei ISHIZU  
Aoyama Gakuin University, Japan |
| IEEM17-P-0515 | A Framework for Knowledge-Intensive Design Decision Support in Model Based Realization of Complex Engineered Systems | Ru WANG, Guoxin WANG, Yan YAN, Shuting CHEN, Janet K ALLEN, Farrokh MISTREE  
¹Beijing Institute of Technology, China  
²The University of Oklahoma, United States |

### Supply Chain Management 1

**11/12/2017 11:15 - 12:45**  
**Room: MR332**  
**Chairs:** Teng-Sheng SU, Chaoyang University of Technology  
Cagatay IRIS, Nanyang Technological University  

**Abstracts:** see page 50

| IEEM17-P-0485 | Integrated Supporting Cooperation Model with Fuzzy Approach for Staff Scheduling Problem in Service Supply Chain | Teng-Sheng SU, Su-Chuan LIU  
Chaoyang University of Technology, Taiwan |
| IEEM17-P-0430 | Models for Continuous Berth Allocation and Quay Crane Assignment: Computational Comparison | Cagatay IRIS, Jasmine Siu Lee LAM  
Nanyang Technological University, Singapore |
| IEEM17-P-0299 | Determining Quality Refining Rice Mill Location with Disruption Risks | Wichitsawat SUKSAWAT NA AYUDHYA  
King Mongkut’s Institute of Technology, Thailand |
| IEEM17-P-0351 | Performance Analysis of Riceberry Rice Supply Chain in Thailand | Wassanai WATTANUTCHARIYA, Thammasak KUARTES  
Chiang Mai University, Thailand |
| IEEM17-P-0453 | Framework of Supply Chain Simulation Using SCOR Model in Newspaper Industry | Arinda Soraya PUTRI, Wahyudi SUTOPO, Muhammad HISJAM  
Universitas Sebelas Maret, Indonesia |
| IEEM17-P-0253 | Pricing Policy in Green Supply Chain Management with a Risk-Averse Retailer | Bo LI, Yushan JIANG, Xiaolong QU  
Tianjin University, China |
| IEEM17-P-0271 | Developing Innovative Supply Chain Using Crowdsourcing: A Conceptual Model | Mahmood ALJ, Asim MAJEED  
¹University of Business & Technology, Saudi Arabia  
²Birmingham City University, United Kingdom |
IEEM17-P-0339
Estimating Component Yield for CLT Production
Urs BUEHLMANN1, R. Edward THOMAS2
1Virginia Tech, United States
2USDA Forest Service, United States

IEEM17-P-0619
Meshes Optimization in Freeform and 3D Printing for Product Design
Chung-Chuan WANG1, Chung-Shing WANG2, Ching-Hu YANG3, Kai-Jai YANG4, Teng-Ruey CHANG5
1Chung-Hua University of Science and Technology, Taiwan
2Tonghua University, Taiwan
3Nan Kai University of Technology, Taiwan

IEEM17-P-0266
Analysis and Mode Establishment of Information Integration Activities - A Case Study Perspective
Te-King CHIEN1, Hung-Lun CHANG1, W.L. LAI2
1National Formosa University, Taiwan
2Takming University of Science and Technology, Taiwan

IEEM17-P-0668
Adaptation of a Product Maturity Model to Highly Iterative Product Development
Günther SCHUH, Jan-Philipp PROTE, Stefan DANY, Marco MOLITOR, Luca PAGANO
RWTH Aachen University, Germany

IEEM17-P-0455
Validation of an Optical System for Measuring the Absolute Angular Position
Tobias SCHNEIDER1, B. EILERT1, Malte STONIS2, Ludger OVERMEYER2
1Institut für Integrierte Produktion Hannover, Germany
2Leibniz Universität Hannover, Germany

IEEM17-P-0407
Integration of an Automated Load Management in a Manufacturing Execution System
Cedric SCHULTZ, Christina BAYER, Martin ROESCH, Stefan BRAUNREUTHER, Gunther BEINHART
Composite and Processing Technology IGCV, Germany

IEEM17-P-0269
Data Analysis on Applying Real Time Tracking in Production Control of Construction
Jianyu ZHAO, Hylton OLIVIERI, Olli SEPPANEN, Antti PELTOKORPI, Behnam BADIHI, Pontus LUNDSTROM
Aalto University, Finland

IEEM17-P-0168
Job Scheduling Integrated with Imperfect Preventive Maintenance Considering Time-Varying Operating Condition
Jiawen HU, Zuhua JIANG
Shanghai Jiao Tong University, China

IEEM17-P-0528
A Genetic Algorithm for Unrelated Parallel Machine Scheduling Minimizing Makespan Cost and Electricity Cost Under Time-of-Use (TOU) Tariffs with Job Delay Mechanism
Bobby KURNIAWAN, Alifan Akbar GOZALL, Wei WENG, Shigeru FUJIMURA
Waseda University, Japan

IEEM17-P-0719
Group Production Scheduling Model with Due Window and Maintenance
Wen-Zhu LIAO, Min JIANG, Xiu-Fang ZHANG
China University of Science and Technology, China

IEEM17-P-0123
Product Variety Management Using Data-Mining Methods – Reducing Planning Complexity by Applying Clustering Analysis on Product Portfolios
Jan HOCHDORFFER, Clemens LAULE, Gizela LANZA
Karlsruhe Institute of Technology (KIT), Germany

IEEM17-P-0132
Age-Differentiated Analysis of the Influence of the Duration of Breaks on Learning Sensorimotor Tasks
Francoise KUHLENBAUMER, Simone POLIS, Philipp M. PRZYBYSZ, Susanne MUTZE-NIEWÖHNER
RWTH Aachen University, Germany

IEEM17-P-0471
In Lean Manufacturing, if the Customer is a King, then the Frontline Worker is a “Knight”: A Case Study
Pulek KHOLOPANE, Kehinde SOBIYI
University of Johannesburg, South Africa
IEEM17-P-0473
Effective Knowledge Management Strategy and Firm’s Size: Evidence from Indonesia Construction Firms
Budi HARTONO1, Sinta SULISTYO2, Kah-Hin CHAP1, Nurni INDARTI1
1University of Gadjah Mada, Indonesia
2Universitas Gadjah Mada, Indonesia

IEEM17-P-0356
Context-Oriented Strategy for Modularization of Engineering Design Processes: An Automotive Case Study
Christoph HOLLAUER, Gregor PAVLITZEK, Markus MÖRTL, Udo LINDEMANN
Technical University of Munich, Germany

IEEM17-P-0726
Applicability of Earned Value Management for Deadline Energy Constrained Applications
Shunichiro SUENAGA, Kenji TEL, Shinichi HONIDEN
National Institute of Informatics, Japan

IEEM17-P-0732
Implementation and Assessment of a Predictive Analytics Model for Development Project Management
Günther SCHUH, Michael RIESENER, Christian DÖLLE
RWTH Aachen University, Germany

IEEM17-P-0814
Challenges of Agile Development Implementation in Mechatronic Development Processes
Kristin GOEVERT1, Attila GÖKDEMIR2, Christoph PEITZ2, Udo LINDEMANN2
1Technical University of Munich, Germany
2OSRAM GmbH, Germany

IEEM17-P-0797
Conflict Management in Outsourced Engineering Projects in South Africa
Bułali MDOONTRAANE, Hannele NEL, Annlize MARNEWICK
University of Johannesburg, South Africa

IEEM17-P-0550
Feature Importance-Guided Multi-Regression Ensemble with Application to Remaining Useful Life Prediction
Feng YANG1, Ching HUANG2, M. Salahuddin HABIBULLAH3, Xulei YANG1, Yan SHEN1, Raymond NEO2
1Agency for Science Technology and Research (A*STAR), Singapore
2PSB Academy, Singapore

IEEM17-P-0336
Status Quo and Future Potential of Manufacturing Data Analytics – An Empirical Study
Sebastian GEORGIER1, Marian WENKING2, Robert H. SCHMITT1, Thomas FRIEDLI1
1RWTH Aachen University, Germany
2University of St. Gallen, Switzerland

IEEM17-P-0104
Monitoring of an Aluminum Melting Furnace by Means of a 3D Light-Field Camera
Sara MOHAMMADIFARD1, Jan LANGNER1, Malte STONIS1, Hubertus SEMRAU2, Sven-Olaf SAUKE3, Hossein LARKI HARCHEGANIE, Bernd-Arno BEHRENS1
1Institut für Integrierte Produktion Hannover, Germany
2ZPF GmbH, Germany
3Leibniz Universität Hannover, Germany

IEEM17-P-0577
Large-Scale Clustering Using Mathematical Programming
Mario GNÄGI, Philipp BAUMANN
University of Bern, Switzerland

IEEM17-P-0842
Association Rules and Collaborative Filtering on Sparse Data of a Leading Online Retailer
Yongzhong WU, Mianmian HUANG, Yuxin LU
South China University of Technology, China

IEEM17-P-0027
A Comparison Between MODWT-SVM-DE Hybrid Model and ARIMA Model in Forecasting Primary Energy Consumptions
Thoranin SUJJAVIRIYASUP1, Komkrit PITIRUEK2
1University of the Thai Chamber of Commerce, Thailand
2Khon Kaen University, Thailand
IEEM17-P-0174
Developing an Error Taxonomy System for Patient Handoff Events
Xiuzhu GU, Tsuyoshi SEKI, Kenji ITOH
Tokyo Institute of Technology, Japan

IEEM17-P-0665
Scheduling Patients in Emergency Department: A Case Study
Dorsaf DALDOUL1, Issam NOUAOURI1, Hamid ALLAOUI2
1University of Tunis Elmanar, Tunisia
2University of Artois, France

IEEM17-P-0796
Simulation Analysis to Improve Outpatient Turnaround Times in Specialty Clinics
Sung SHIM1, Arun KUMAR2, J. JIAO3
1Seton Hall University, United States
2RMIT University, Australia
3Georgia Institute of Technology, United States

IEEM17-P-0839
Applying Lean Principles to Health Economics Transactional Flow Process to Improve the Healthcare Delivery
Ibrahim ALRASHED, Parminder Singh KANG
De Montfort University, United Kingdom

IEEM17-P-0586
Does Policy of Delayed Retirement Affect Individual Health
Yan ZENG, Qifan JIA, Jie ZHOU
Chinese Academy of Sciences, China

IEEM17-P-0698
An Integer Programming Model for Radiographer Scheduling Considering Skills and Training
Hisashi YUURA1, Toshiyuki MIYAMOTO2, Kuniyuki HIDAKA2
1Osaka University, Japan
2Osaka University Hospital, Japan

IEEM17-P-0615
An Assignment-Based Continuous-Time MILP Model for the Resource-Constrained Project Scheduling Problem
Tom RIHM, Norbert TRAUTMANN
University of Bern, Switzerland

IEEM17-P-0288
A Robust Optimisation Approach to the Aircraft Sequencing and Scheduling Problem with Runway Configuration Planning
Kam Hung NG, Carman Ka Man LEE, Felix CHAN
The Hong Kong Polytechnic University, Hong Kong SAR

IEEM17-P-0409
A Cut-Off Grade Optimization Model in the Open Pit Mining Considering Reclamation and Valuable Waste Materials
Benazir IMAM ARIF MUTTAQIN, Cucuk Nur ROSYIDI, Eko PUJIYANTO
Universitas Sebelas Maret, Indonesia

IEEM17-P-0499
Comparison of PSO and DE for Truck Scheduling in Multi-Door Cross Docking Terminals
Warisa WISITTIPANICH, Piya HENGMEECHAI
Chiang Mai University, Thailand

IEEM17-P-0836
Worst Case Scenario Lemma for t-Robust Combinatorial Optimization Problems Under Max-Min Criterion
Jiabao ZHANG1, Wei WU2, Mutsunori YAGIURA1
1Nagoya University, Japan
2Seikei University, Japan

IEEM17-P-0393
Multi-Skilled Manpower Scheduling with Part-Time Consideration: Case Study
Ping Chong CHUA, Hendra Teja WIRAWAN, Tay Jin CHUA
Singapore Institute of Manufacturing Technology, Singapore
Human Factors 1
11/12/2017 13:45 - 15:15
Room: MR329
Chairs: Ibertha Maya SOPHA, Gadjah Mada University
Seng Fat WONG, University of Macau
Abstracts: see page 58

IEEM17-P-0203
Knowledge Engineering: Exploring Evacuation Behavior During Volcanic Disaster
Ibertha Maya SOPHA1, Anna Maria Sri ASIH2, Dini Graita ILMIA2
1Universitas Gadjah Mada, Indonesia
2Gadjah Mada University, Indonesia

IEEM17-P-0884
Multi-Control and function Design of Ergonomic Electric Wheelchair for Reducing Pressure Ulcer Problem
Seng Fat WONG, Bin LIN, Z. C. LUNO
University of Macau, Macau

IEEM17-P-0896
Ergonomic Assessment and Design Improvement of Shopping Carts for the Satisfaction of Buyers in Grocery Stores and Supermarkets
Rene ESTEMBER, Mara Hiyasmin BERDAN
Mapua University, Philippines

IEEM17-P-0406
Research on Low Cost Virtual Assembly Training Platform Based on Somatosensory Technology
Shengqian JIANG, Peng LIU, Dawei GAO, Yang XU, Xian MENG, Zhaoyi LIU, Zhuo HUANG, Ruolan XU
Jilin University, China

IEEM17-P-0571
A Short Review of Mental Models of Operators in Main Control Rooms of Nuclear Power Plants
Yingzhi ZHANG, Zhizhong LI
Tsinghua University, China

IEEM17-P-0296
An Identification of Dimensions Able to Attract the Potential Workforce for I.T. Industry in India
Bhartrihari PANDYA1, Vijayshri TEWAR1, Richa SINGH DUBEY
1Indian Institute of Information Technology, Allahabad, India

IEEM17-P-0915
Design Thinking and Semiotics to Increase Socio-Cognitive-Affective Engagement: An Inclusive Design Human Factors Case Study
Chien-Sing LEE1, K. Daniel WONG2
1Sunway University, Malaysia
2Daniel Wireless Software Pte. Ltd, Singapore
IEEM17-P-0809  
Topology Optimization as an Innovative Design Method for Additive Manufacturing  
Dinh Son NGUYEN, Frédéric VIGNAT  
1The University of Danang, Viet Nam  
2University of Grenoble Alpes, France

IEEM17-P-0084  
Neural Network Analysis of Behavioral Agent-Based Service Channel Data  
Karthik SANKARANARAYANAN, Ralph LAITE, Nataliya PORTMAN  
1University of Ontario Institute of Technology, Canada  
2TradeRen, Canada

IEEM17-P-0505  
Agent Based Simulation of a Payment System for Resilience Assessments  
Aron LARSSON, Osama IBRAHIM, Leif OLSSON, Joeri VAN LAERE  
1Mid Sweden University, Sweden  
2Stockholm University, Sweden  
3University of Skövde, Sweden

IEEM17-P-0417  
A Hybrid Regression Technique for House Prices Prediction  
Sefei LU, Zengxiang LI, Zhen QIN, Xulei YANG, Rick Siow Mong GOFF  
1Agency for Science Technology and Research (A*STAR), Singapore  
2Agency for Technology and Research (A*STAR), Singapore

IEEM17-P-0440  
Modeling of Power Profiles of Milling Machines for the Use in Factory Models to Optimize Energy Efficiency  
Matthias MEISSNER, Andreas WIRTZ, Johanna MYRZIK  
TU Dortmund University, Germany

IEEM17-P-0448  
A System Model to Improve the Productivity of a South African Steel Industry  
Thomas MUNYA, Charles MBOHWA, Olasumbo MAKINDE, Boitumelo RAMATSETESE  
1Tshwane University of Technology, South Africa  
2University of Johannesburg, South Africa
IEEM17-P-0517
S.C. Johnson LIM, Izzat Syahmiri GHAZALI
Universiti Tun Hussein Onn Malaysia, Malaysia

IEEM17-P-0909
A Cloud-Based Dynamic Random Software Testing Strategy
Hanyu PEI1, Beibei YIN2, Min XIE1, Kai-Yuan CAI1
1City University of Hong Kong, Hong Kong SAR
2Beihang University, China

IEEM17-P-0222
The Effective Route Selection for East-West Economic Corridor in the Greater Mekong Subregion: Machine Vision Approach
Woramol Chaowarat WATANABE1, Takumi ASADA2, Mikiharu ARIMURA2
1Naresuan University, Thailand
2Wataran Institute of Technology, Japan

IEEM17-P-0401
Analyzing the Impact of Investor Sentiment in Social Media to Stock Return: Survival Analysis Approach
Aldila RIZKIANA, Hasrini SARI, Pamoedji HARDJOMIJOJO, Budhi PRIHARTONO, Titah YUDHISTIRA
Bandung Institute of Technology, Indonesia

IEEM17-P-0302
Business Process Modelling Tool Selection: A Review
Chuks MEDOH, Arnesh TELUKDAR
University of Johannesburg, South Africa

IEEM17-P-0834
Implementing Industry 4.0 - A Technological Readiness Perspective
Premaratne SAMARANAYAKE1, Krishumarthy RAMANATHAN2, Tritos LAOSIRIHONGTHONG2
1Western Sydney University, Australia
2Thammasat University, Thailand
A Bi-Level Model with Rough Coefficients for Multi-Mode Resource-Constrained Scheduling Problems
Zhe ZHANG¹, Yang WANG²
¹Nanjing University of Science and Technology, China
²Sichuan University, China

An Integrated Approach for Automatic Execution of BIM-based Assemblies Using Light-Framed Constructions
Boya JIANG¹, Lau SSY², Qianning ZHANG³
¹Nanjing Tech University, Singapore
²National University of Singapore, Singapore

Towards an Integrated Controlling Tool Based on a Time-Varying Project Risk Management Concept
Zoltan SEBESTYÉN, Tamás TÓTH
Budapest University of Technology and Economics, Hungary

Agile-Waterfall Hybrid Product Development in the Manufacturing Industry – Introducing Guidelines for Implementation of Parallel Use of the Two Models
Günther SCHUH¹, Eric REBENTISCH², Michael RIESENER³, Frederic DIELS¹, Christian DÖLLE¹, Steffen EICH²
¹RWTH Aachen University, Germany
²Massachusetts Institute of Technology, United States

Exploring Risks Causing Schedule Overrun in Upstream Natural Gas Projects - A Critical Review and Implications for Future Research
Munmun BASAK, William Vaughan COFFEY, Robert PERRONS
Queensland University of Technology, Australia

An Approach for Managing Project-Communicated Content
Wen-Lung TSAI, Bo-Wei DU, Ying-Hsi CHEN, Yu-Xun LIN
Oriental Institute of Technology, Taiwan

Is Big Data for Everyone? The Challenges of Big Data Adoption in SMEs
Satya SHAH, Cristina BARDON SORIANO, Alec COUTROUBIS
University of Greenwich, United Kingdom

Spatial-Temporal Traffic Speed Bands Data Analysis and Prediction
Shen REN¹, Lin HAN², Zengxiang LI¹, Bharadwaj VEERAVALLI¹
¹Agency for Technology and Research (A*STAR), Singapore
²National University of Singapore, Singapore

A New Data-Driven Intelligent Fault Diagnosis by Using Convolutional Neural Network
Long WEN, Liang GAO, Xinyu LI, Minzhao XIÉ, Gaosin LI
Huazhong University of Science and Technology, China

Data Analytics in Product Development: Implications from Expert Interviews
Julian WILBERG, Fabian SCHÄFER, Peter KANDLBINDER, Christoph HOLLAUER, Mayada OMER, Udo LINDEMANN
Technical University of Munich, Germany

Investigate Human Behavior During Ramadan Through Network Structure: Evidence from Twitter
Aamna AL-SHEHHI, Wei Lee WOON, Zeyar AUNG
Khalifa University of Science and Technology, United Arab Emirates

Predictive Modeling of Aircraft Systems Failure Using Term Frequency-Inverse Document Frequency and Random Forest
Weiili YAN, Jun-Hong ZHOU
Singapore Institute of Manufacturing Technology, Singapore
IEEM17-P-0565
Managing and Evaluating Different Projects in a Hospital Through the Analytic Hierarchy Process: Methodology and Test Case
Carlotta PATRONE1, Adriano LAGOSTENA1, Roberto REVETRIA2
1E.O. Ospedali Galliera, Italy
2University of Genoa, Italy

IEEM17-P-0594
Teachers’ Mental Health: Perceived Social Justice and Life Satisfaction
Yan LI, Qifan JIA, Jie ZHOU
Chinese Academy of Sciences, China

IEEM17-P-0870
Applying Bayesian Network for Noncommunicable Diseases Risk Analysis: Implementing National Health Examination Survey in Thailand
Karowgan LEEROJANAPRAPA1, Waiakul ATTHIRAWONG1, Wichai AEKPLAKORN1, Kittiwat SIRIKASEMSUK1
1King Mongkut’s Institute of Technology Ladkrabang (KMITL), Thailand
2Mahidol University, Thailand

IEEM17-P-0303
Exploring the Internet Resource for Senior Citizens in Taiwan
Shann-Bin CHANG1, K. Y. HUANG2, Shu-Min CHANG3
1Changqing University of Technology, Taiwan
2Ling Tung University, Taiwan
3Nanhai University of Technology, Taiwan

IEEM17-P-0858
Transformation of Health Care System Using Internet of Things in Villages
A.S. KARTHIKA, Kavashree PRAKASHAN, R. ANKayARKANNI, J. BRIGHT JOSE
St. Xavier’s Catholic College of Engineering, India

IEEM17-P-0715
A Deeper Look at the Causes of Hospital Readmissions
Zhongyu YU, William B. ROUSE
 Stevens Institute of Technology, United States

IEEM17-P-0597
Optimal Pricing Considering Customer Categories: Case on Car Rental Industries
Nur Aini MASRUROH, Vivian Prislyane TJAKRA, Rinah Rahma RATINGHAYU
Gadjah Mada University, Indonesia

IEEM17-P-0840
A Comparison of Integer Programming Formulations and Variable-Fixing Method for the Nurse Scheduling Problem
Masaya HASEBE1, Takamasu YAMAZAKI1, Masakazu RUYMAE1, Wei WU1, Koji NONOE1, Atsuko IKEGAM1
1Seikei University, Japan
2Hosei University, Japan

IEEM17-P-0522
Optimization of Product Bundling Strategy Decisions and Inventory Allocation with the Integration of the Degree of Contingency and Dead Stock Levels in a Multiple Time Period Setting
Edward John FRANCO, Mikhaila Carissa SANTOS, Denise Ericka SUYOM, Dennis CRUZ
De La Salle University, Philippines

IEEM17-P-0768
Agent Scheduling of Call Center Using Decomposition Technique
Netnawee UM-IN, Wipawee THARMMAPHORNPHILAS
Chulalongkorn University, Thailand

IEEM17-P-0767
A Mathematical Model for Double Layer Precast Production Scheduling
Nuntiya IAMSUMANG, Wipawee THARMMAPHORNPHILAS
Chulalongkorn University, Thailand

IEEM17-P-0065
A New Two-Stage Stochastic Model for Reverse Logistics Network Design Under Government Subsidy and Low-Carbon Emission Requirement
Hao YU, Wei Deng SOLVANG
UIT - The Arctic University of Norway, Norway

IEEM17-P-0318
Supply Chain Network Reconfiguration in New Products Launching Phase
Hamed JAHANI, Babak ABBASI, Farzad ALAVIFARD
RMIT University, Australia

IEEM17-P-0795
An Optimal Scheduling Policy for Satellite Constellation Deployment
Sunil SINDHU, Goutam ŠEN
Indian Institute of Technology Kharagpur, India
IEEM17-P-0813
A Framework for Lean Knowledge Dissemination: Enhancing Innovation Excellence
R.M. Chandima RATNAYAKE1, Ville ISOHERRANEN2
1University of Stavanger, Norway
2University of Oulu, Finland

IEEM17-P-0851
The Effects of Cooperative Activities with Competitors on the Performances of Innovation and Management
Yongrae CHO1, Choonghyun LEE2, Eunji MOK3
1Science and Technology Policy Institute (STEPi), South Korea
2Korea Institute of Science & Technology Evaluation and Planning, South Korea
3Sejong University, South Korea

IEEM17-P-0162
Perceived Distance as a Reflection of an Organizational Culture of Learning from Failure
Jun NAKAMURA1, Sanetake NAGAYOSHI2
1Shibaura Institute of Technology, Japan
2Shizuoka University, Japan

IEEM17-P-0073
Relationship Among Knowledge Sharing, Open Innovation and Green Production: A Multiple Stakeholder Perspective in Batik Tulis Industries
Augustina Ash RUMANTI1, T.M.A. Ari SAMADHI1, Iwan Inrawan WIATMADJA1, Indrasyi SUNARYO2
1Telkom University, Indonesia
2Bandung Institute of Technology, Indonesia

IEEM17-P-0062
From Potential to Realized Technological Capability: The Case of Indonesian Vessel Component Industry
Dian PRIHYADANTI1, Budi TRIYONO1, Dudi HIDAYAT2
1Indonesian Institute of Science, Indonesia
2Technical University of Netherland, Delft, Netherlands

IEEM17-P-0731
The Influence of Information Technology Infrastructure and Leadership Style on Knowledge Management Implementation
Saide SAIDE1, Rahmat TRIALIHF1, Azhiah PUTRI1, Putri Nadya FAZRI1, Windia HAFIZA2
1State Islamic University of Sultan Syarif Kasim, Indonesia
2Brawijaya University, Indonesia

IEEM17-P-0603
Research on the Development of General Aviation Industry Chain in Shaanxi Province Based on the Model of GEMD
Qinglin BAO, Huaiqi CHAI, Kang WU
Northwestern Polytechnical University, China

IEEM17-P-0224
Creating an Ability to Respond to Changing Requirements by Systematic Modelling of Design Assets and Processes
Samuel ANDRE1, Fredrik ELGH1, Jan Holmquist2
1Linköping University, Sweden
2Göteborg University, Sweden
Developing Advanced Traffic Violation Detection System with RFID Technology for Smart City
Seng Fat WONG, H. C. MAK, C. H. KU, Weng Ian HO
University of Macau, Macau

Path Location Problem for the Marine Container Terminal with Arbitrary Configuration
Etsuko NISHIMURA
Kobe University, Japan

Feasibility Analysis of Renewable Based Hybrid Energy System for the Remote Community in Pakistan
Fahad ALI, Yuesxiang JIANG, Kashifullah KHAN
1 Zhejiang University China, China
2 University of Science and Technology of China, China

An Integrated Customer-Manufacturer Optimization Model to Determine the Optimal Product Price and Quality Level Using Theory of Utility
Anindya Rachma DWICAHYANI, Cucuk Nur ROSYIDI, Eko PUJIYANTO
Universitas Sebelas Maret, Indonesia

Modelling and Simulation of Agricultural Production System Based on IoT Cultivated Fields Information
Yusaku MATSUMOTO, Hironori HIBINO, Naoki KUBO, Makoto KIMURA
1 Tokyo University of Science, Japan
2 HATAKE Company Inc., Japan
3 AGROPOLIS Llc., Japan

Virtualization Technologies in Product Development: A Cross-Industrial User-Study
Sebastian KREMS, Diana REICH, Rainer STARK
1 BMW Group, Germany
2 Technische Universität Berlin, Germany

Reliability Analysis of Cyber-Physical Systems Considering Cyber-Attacks
Zhibui FANG, Huadong MO, Yong WANG
1 University of Science and Technology of China, China
2 ETH Zurich, Switzerland

The Effect of Uncertainty Avoidance on Lean Implementation: A Cross Cultural Empirical Study Involving Toyota
Nihal JAYAMAHA, Nigel GRIGG, Nisansala PALLAWALA
Massey University, New Zealand

Inventory Control Model of a 4-Echelon Production-Distribution System
Mounita TEWARY, Debabrata DAS, Nirmal Baran HUI
1 National Institute of Technology Durgapur, India
2 Assam Engineering College, India

Reference Process for the Continuous Design of Production Networks
Günther SCHUH, Jan-Philipp PROTE, Stefan DANY
RWTH Aachen University, Germany

Additive Manufacturing Impact for Supply Chain – Two Cases
Sobolev IVAN, Yong YIN
Doshisha University, Japan

Coordination in Supply Chain Finance Under CVaR Criteria
Nina YAN, Ye LIU, Chongqing LIU, Hongyan DAI
Central University of Finance and Economics, China

Continuous Improvement of Complex Process Flows by Means of Stream as the “Standardized Cross-Enterprise Value Stream Management Method”
Christof OBERHAUSEN, Maysam MINOUFEKR, Peter PLAPPER
University of Luxembourg, Luxembourg

Relationship Between Stringent Customer Environmental Requirements and Environmental Performance in Sustainable Supply Chain
Md Rezaul Hasan SHUHMAN, Shams RAHMAN, Kamrul AHsan RMIT University, Australia
IEEM17-P-0754
Allocation of College Students to Business Majors with the Aid of a Linear Programming Model
Ahmed EL-BOURI, Asma AL-ZAIDI
Sultan Qaboos University, Oman

IEEM17-P-0223
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2University of Johannesburg, South Africa

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2Kanagawa University, Japan
3Doshisha University, Japan

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Yang LIU1, Yongkui SHI2, Mingwei SUN1, Liangliang ZHANG1, Ning YU3, Yonglu DING3
1Shandong University of Science and Technology, China
2State Key Laboratory Breeding Base for Mine Disaster Prevention and Control, China

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1PLA91872, China
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1University of Minho, Portugal
2University of Stavanger, Norway

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University of Johannesburg, South Africa

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Laura Xiao XIA1, Feng Yu WANG2
1Singapore Institute of Manufacturing Technology, Singapore
2Singapore Institute of Manufacturing Technology (SIMTech), Singapore

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Feng CHEN1, Tsui-Ping CHUNG1, Le WANG1, Meng QIU1
1Jilin University, China
2FAW-Volkswagen Automotive Co., Ltd., China

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Wilson R. NYEMBA1, Marvin MASWERA2, Charles MBOHWA1
1University of Johannesburg, South Africa
2University of Zimbabwe, Zimbabwe

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Mohd Norzaimi CHE ANU1, Shahrun KAMARUDDIN2, Abdul Azid BSHAK2
1Universiti Kuala Lumpur, Malaysia
2Universiti Teknologi Petronas, Malaysia

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Ravi K. SIKHWAL, Peter R. N. CHILDS
Imperial College London, United Kingdom
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3Indian Institute of Technology, Bombay, India

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1Dalian University of Technology, China
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1University of Langlangbua, Indonesia
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2ESTIA – Bidart, France
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2University of Indonesia, Indonesia

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2King Mongkut’s Institute of Technology Ladkrabang, Thailand

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1Deutsche MTM-Vereinigung e.V., Germany

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2Jönköping University, Sweden

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2Murata Machinery, LTD., Japan

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1Institut Teknologi Bandung, Indonesia  
2Telkom University, Indonesia
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Kasin RANSIKARBUM, Namhun KIM
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2Kunsan National Institute of Science and Technology, South Korea

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Norwegian School of Economics, Norway

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1Southeast University, China
2Nanjing Audit University, China

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Southeast University, China

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Tohoku University, Japan

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1University of Johannesburg, South Africa
2University of Zimbabwe, Zimbabwe

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1University of Tehran, Iran
2Arts et Métiers ParisTech, France

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Niranjan Kumar SINGH, Sivasadan MAMBETA
National Institute of Foundry and Forge Technology, India

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Ostwestfalen-Lippe University of Applied Sciences, Germany

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2Fortiss GmbH, Germany

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Houbao XU, Mei LI
Beijing Institute of Technology, China

IEEM17-P-0575
On the Mathematical Program in Theater Anti-Aircraft Distribution Problem
Trang T. NGUYEN, Trung Q. BUI, Bang Q. NGUYEN, Su TRAN LE
Viettel Research and Development Institute, Viet Nam

IEEM17-P-0922
Nonparametric EWMA Chart for Simultaneous Monitoring of Event Frequency and Magnitude
Shuo HUANG1, Jun-YANG1, Amitava MUKHERJEE2
1Beihang University, China
2Xavier School of Management, India

IEEM17-P-0828
Using Meta-Heuristic Algorithms and Hybrid of Them to Solve Multi Compartment Vehicle Routing Problem
Masoud RABBANI, Zahra TAHAEI, Hamed F ARROKHI-ASL, Nikoofar AKBARIAN/SARAVI
University of Tehran, Iran

IEEM17-P-0908
The Characteristic of Cold Metal Transfer (CMT) and its Application for Cladding
Nelson Edoh IMOUDU1, Yonas Zewdu AYELE2, Abbas BARABADI2
1UT The Arctic University of Norway, Norway
2Oslofjord University College, Norway

IEEM17-P-0927
Study on Fault Diagnosis of SVM for Mechanical and Electrical Product Based on Improved Conjugate Transformation
Hui ZHENG, Jun-xia ZHANG
Tianjin University of Science & Technology, China
IEEM17-P-0439
The Impact of Digitalization on Product Lifecycle Management: How to Deal with it?
Yan XIN, Ville OJANEN
Lappeenranta University of Technology, Finland

IEEM17-P-0199
How Knowledge Management Impacts Performance: An Empirical Study in Chinese Knowledge-Intensive Enterprises
Yana YUAN, Huaqi CHAI, Liang LIU
Northwestern Polytechnical University, China

IEEM17-P-0469
Factors Influencing Intention to Use of Smartphone Applications in Thailand
Massoud MOSLEHPOUR*, Khoirul AMRI*, Paoleena PROMPASORN1, 2
1Asia University, Taiwan
2SGC, Thailand

IEEM17-P-0385
Technology Management, R&D Investment, and Small and Medium-Sized Enterprise Growth
SooGeun AHN, Jeehwan YOON, YoungJin KIM
Korea University, South Korea

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Research on Foreign Capital R&D Ecosystem in China Based on Dissipative Structure Theory
Qilei LIU*, Peng GUO*, Yueyan LEI, Yuyan LEI, Yuxi ZHONG
1Northwestern Polytechnical University, China
2Northwestern University, China

IEEM17-P-0530
Collaboration Between SMEs and its Stakeholders: Cross-Tabulation Analysis for Indonesian SMEs Using GEM Data
Ceicalia TESAVRITA, Cindy Marika Amalia WIBOWO, Iwan Inrawan WIRATMADJA
1Universitas Katolik Parahyangan, Indonesia
2Bandung Institute of Technology, Indonesia

IEEM17-P-0805
Risk Reduction Using Grievance Handling Mechanism in Handloom Industry
Lovelin Auguskani P, Sree Dey V, Darwin Jose Raja A, Jerlin Priya J, Mansale Beno M
1St.Xavier’s Catholic College of Engineering, India
2Manonmaniam Sundaranar University, India
3Ammu Mal College of Nursing, India

IEEM17-P-0688
Analysis of Risk Sources in New Product Development Process Using Fuzzy Failure Mode Analysis
Avanish Singh CHAUHAN, Om Prakash YADAV, Ajay Pal Singh RATHORE, Gunjan SONI
1Malaviya National Institute of Technology Jaipur, India
2North Dakota State University, United States

IEEM17-P-0131
New Product Development Project Risks in Saudi Firms - Preliminary Findings
Abdullah ALRABGHI, Muhammad AKRAM, Abdulaziz ALHARBI, Owais NAGRO, Abdullah BUKHARI
1University of Jeddah, Saudi Arabia
2Cranfield University, United Kingdom

IEEM17-P-0472
The Uncertainty Importance Analysis for the Fault Tree and its Probability Density Evolution Algorithm
Guo JI, Chaoyan XIE, Fayuan WEI, Bin LIAO
China Academy of Engineering Physics, China

IEEM17-P-0574
Apply HFACS to Accident Investigation System Interface Design
Ting Yi LIN, Kang-Hung LIU, Chien-Chi CHANG
National Tsing Hua University, Taiwan

IEEM17-P-0711
Petri-Net Based Safety Analysis of Process Systems
Jianfeng ZHOU
Guangdong University of Technology, China
IEEM17-P-0052
Network-Based Process Control and Improvements with Fuzzy Time Delay Modulator
Abdul-Wahid SAIF, Muneeb A. AKRAM
King Fahd University of Petroleum and Minerals, Saudi Arabia

IEEM17-P-0038
Modeling and Simulation of Cascading Failure on R&D Network Based on Different Node States Under Attack Strategies
Yue SONG, Naiqing YANG, Yanlu ZHANG, Jingbei WANG
Northwestern Polytechnical University, China

IEEM17-P-0663
A System Dynamics Case Study of Resilient Response to IP Theft from a Cyber-Attack
Daniel SEPULVEDA1, Omera KHAN2
1Technical University of Denmark, Denmark
2Aalborg University, Denmark

IEEM17-P-0411
Throughput Analysis of Random Storage Systems Operated Under the Closest Eligible Location Rule
Anja HESSLER, Christoph SCHWINDT
Clausthal University of Technology, Germany

IEEM17-P-0384
An Optimization Model for Quality Improvement Investment Decisions Considering Learning and Forgetting Curve
Mega Anisa PRATAMA, Cucuk Nur ROSYIDI, Eko PUJIVANTO
Universitas Sebelas Maret, Indonesia

IEEM17-P-0538
A Graphical Method for Multi-Signal Flow Graph Modeling and Testability Analysis Based on Visio Control Component
Jinsong YU, Yidong ZHENG, Diyin TANG, Y. YANG
Beihang University, China

IEEM17-P-0381
Performance Measurement of the Relationship Between Farmers-Cooperatives-Industrial Processing Milk in a Dairy Supply Chain: A Balanced Supply Chain Management Scorecard Approach
Aries SUSANTY, Arlan BAKHTIAR, Ratna PURWANINGSIH, Dina Firma DEWANTI
Diponegoro University, Indonesia

IEEM17-P-0491
Optimal Replenishment Policy for Inventory Systems with an Unreliable Supplier
Allen H. TAI
The Hong Kong Polytechnic University, Hong Kong SAR

IEEM17-P-0372
Distribution Center Capacity Analysis in Stochastic Environment: An Application of Value Stream Analysis and Monte Carlo Simulation
Ammar M. AAMER
Sampoerna University, Indonesia

IEEM17-P-0524
A Comprehensive Model for Supply Chain Performance Measurement: Application in the Coal Beneficiation Plant of Steel Manufacturing Company
Md. Asif EQUBAL1, Azhar Equbal2, Archana KUMAR1, Rajkumar OHDAR2
1Cambridge Institute of Technology, India
2National Institute of Foundry and Forge Technology, India

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Model Development of Rescue Assignment and Scheduling Problem Using Grasp Metaheuristic
Amelia SANTOSO1, Dina Natallah PRAYOGO2, Joniarto PARUNG1, Hazrul ISWADI1, D.A. RIZQI1
1University of Surabaya, Indonesia
2University of Indonesia, Indonesia

IEEM17-P-0346
Last Mile Distribution in Humanitarian Logistics Under Stochastic and Dynamic Consideration
Meilinda Fitriani Nur MAGHFIROH, Shinya HANAOKA
Tokyo Institute of Technology, Japan

IEEM17-P-0844
Multi-Objective Optimization of the Competitive Supply Chain Network Design Based on a Huff Model
Nioshoat AKBARIAN SARBARI, Reza TAWAKKOLI- MOGHADDAM, Zahra TAHAEI
University of Tehran, Iran
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Assessing Performance of Aging Air-Cooled Heat Exchangers Using Inspection and Performance Data  
Ainul Akmar MOKHTAR¹, Masdi B. MUHAMMAD², Hilmi HUSSIN¹, Mohd Amin ABDUL MAJID¹  
¹Universiti Teknologi Petronas, Malaysia  
²Universiti Teknologi PETRONAS, Malaysia

IEEM17-P-0244  
Energy Balance of Waste Management Systems: A Case Study  
Alberto BELLINI, Alessandra BONOLI  
University of Bologna, Italy

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Schools location through hybrid multi-criteria methodology to satisfy demand of extended school day program in Colombia  
Jonathan CALIXTO, Nicolas TABARQUINO, Pablo MANYOMA  
Universidad del Valle, Colombia

IEEM17-P-0507  
Effect of Socioeconomic Status on Lung Cancer Survival: A Mediation Analysis Based on Bayesian Network Approach  
Kartika Nur ANISA, Shi-Woei LIN  
National Taiwan University of Science and Technology, Taiwan

IEEM17-P-0261  
Development of Intelligent Building Management System Evaluation and Selection for Smart Factory: An Integrated MCDM Approach  
Chih-Hao YANG  
University of National Defense, Taiwan

IEEM17-P-0601  
OPBI: An Open Pipeline for Biomarker Identification  
Sugandima VIDANAGAMACHCHI¹, Mahesan NIRANJAN²  
¹University of Ruhuna, Sri Lanka  
²University of Southampton, United Kingdom

IEEM17-P-0019  
Interpretive Ranking Process-based Lean Manufacturing Barrier Evaluation  
Linda ZHANG¹, Balkrishna Eknath NARKHEDE², Anup CHAPLE¹  
¹IESEG School of Management, France  
²Veermata Jijabai Technological Institute (VJTI), India

IEEM17-P-0906  
Transiting Toward the Factory of the Future: Optimal Buffer Sizes and Robot Cell Design in Car Body Production  
Alain PATCHONG¹, Kerbache LAOUCINE²  
¹MEXENCE Digital & Robotics, France  
²HEC Paris, Qatar

IEEM17-P-0748  
A Random Forest Method for Obsolescence Forecasting  
Yosra GRICHI, Yvan BEAUREGARD, Thiem-My DAO  
Ecole de Technologie Supérieure, Canada

IEEM17-P-0450  
Use of Additive Manufacturing for Polymer Tooling: Case Study from Reaction Injection Molding  
Audun L. STORSANDEN, Marcus VÅLE, R.M. Chandima RATNAVAKE  
University of Stavanger, Norway

IEEM17-P-0015  
A Hybrid Backtracking Search Algorithm for Permutation Flow-Shop Scheduling Problem Minimizing Makespan and Energy Consumption  
Peng CHEN¹, Long WEN², Ran LI², Xinyu LI²  
¹Huazhong University of Science and Technology, China  
²Jianghan University, China

IEEM17-P-0741  
Hybrid Simulation Method by Cooperating Between Manufacturing System Simulation and Computational Fluid Dynamics Simulation First Report: Optimization for Energy Consumption per Unit of Production Throughput Considering Compressed Air Feed  
Hitoshi NAGASAWA¹, Hironori HIBINO¹, Motonobu HASHIMOTO², Norifumi KASE²  
¹Tokyo University of Science, Japan  
²ITOCHU Techno-Solutions Corporation, Japan
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Chairs: Yaping LI, Nanjing Forestry University, Shanghai Jiao Tong University, Niranjan Kumar SINGH, NIFFT, Ranchi, JKD, INDIA

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Robust Inference Traceability Technology for Product Quality Enhancement
Qi XIU, Keiro MURO
Hitachi, Ltd., Japan

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An Application of Fractional Factorial Method to Obtain Robust Solutions at a Glove Manufacturing Environment in Sri Lanka
Achinthya PERERA, Pramila GAMAGE
University of Peradeniya, Sri Lanka

IEEM17-P-0784
Spectral Network Approach for Multi-Channel Profile Data Analysis with Applications in Advanced Manufacturing
Chen ZHIANG, Linmiao ZHANG, Nan CHEN
1National University of Singapore, Singapore
2Micron Technology, Singapore

IEEM17-P-0364
Quality, Excellence and Culture in the Pursuit of Organizational Agility
Andre CARVALHO, Paulo SAMPAIO, Eric REBENTISCH, Pedro SARAIVA
1MIT Portugal Program / University of Minho, Portugal
2University of Minho, Portugal
3Massachusetts Institute of Technology, United States
4University of Coimbra, Portugal

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An Optimization Design of the Exponentially Weighted Moving Average Control Chart
Mona AGHNIAEI, Mohammad SHAMSUZZAMAN, Sadeque HAMDAN
University of Sharjah, United Arab Emirates

IEEM17-P-0801
Optimization of Green Sand Casting Parameters Using Taguchi Method to Improve the Surface Quality of White Cast Iron Grinding Plates – A Case Study
Lakshman SAMARAWEERA, Shiron THALAGALA, Pramila GAMAGE, Manjula NANAYAKKARA
University of Peradeniya, Sri Lanka

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Chairs: Satya SHAH, University of Greenwich UK
Huey Yuen NG, Singapore Institute of Manufacturing Technology (SIMTech), Singapore

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An Overview of Sustainable Practices in Food Processing Supply Chain Environments
Olumide OJO, Satya SHAH, Alec COUTROUBIS
University of Greenwich, United Kingdom

IEEM17-P-0182
How Do Employees Inspire Innovative Work Behavior? Transformational Leadership and Work Motivation Perspectives
Jen-Chia CHANG, Chia-Ying LEE, Pai-Yen WEI, Wei-Cheng HUANG
National Taipei University of Technology, Taiwan

IEEM17-P-0366
Design of an Evaluation Methodology for the Service Design and Development Process from Concurrent Engineering: The Case of the Advertising Sector
Dayni REYES, Rita PENABAENA-NIEBLES
Universidad del Norte, Colombia

IEEM17-P-0477
Sustainable Supply and Demand Chain Integration within Global Manufacturing Industries
Elmira NAGHI GANJI, Satya SHAH, Alec COUTROUBIS
University of Greenwich, United Kingdom

IEEM17-P-0878
Product-Service System for Indonesian Industrial Estate Firms: A Conceptual Framework
Christina WIJARAWAN, Gatot YUDOKO, Yuliani DwI LESTARI
Institut Teknologi Bandung, Indonesia

IEEM17-P-0649
Unlocking the Economic Value and Potential of Design for Manufacture and Assembly in a Developing Country for Sustainability
Wilson R. NYEMBA, Rodney MUZOROZA, Tauryanashe CHEKUKU, Charles MBOHWA
1University of Johannesburg, South Africa
2University of Zimbabwe, Zimbabwe

IEEM17-P-0423
The Delivery of Service Quality to Increase Customer Repurchase Behaviour and Customer Satisfaction at Fast Food Outlets in Central Johannesburg, South Africa
Save AKILIMALISSIGA, Nita SUKDEO, Andre VERMEULEN
University of Johannesburg, South Africa
A Jointly Integrated Maintenance and Emission Optimization for a Manufacturing and Remanufacturing System
Zied HAJEJ, Nidhal REZG, Salim BOUSLIKHANE
Lorraine University, France

A Simple Algorithm to Verify Cycles in MSNs for a Given Demand Level
Shin-Guang CHEN
Tungnan University, Taiwan

Cause Analysis of Representative Troubles at Distillation Tower Using Discriminant Analysis
Jun OKITSU1, Toshiaki MATSÜO1, Hiroki YAMAMOTO1, Haslinda Bt ZABIRI2, lemma Dendena TUSA2, Marappagounder RAMASAMY2
1Hitachi Ltd., Japan
2Universiti Teknologi PETRONAS, Malaysia

Reliability Modeling of Incomplete Common Cause Failure Systems Subject to Two Common Causes
Jin QIN, Ruoxing GU, Guijie LI
China Academy of Engineering Physics, China

Bi-Level Optimization for Maintenance Service Contracts Involving Three Parties Using Genetic Algorithm
Nur F. SA’IDAH, Andi CAKRAVASTIA, Udjiana S. PASARIBU, Bermawi P. ISKANDAR
Bandung Institute of Technology, Indonesia

Joint Optimization of Preventive Maintenance and Economic Production Quantity with Considering Demand Adjustment
Xuejuan LIU, Rui PENG, Qinxia LI, Xiaoyang MA
University of Science and Technology Beijing, China
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Chairs: Lena Stephanie FELIX, Nanyang Technological University
Ville OJANEN, Lappeenranta University of Technology

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Singapore’s NEHR: Challenges on the Path to Connected Health
Lena Stephanie FELIX
Nanyang Technological University, Singapore

IEEM17-P-0656
Achieving Strategic Growth in Microenterprises through Information Technology: UK Micro Enterprise Case Study
Satya SHAH, Matthew LONG, Elmira NAGHI GANJI
University of Greenwich, United Kingdom

IEEM17-P-0633
Mechanisms for Effective Tacit Knowledge Transfer in University Laboratory: An Agent-Based Approach
Fadillah RAMADHAN1, Rayinda Pramuditya SOESANTO2, Afrin Fauzya RIZANA3, Amelia KURNIAWATI4, Iwan Irawan WIRATMADJA5
1Institut Teknologi Nasional, Indonesia
2Telkom University, Indonesia
3Bandung Institute of Technology, Indonesia

IEEM17-P-0905
Research on the Key Factors of Tacit Knowledge Diffusion in Customized Titanium Processing Enterprises Based on ISM Model
Qinglin BAO, Haqai CHAI, Kang WU
Northwestern Polytechnical University, China

IEEM17-P-0759
Design and Development of a Training Module for Data-Driven Product-Service Design
Anies Faziehan ZAKARIA, S.C. Johnson LIM
Universiti Tun Hussein Onn Malaysia, Malaysia

IEEM17-P-0330
Servitization and the Wider Services Communities: A Bibliometric Study
Alan PILKINGTON1, Jawwead RAJA2, Juliana HSUAN3, Thomas FRANDSEN4
1University of Westminster, United Kingdom
2Copenhagen Business School, Denmark

Safety, Security and Risk Management 2

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Chairs: Nantakrit YODPIJIT, King Mongkut’s University of Technology North Bangkok
Om Prakash YADAV, North Dakota State University

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Environmental Analysis of Biomass Power Plants for Sustainability in Thailand
Manutchanok JONGPRASITHPORN1, Adisak MARTSR2, Supapat PHUANGKAEW3, Wannapong YEAMMA1, Nantakrit YODPIJIT4
1King Mongkut’s Institute of Technology Ladkrabang, Thailand
2King Mongkut’s University of Technology North Bangkok, Thailand

IEEM17-P-0377
High School Students' Knowledge and Seismic Risk Perception: The Case of Mexico City
Jaime SANTOS-REYES, Tatiana GOUGEVA
Instituto Politécnico Nacional, Mexico

IEEM17-P-0907
Quantitative Risk Analysis of Components Under High Stress
Yonas Zewdu AYELE1, Abbas BARABADI2
1Østfold University College, Norway
2UiT The Arctic University of Norway, Norway

IEEM17-P-0694
Awareness of Information Security and its Implications to Legal and Ethical Issues in Our Daily Life
Daniel TSE, Zehan XIE, Zhaolin SONG
City University of Hong Kong, Hong Kong SAR

IEEM17-P-0567
Injury Prediction Based on Safety Climate Questionnaire Score Using Artificial Neural Networks
Yu Cheng CHANG, Szu Yu LEE, Pin-Ling LIU, Chien-Chi CHANG
National Tsing Hua University, Taiwan

IEEM17-P-0700
Procurement and Reserves Polices for Humanitarian Logistics
Lin ZHANG1, Jun TIAN1, Richard Y. K. FUNG2, Chuangyin DANG3
1Xi’an Jiaotong University, China
2City University of Hong Kong, Hong Kong SAR
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Chairs: Amos NG, University of Skövde
Stanislav CHANKOV, Jacobs University Bremen

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IEEM17-P-0279
Lean, Simulation and Optimization: A Maturity Model
Ainhoa GOIENETXEA URIARTE1, Amos H.C. NG1, M. URENDA MORIS2, Mats JÄGSTAM1
1University of Skövde, Sweden
2Jönköping University, Sweden

IEEM17-P-0650
Analysis of Human Arm Motions at Assembly Work as a Basic of Designing Dual Robot Arm System
Bernadus KRISTYANTO, Brillanta NUGRAHA, Anugrah PAMOSOAJI, Kristanto NUGROHO
Universitas Atma Jaya Yogyakarta, Indonesia

IEEM17-P-0399
Integrated Vendor-Buyer Inventory Model Considering Imperfect Quality and Inspection Errors with Controllable Lead Time
Amanda SOFIANA, Cucuk Nur ROSYIDI
Universitas Sebelas Maret, Indonesia

IEEM17-P-0770
Concurrent Scheduling of a Job Shop and Microgrid to Minimize Energy Costs Under Due Date Constraints
Ashley THORNTON1, Cedric SCHULTZ2, Sami KARA1, Gunther REINHART3
1University of New South Wales, Australia
2Composite and Processing Technology IGCV, Germany

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Room: MR332

Chairs: Ciwei DONG, Zhanqun University of Economics and Law
Weihua LIU, Tianjin University

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IEEM17-P-0745
The Coexistence of Printed Book and Electronic Book in a Book Supply Chain
Yanping CHENG1, Ciwei DONG1, Renjun LIU2
1Central China Normal University, China
2Zhanqun University of Economics and Law, China

IEEM17-P-0347
The Choice of Buy-Back Contract in Logistics Service Supply Chain with Demand Updating and Mass Customization Service
Weihua LIU
Tianjin University, China

IEEM17-P-0570
Heterogeneous Vehicle Routing Delivery on Collaborative Distribution Using Genetic Algorithm – The Case of Yogyakarta City
Anna Maria Sri ASIH1, Bertha Maya SOPHA1, Yussia KHAI Run NISIA1, Hendra Edi GUNAWAN1, Yuni KARUNI AWATI1
1Universitas Gadjah Mada, Indonesia
2Province of D.I. Yogyakarta, Indonesia

IEEM17-P-0841
The Joint Decisions of Modularity Level Design and Refund Price in a Two-Tier Supply Chain
Qingying LI, Weijian ZHOU
Donghua University, China

IEEM17-P-0275
Capacity Investments in Logistics Outsourcing
Tarun JAIN1, Jishnu HAZRA1
1Indian Institute of Management Udaipur, India
2Indian Institute of Management Bangalore, India

IEEM17-P-0635
Towards an Approach to Assess Supply Chain Quality Maturity
Ana FERNANDES1, Rui OLIVEIRA1, Catarina CUBO1, Paulo SAMPAIO1, Maria do Sameiro CARVALHO1, Paulo AFonso1, J. ROQUE1, Marcio REBELO1, Joao BRANDAO1
1University of Minho, Portugal
2Bosch Car Multimedia, Portugal

IEEM17-P-0635
Evaluation of Market Entry Strategies of Late Entrant in the Sustainable SCM
Tasuya INABA
Kyushu Institute of Technology, Japan
### Decision Analysis and Methods 4

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Room: MR333

Chairs: Ainul Akmar MOKHTAR, Universiti Teknologi Petronas  
Xue-Ming YUAN, Singapore Institute of Manufacturing Technology

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Room: MR334

Chairs: Jasmine Siu Lee LAM, Nanyang Technological University  
Diego MANOTAS-DUQUE, Universidad del Valle

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Keio University, Japan

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Sadayo HIRATA
Shibaura Institute of Technology, Japan

IEEM17-P-0502
Risk Evaluation in Project Management Implementation: The Case of Infrastructural Development Projects
Jan-Harm PRETORIUS, Nokuthula DLUDHLU, Jurie VAN WYNGAARD
University of Johannesburg, South Africa

IEEM17-P-0034
Why CPM is Not Good Enough for Scheduling Projects
Tapan P BAGCHI, Kaushik SAHU, Bimal K JENA
1Indian Institute of Technology Kharagpur, India
2KIT University, India

IEEM17-P-0185
Günter SCHUH, Michael RIESENER, Jan KANTELBERG, Niklas STEIREIF
RWTH Aachen University, Germany

IEEM17-P-0559
Using Fuzzy Front End Theory on the New Product Development and Innovation
Yuexin LI, Na LIU, Hanyan ZHANG, Jintao YU, Shen SUN
1Shandong Jianzhu University, China
2Purdue University, United States

IEEM17-P-0435
How Do Flexible Options Affect Customer Decision Making in an Online Configurator System?
Yue WANG, Guohua TANG, Daniel MO
1Hang Seng Management College, Hong Kong SAR
2Alibaba Group, China

IEEM17-P-0653
ETO Bid Solutions Definition and Selection Using Configuration Models and a Multi-Criteria Approach
Abdourahim SYLLA, Elise VAREILLES, Thierry COUDERT, Michel ALDANONDO, Laurent GENESTE, Yvan BEAUREGARD
1Université de Toulouse – Mines Albi, France
2Université de Toulouse – ENI Tarbes, France
3École de Technologie Supérieure, Canada

IEEM17-P-0293
Assessing the Profitable Conditions of Online Grocery Using Simulation
Ahmed ALZUBAIRI, Abdullah ALRABGHI
1King Abdulaziz University, Saudi Arabia
2University of Jeddah, Saudi Arabia

IEEM17-P-0527
Application of Revenue Management in Supply Chain of Postal Services
Ahmad TEYMOURI, Amir KHATAIE, Pavel ANDREEV, Craig KUZIEMSKY
University of Ottawa, Canada

IEEM17-P-0683
The Study of Critical Success Factors of Cross-Border E-Commerce Freight Forwarder from China to Thailand
Ting SUN, Woramol Chaowarat WATANABE
Naresuan University, Thailand

IEEM17-P-0349
A User Experience Evaluation for Wendy’s Online Delivery Website Geared Towards Improving Customer Experience
Wendy SIA, Rendell TIU, Jazmin TANGSOC
De La Salle University, Philippines
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Chairs: Yaping LI, Nanjing Forestry University, Shanghai jiao Tong University, Yihai HE, Beihang University

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Jointly Optimal Design of Perfect Maintenance Policy and CUSUM Control Chart
Yapeng LI, Long CHEN, Ershun PAN, Zhen CHEN
Shanghai jiao Tong University, China

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Development of a Low-Cost Tool for Semi-Automatic Classification and Counting of Particles in Industrial Oils
Bruno Cesar CAIXETA LEME, Luis Fernando DE ALMEIDA, Jose Walter PARQUET BIZARRIA, Francisco Carlos PARQUET BIZARRIA, Alvaro Manoel SOUZA SOARES, Marcos Alessandro CRUZ RAMOS
University of Taubate, Brazil

IEEM17-P-0243
Intelligent Fault Diagnosis of Rotating Machinery Using Locally Connected Restricted Boltzmann Machine in Big Data Era
Salvio XING, Yaguo LEI, Feng HIA, Jing LIN
Xi’an Jiaotong University, China

IEEM17-P-0540
Memetic Algorithm to Optimize Level of Repair and Spare Part Decisions for Fleet System
Ayush JAIN, Ganesh K. RAO, Manish RAWAT, Bhupesh Kumar LAD
1Manipal University, India
2Indian Institute of Technology Indore, India

IEEM17-P-0217
Optimal Scheduling of Imperfect and Perfect Inspections for Systems Subject to Continuous Degradation
Jingyuan SHEN, Lirong CUI
Beijing Institute of Technology, China

IEEM17-P-0259
Reliability Assessment of NAND SSD Based on Acceleration Degradation Test
Peng LI, Kai LUI, Wei D’ANc, Tianji ZOU
Chinese Academy of Sciences, China

IEEM17-P-0366
Reliability Analysis for Single-Unit System of Warship Equipment with One Repairman Having Vacations Based on Phase-Type Distribution
Tong CHEN, Bingjuing WANG, Dongliang YIN
1Nanjing University of Engineering, China
2HuaZhong University of Science and Technology, China

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On Economizing Local Foods Networks in Developing Countries
Per ENGELSETH1, Yuanita HANDAYATI2, Maria WIDYARINI3
1Molde University College, Norway
2Institut Teknologi Bandung, Indonesia
3Parahyangan Catholic University, Indonesia

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Tax Policy and Sourcing Strategy – A Social Welfare Perspective
Huafan MA1, Ziping WANG2
1Wenzhou-Kean University, United States
2Morgan State University, United States

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On the Circular Supply Chain’s Impact on Revenue Growth for Manufacturers of Assembled Industrial Products – A Conceptual Development Approach
Samuel B. LARSEN, Torben KNUDBY, Jacques VAN WONTERGHEM, Peter JACOBSEN
Technical University of Denmark, Denmark

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Pricing Decisions of Seller and Speculative Strategic Customers
M. LI, J. J. LU, Yongguan LAN, Z. W. MIAO
Xiamen University, China

p.114 IEEM17-P-0686
Strategic Organizing of Piping Supplies for Ship Construction
Per ENGELSETH, Bich LE
Molde University College, Norway

p.114 IEEM17-P-0712
A Multi-Channel Sale System Under Financially Constraint
Xin LI, Yan CHEN
Macau University of Science and Technology, China

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Optimal Multi-Period Multi-Product Supplier Selection and Order Allocation: Balancing Supplier Development and Supplier Switching
Lixin CUI1, Lu BAI1, Zhipeng CUI2
1Central University of Finance and Economics, China
2Tianjin University, China

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Multi-Objective Optimization of Costs and Pollutants in Order to Manage the sustainable Supply Chain of Bio-Fuels
Elahreh JAFARNJAD1, Jamal ALIABADI2
1Islamic Azad University South Tehran Branch, Iran
2Iran University of Science and Technology, Iran

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Constraint Based Dynamic Inventory Scheduling Strategy for Spare Parts Service Logistics Management
Daniel MO, Danny HO, Nicole CHAN
Hang Seng Management College, Hong Kong SAR

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Status and Future of Manufacturing Execution Systems
Emrah ARICA1, Daryl John POWELL2
1SINTEF Technology and Society, Norway
2Kongsberg Maritime AS, Norway

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A GA-Based Method for Sales Order Allocation in a MTS/ MTO Supply Chain
Chin Sheng TAN, Zhong Jin NG, Chi XU
Agency for Science, Technology and Research (A*STAR), Singapore

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Using DEA Model Without Input and with Negative Input to Develop Composite Indicators
William CHUNG
City University of Hong Kong, Hong Kong SAR
Feasibility Analysis of Grid Tied PV System Based on Net-Metering Incentive for a Developing Country: A Case Study of Pakistan

Ayesha ZAHIR, Shaob Ahmed KHAN, Afshan NASEEM
National University of Sciences and Technology (NUST), Pakistan

Assessing the Possible Potential in the Global Energy Consumption: Integrated Artificial Neural Network and Data Envelopment Analysis

Oludolapo OLANREWAJU, Charles MBOHWA
University of Johannesburg, South Africa

The Selection of Enterprise Technology Innovation Mode (TIM) Based on Grey- AHP Method

Hengjie ZHANG, Yuming ZHU, Xiaoyu SONG
Northeastern Polytechnic University, China

Nested Bilevel Genetic Algorithms for Game-Theoretic Optimization of Product Line Design Considering Competition

Xiaojie LIU1, Gang DU2, Roger J. JIAO2, Yi XIA1
1Tianjin University, China  
2Georgia Institute of Technology, United States

A Two-Staged Task Assignment Algorithm for Worker Recommendation in a Crowdsourcing Environment

Rong CHEN1, Shifei CHEN1, Xiaoyao ZHANG1
1Dalaman Maritime University, China
2Sichuan University, China

Simulation-Driven Manufacturing Planning for Product-Production Variety Coordination

Xuejian GONG1, Jonas LANDAHL2, Hans JOHANNESSON2, Roger J. JIAO3
1Georgia Institute of Technology, United States  
2Chalmers University of Technology, Sweden

Statistical Analysis of Oil Insulation Breakdown Voltage

Himanshu GUPTA, Supriyo DAS
National Institute of Technology Meghalaya, India

Robust Model Predictive Control for Energy Management of Isolated Microgrids

Mengyan ZHAI, Yajie LIU, Tao ZHANG, Yan ZHANG
Huazhong University of Science & Technology, China


Mengyan ZHAI, Yajie LIU, Tao ZHANG, Yan ZHANG
National University of Defense Technology, China

Industry 4.0 Interface for Dynamic Reconfiguration of an Open Lab Size Automated Production System to Allow Remote Community Experiments

Safa BOUGOUFFA, Kilian MESSMER, Suhyun CHA, Emanuel TRUNZER, Birgit VOGEL-HEUSER
Technical University of Munich, Germany

Integrated Value Stream Mapping and Simulation for Cash-to-Cash Cycle Time Improvement of a Machining Facility

Weidong LIN1, Engsuwan CHAN2, Lifeng KWAN1
1Singapore Institute of Technology, Singapore  
2Emasek Polytechnic, Singapore

Manufacturing Industry in Cloud Computing Era: Case Study

Yuqiuhe HAO, Petri HELO
University of Vaasa, Finland

A Fuzzy Approach for Fatigue and Creep Analysis in a Fire and Tube Boiler

Tawanda MUSHIRI1, Alimom Z. SHOKO2, Charles MBOHWA1
1University of Johannesburg, South Africa  
2University of Zimbabwe, Zimbabwe

The Advantage of the Arduino Sensing System on Parking Guidance Information Systems

K. Y. HEAN1, Sham-Bin CHANG2, P. R. TSAI3
1Long Tung University, Taiwan  
2Chungang University of Technology, Taiwan

An Intelligent Optimization Approach for Waste Collection with Dynamic Disposal Trips

Qo WEI, Qi LIU, Xiaoxia GUO
Sichuan University, China

A Sequential Multi-Objective Robust Optimization Approach Under Interval Uncertainty Based on Support Vector Machines

Tingli XIE, Qi ZHOU, Jiewang HU, Leshi SHU, Ping JLIANG
Huazhong University of Science & Technology, China

Reliability-Oriented Quality Risk Modeling and Monitoring Approach in Manufacturing Process

Jiaming CUI, Yihai HE, Chunling ZHU1, Fengdi LIU2
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2School of Mechanical Engineering, Beihang University, China

Test Stand for the Investigation of Driven Rollers

Benjamin KUSTER1, Malhe STONIS2, Ludger OVERMEYER3
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2Leibniz Universität Hannover, Germany

Multi-Criteria Classification for Prioritization of Preventive Maintenance Tasks to Support Maintenance Scheduling

Isabel LOPES1, P. SENRA1, Bruna NETO2, R. COSTA2, Miguel SOUSA3, Tiago CABO3, J.A. OLIVEIRA1
1University of Minho, Portugal  
2Bosch Car Multimedia Portugal, Portugal  
3University of Porto, Portugal

A Method for Function Modules Clustering Based on the Function Analysis and the Law of System Completeness

Yuquan DU, Ping JIANG, Shenghui TAN, Runhua TAN
Hebei University of Technology, China

Analysis of Multi-State Warm Standby System Reliability Model with Repair Priority

Tao HU, Dongliang YIN, Tong CHEN
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Reliability Model Analysis on Parallel System Having Multiple Vacations of One Repairman

Wei WANG1, Dongliang YIN1, Bingjing WANG2
1Naval University of Engineering, China  
2Hangzhou University of Science and Technology, China

The Reliability Analysis of Multi-State Cold Standby System Based on Phase-Type Distribution

Fang LI, Tong CHEN, Peng DI
Naval University of Engineering, China

A Maintenance Evaluation Method for Complex Systems with Standby Structure Based on Goal Oriented Method

Xiaojian YI1, Lei CHEN2, Jian SHI3, Peng HOU4, Yuehua LAI5
1Naval University of Engineering, China  
2Fangliang YIN, Tong CHEN, Peng DI
3National University of Defense Technology, China
4China North Vehicle Research Institute, China
5Chinese Academy of Sciences, China
A Mean Life Evaluation Method for Complex Multi-Function Systems Based on GO Method: Case Study of Vehicle Transmission System
Ke BAO, Xiaojian YI, Yuefeng CHEN, Zhong ZHANG
1China North Vehicle Research Institute, China
2Beijing Special Vehicle Institute, China

Criticality Analysis from Maintainability Point of View
Javad BARABADY, Xueli GAO, Tore MARKKESET
1IET The Arctic University of Norway, Norway
2Aker Solutions, Norway
3University of Stavanger, Norway

Research on Basic Maintenance Unit Model Under Two-Level Maintenance
Di ZHOU, Zhiyu JIA, Chenhui ZENG
CHINA Aero-Fuelely technology Establishment, China

Tool Condition Monitoring in Deep Hole Gun Drilling: A Data-Driven Approach
Jihoon HONG, Jun-Hong ZHOU, Hui Leng CHAN, Chong ZHANG, Huan XU, Geok Soon HONG
1Singapore Institute of Manufacturing Technology (SIMTech), Singapore
2Singapore Institute of Manufacturing Technology, Singapore
3National University of Singapore, Singapore

Modelling Electricity Spot Prices with a Three-Regime Markov Model
Yajna MAHARAJ, Venkata Seshachala S. YADAVALI
1University of Pretoria, South Africa
2Aker Solutions, Norway
3Singapore Institute of Manufacturing Technology (SIMTech), Singapore

A Fitness Approximation and On-Line Variable-Fidelity Metamodel Based Multi-Objective Genetic Algorithm
Leshi SHU, Qi ZHOU, Jixiang HU, Xiangzheng MENG, Ping JIANG
Huazhong University of Science & Technology, China

A Global Support Vector Regression Based on Sorted K-Fold Method
Xiangzheng MENG, Qi ZHOU, Jixiang HU, Leshi SHU, Ping JIANG
Huazhong University of Science & Technology, China

Normal Forms of Homoclinic Bifurcation for a Rotor-Active Magnetic Bearings System
Fenghong YANG
Central University of Finance and Economics, China

Analysis on Factors Affecting the Configuration of Maintenance Support System
Xinbao YUAN, Tao HU, Chun-Hui YANG
Nanlan University of Engineering, China

Research of Silicone Oil Uniformity for Butyl Rubber Stopper and Simulation Verification
Yanyan ZHU, Caiyun CHEN, Pengcheng DONG, Jiping LU, Shuai JIANG
1Beijing Institute of Technology, China
2Yanshan University, China

The Effect of Tightness-Looseness on Well-Being: Residential Mobility as a Moderator
Bing HUANG, Xiaopeng REN
1University of Chinese Academy of Sciences, China
2Institute of Psychology, China

The Effect of Calling Orientations on Work Engagement of Employees in Securities Company: An Intermediary Model of Mediation
Jie ZHU, Yong WANG, Li-qi YI
Institute of Psychology, China

The Impact of Feedback on Work Engagement — The Mediating Effect of Psychological Empowerment
Jie XIAO, Tong LIU, Yi-Wen CHEN
Institute of Psychology/University of Chinese Academy of Sciences, China

Research on the Influence of Employees’ Career Adaptability on Occupational Success
Hong XU, Tong LIU, Yi-Wen CHEN
1University of Chinese Academy of Sciences, China
2Institute of Psychology/University of Chinese Academy of Sciences, China

The Effect of Servant Leadership on Work-Related Well-Being: The Mediating Role of Work Flow and Work Engagement
Li-Na JIN, Tong LIU, Yi-Wen CHEN
Institute of Psychology/University of Chinese Academy of Sciences, China

Predictive Modeling of Potential Customers Based on the Customers Clickstream Data: A Field Study
Tian SUN, Mengjie WANG, Zhe LIANG
1Shanghai Zhengda Xinmulan Technology Co., Ltd., China
2Tongji University, China

Service Strategy Under Online B2C Dual-Channel Competition
L. L. SHANGGUAN, Y. F. HE, Yongquan LAN, Z. W. MIAO
Xiamen University, China

The Effects of Relationship Norms on On-Line New Product Development Value Co-Creation Engagement
Huan-Yu ZHAO, Tong LIU, Yi-Wen CHEN
1University of Chinese Academy of Sciences, China
2Institute of Psychology/University of Chinese Academy of Sciences, China

Effect of Service Recovery on Recovery Satisfaction and Behavior Intention: An Empirical Study on Clothing Product Online Shopping
Yun LI, Tong LIU, Yi-Wen CHEN
Institute of Psychology/University of Chinese Academy of Sciences, China

Keyword Extraction from Online Product Reviews Based on Bi-Directional LSTM Recurrent Neural Network
Yue WANG, Jian ZHANG
1Hang Seng Management College, Hong Kong SAR
2Dongguan University of Technology, China

Empirical Study of the Relationship Between Flow Experience, Perceived Transaction Value and Impulse Buying Behavior
Wen-Ji WEL, Si-JIN MA, Yi-Wen CHEN
Institute of Psychology/University of Chinese Academy of Sciences, China

Solution to Excess Capacity in View of Stakeholders
Xiaoting LI, Jinglong BAO, Jianguang SUN, Jinjin ZHAO
1Hebei University of Technology, China
2Tianjin Environmental Protection Bureau, China
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Understanding the Service Desk: Applied Forecasting and Analytics Approach
Jun Jie NG
Defence Science & Technology Agency, Singapore

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Multimode Resource-Constrained Multi-Project Scheduling with Ad Hoc Activity Splitting
Byung Jun JKO, Ting Chong CHUA
Singapore Institute of Manufacturing Technology, Singapore

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Resource-Constrained Project Scheduling in Hazardous Environment
Shuai LI, Zhichong ZHANG, Kaishuin HU, Shaoyong ZHAO, Xiaohui YAN
Donghua University of Technology, China

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Wiki as a Research Support System – A Trial in Information Systems Research
Chewk Hang AU
The Chinese University of Hong Kong, China

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Outsourcing in Business and Management Studies: A Co-Citation Analysis
Keng-Chieh YANG1, Conna YANG1, Chia-Hui HUANG2, Tai-Ch Lee3
1Hua Hsia University of Technology, Taiwan
2Ming Chuan University, Taiwan
3National Taipei University of Business, Taiwan

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Applicability of Lean Product Development to a Company in the Marine Sector
Elisabeth SYNNES, Torgeri WELO
Norwegian University of Science and Technology, Norway

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The Effect of Service Quality Among Customer Satisfaction, Brand Loyalty and Brand Image
Kai-Fu YANG, Hao-Wei YANG, Wen-Yu CHANG, Hsuan-Kuang CHEN
Changyang University of Technology, Taiwan

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Exploring the Role of Professional Development Motivation Between Work Values and Job Satisfaction
Jen-Chia CHANG, Kuei-Miao LIN
National Taipei University of Technology, Taiwan

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A Game-Based Learning System to Disseminate Kanban Concept in Engineering Context: A Case Study from Risk-Based Inspection Project
Antonio VIEIRA, Nuno SOARES, Sergio D. SOUSA
University of Minho, Portugal

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Analysis of the A3 Report Template and Suggestions for Improvement
Susiwati TA, Laura Xiao Xia XU
Singapore Institute of Manufacturing Technology, Singapore

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Influence of Parental Rearing Patterns on Academic Burnout: The Mediating Role of Psychological Capital and Self-Control
Yu-Mei HE, Tong LUI, Yi-Wen CHEN
Institute of Psychology, University of Chinese Academy of Sciences, China

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Safety, Sustainability, and Consumers’ Perceived Value in Affecting Purchase Intentions Toward Organic Food
Shu-Ten HSU, Chiao-Chen CHANG, Tyrone T. LIN
National Dong Hwa University, Taiwan

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Appraisal of Mask Manufacture Information Security Based on ISO27001 and Common Criteria
Cynthia WANG, Eric GUO, Sammy CHEN, Sherry ZHU, Jason WU
Semiconductor Manufacturing International Corporation, China

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Study on Hazard Identification Method for Life Cycle of Patch Board
Xia LIU, Bisong LIU, Wanjun TANG, Wu QIAN, Pei FEI
China National Institution of Standardization, China

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An Improved Aircraft Landing Distance Prediction Model Based on Particle Swarm Optimization - Extreme Learning Machine Method
Selin QIAN, Shengbin ZHOU, Wendong CHANG, Fajie WEI
Beihang University, China

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Light SIEM for Semiconductor Industry
Wu QINGRONG, Sherry ZHU, Eric GUO, Max LU
Semiconductor Manufacturing International Corporation, China

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An Efficient Intranet Architecture Scheme Based on Regional Function and Security Requirement in Semiconductor Manufacturing Enterprises
Fan SHU/AIJI, Sherry ZHU, Eric GUO, Max LU, Wu QINGRONG
Semiconductor Manufacturing International Corporation, China

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Big Data Analytics to Improve PhotoMask Manufacturing Productivity
Xiaoming FAN, Xuan ZHU, Kuei Chi KUO, Cong LU, Jason WU
Semiconductor Manufacturing International Corporation, China

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Failure Mode Classification for Control Valves for Supporting Data-Driven Fault Detection
Emanuel TRU/NZER1, Iris WEISS1, Jens POLMER2, Carolin SCHROEFFER1, Birgit VOGEL-HEUSER2, Stefan EBEN2, Stefan UNLAND3, Christian VERMUM3
1Technical University of Munich, Germany
2Hamburg University of Applied Science, Germany
3Ewok Industries AG, Germany

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Development of an Entropy-Based Feature Selection Method and Analysis of Online Reviews on Real Estate
Hiroki HORINO, Hirofumi NONAKA, Elisa Claire ALEMÁN CARREON1, Toru HIRAOKA4
1Nagoya University of Technology, Japan
2University of Nagasaki, Japan

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Abnormal Data Analysis in Process Industries Using Deep-Learning Method
Wen SONG, Wei WENG, Shigeru FUJIMURA
Waseda University, Japan

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Implementing the Balanced Scorecard in Excel for Small and Medium Enterprises
Antonio VIERA, Nano SOARES, Sergio D. SOUSA
University of Minho, Portugal

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Determining Golden Process Routes in Semiconductor Manufacturing Process for Yield Management
Chang-Ho LEE1, Dong-Hee LEE2, Young-Mok BAE3, Kwang-Jae KIM4
1Pohang University of Science and Technology, South Korea
2Hanyang University, South Korea

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Nonparametric Variance Control Charts Based on Siegel-Tukey Test
Suyi LI
Beijing Institute of Technology, China

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Optimization of Machining Parameters for Ultrasonic Assisted Vibration-Grinding (UAVG) of Ultra-Low Expansion (ULE) Optical Glass Using Taguchi Method
Kabwe MULENGA1, Bing GUO, Xingyu FU2, Qingliang ZHAO3
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2Harkin Institute of Technology, China
The Panel Data Predictive Model for Recurrence of Cerebral Infarction with Health Care Data Analysis
Xiaohan LI, Wenbing CHANG, Shenghan ZHOU, Fajie WEI
Beihang University, China

Design and Implementation of a Dynamic Healthcare System for Weight Management and Health Promotion
Chin-Yuan HUANG, Ming-Chin YANG, Chin-Yu HUANG, Po-Sen CHIU, Zai-Sheng LIU, Ray-I CHANG
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2 National Tsing Hua University, Taiwan

Combined Forecasting of Patient Arrivals and Doctor Rostering Simulation Modelling for Hospital Emergency Department
Weidong LIN, Leslie CHIA
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2 KK Women’s and Children’s Hospital, Singapore

Modeling Ambulatory Care to Obtain a Balance Between Quantity and Quality Provided
Ana Cecilia LYRA FIALHO BREDA, Lays Marina FERREIRA MARQUES, Laryssa HOLANDA
University Center CESMAC, Brazil
Abstracts

IEEM17-P-0808
Evaluating Erlang C and Erlang A Models for Staff Optimization: A Case Study in an Airline Call Center
Kaushik NAG, Magdy HELAI
American University of the Middle East, Kuwait
This research article aims to examine the relationship between lean manufacturing practices and operational performance of small and medium-sized manufacturing enterprises, operating in India. Using a survey questionnaire, responses were collected from 121 manufacturing firms in India. Bivariate correlation and linear regression analyses were employed to investigate the effects of lean manufacturing methods on operational performance. Overall, the results from Indian manufacturing perspective indicate that lean strategy implementation is important predictor of operational performance. By testing the effect of lean manufacturing practices on operational performance of small-medium-sized manufacturing businesses, this study shows strong foundations on lean manufacturing practices as an effective way of improving operational performance.

IEEM17-P-0417
Robustness Through Possible Crew Swaps in Airline Operations
Ian Frederic ILAGAN, Charlle SY
De La Salle University, Philippines
Delays in airline transportation resulting from poor planning of resources, such as crew, are commonplace. Common practices that deal with disruptions, such as purposeful cancellation of flights or assignment of emergency crew, have several drawbacks. Disruption management in terms of robustness, while increasing planned costs, are capable of creating flight schedules resistant to delays. This paper proposes an approach that incorporates delay propagation costs of flights in planning, and finds swap opportunities for crew assigned to each flight in case of disruptions. The crew swaps should lessen the need to assign emergency crew to specific flights, which is seen as costlier. A scenario is presented comparing the solutions obtained through the traditional crew pairing model and the proposed crew swap model. A solution is obtained with a comparatively higher planned cost, but with significantly lower delays.

IEEM17-P-0210
A Mixed Integer Programming Optimization of Bundling and Pricing Strategies for Multiple Product Components with Inventory Allocation Considerations
Paul Siegfried BARRIOS, Dennis CRUZ
De La Salle University, Philippines
Bundling has been practiced in different industries because of the numerous opportunities that it can provide both to the company and to the customers. However, the implementation of bundling entails the need for retailers to face several challenges in coming up with decisions that will successfully actualize the benefits. This is why literature has witnessed a spurt in the articles dedicated to the study of bundling. This study proposes a mixed integer programming model that maximizes profit by simultaneously optimizing the bundling and the pricing strategies, along with the inventory allocation decisions, of a firm having multiple product components. Results showed that the bundling decisions are dependent on the customer's preference and the profit margin of the bundles which are influenced by different factors including cost, inventory, and valuation. Increasing valuation can increase profit but can also threaten the profit margin of other bundles, unlike cost reduction which will always lead to higher profits. Finally, inventory reduction limits the profit of the firm while making mixed bundling, selling strategy or pure components selling strategy more profitable to adopt.

IEEM17-P-0211
A Tool for Selecting Optimal Emergency Response Unit Locations Using an Integrated AHP-MILP Approach
Jayne Lois SAN JUAN, Christine FERNANDEZ, Bryanne LIM, Erika LIM, Richard LI
De La Salle University, Philippines
The location of emergency response units (ERUs) is crucial to their operational success. This paper proposes the use of both qualitative and quantitative techniques to consider possible trade-offs between the two in determining optimal locations through an integrated Analytical Hierarchical Process and Mixed Integer Linear Programming approach with consideration of multiple routes with changing velocities and multiple ERU locations in a district. Neither objective is optimized at the other's expense through the maximization of the least efficiency value generated. A case application showed the model's validity by prioritizing the ERU locations that had the highest preference ratings. Scenario analysis revealed that varying ERU capacity does not change the optimal solution but affects the percent of population served, while changing the number of ERUs required per district and the preference ratings of the potential locations does, as the model adjusts to meet the new requirements and considers changed priorities.

IEEM17-P-0241
Positive Behaviour Changes Through Learn-Practice-Implement Leadership Behavioural Standards
Bin MA, Roland LIM, Ming Hon TOH, Huey Yuen NG
Singapore Institute of Manufacturing Technology (SIMTech), Singapore
Productivity has been identified by the Singapore government as a key pillar to supports the economic growth. However, improving the labour productivity can prove to be challenging, especially when the local workforce is shrinking. To address this challenge, local companies have embarked on a lean manpower transformation journey. From our experience with more than 200 local companies, it is the company's productivity leadership and leaders behaviours that determines the fate of its lean transformation. In this paper, we present the Leadership Behavioural Standards (LBS), a practical method that focuses on people development to help companies to improve their productivity leadership through leaders' positive behaviour changes. This method is developed based on the lean management philosophy, behavioural science and scientific psychology.

IEEM17-P-0639
Joint Decision Making About Price and Duration of Discount Airfares
Yanli FANG, Yan CHEN, Xin LI
Macau University of Science and Technology, China
Dynamic pricing is a common mechanism used in the market to enhance revenue generation from different segments of customers. In this paper, we study a joint decision making problem, faced by an airline, about the optimal price and duration of the discounted airfares to maximize its revenue. Customers have heterogeneous valuations about the air ticket. Furthermore, customers' valuations increase over the sales horizon as customers learn more about their travel schedule. In this study, the interaction between the airline and customers is modeled as a Stackelberg game, where airline acts as the leader and customers act as followers. The optimal joint decision is derived to maximize airline's total expected revenue. At last, a numerical example is conducted to illustrate the strategic pricing decision of the airline.
IEEM17-P-0229

Engaging with Industry to Improve Student Learning on Undergraduate Engineering Programmes

Margaret MORGAN, Pearse O’GORMAN
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It is widely accepted that students’ learning is closely linked to their levels of engagement. Whilst there is no single, universally accepted definition of ‘fully engaged student’ there is a general consensus that active participation by the student leads to higher levels of student learning. Engineering programmes typically provide many opportunities for their students’ active participation, yet many students simply drop out or discontinue their studies before graduation. This paper describes how staff in the School of Engineering at Ulster University have used an active participation approach in a second year module in industrial engineering using a series of industrial student visits. Students’ participation during the visits and their perceptions of industry before and after the visits are described. Practical suggestions on how to visit manufacturing companies might be incorporated into the undergraduate engineering curriculum are provided.

IEEM17-P-0345

Analysis of the Stakeholders of Engineering Education System to Improve the Creativity of Engineering Education

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Improving the creativity of engineering education is the responsibility of many stakeholders. In this paper, the major stakeholders involved in the engineering education systems including, students, faculty members and lecturers, and engineering institutions are studied. The aim is to identify what these stakeholders are required to develop or change in order to meet the needs of the global engineering education. In addition, the paper summarizes the barriers towards creativity with respect to each stakeholder. The paper also discusses how the understanding of the different learning styles for students can help to provide a better learning experience for the students. The paper depends mainly on a preliminary research from the literature to summarize the engineering education requirements, and barriers.

IEEM17-P-0523

Towards the Best Method of Cross Cultural Training for IT Engineering Graduates from Eastern Indonesia Region: Ready to be Global Engineers

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Indonesian IT engineering graduates are nowadays expected to work in multicultural work team. Generally, Indonesian IT engineering students are only focused on their technical skill. In fact, they need a balance of technical and non-technical cross cultural skill. To conduct cross cultural training in order to prepare them to be ready on international assignments, the best methods need to be selected concerned to some factors. The purpose of this paper is to analyze the best and applicable cross cultural training methods to be given for Eastern Indonesian IT engineering graduates. This study reports part of the results of a web-based survey of Indonesian expatriate engineers addressing their knowledge, experience and perceptions of working in multicultural working team. The output of this paper is a recommendation of the best cross cultural training methods for Eastern Indonesian IT engineering graduates as their additional valuable skill to be ready in international employment.

IEEM17-P-0845

Development of Needham Model Based e-Module for Electromagnetic Field & Wave

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This paper aims to discuss the design and development of Needham Model Based e-Module for Electromagnetic Field and Waves (EMT) course. This course is tough and students are facing problem to understand the extremely abstract concept in EMT. Without the strong support of the fundamental theories, students cannot perform in the practical class. This study was using ADDIE model as research methodology, but this paper will only discuss the three phases of ADDIE, namely analyze, design and development phases. The e-module was design and development using Needham Model which consist of five stages that are orientation, generation of idea restructuring of idea, application of idea, and reflection. The e-module was assessed by three experts from the area of EMT, Multimedia and pedagogy. The results of the assessment from 3 experts showed that the Needham Model-based e-module is in line with the subject content, the multimedia selection is suitable and the learning approach is good. The experts also accept the e-module at the high level of usability in teaching EMT. As a conclusion, the e-module is recommended to students enroll in EMT course.

IEEM17-P-0007

Industrial IoT Business Workshop on Smart Connected Application Development for Operational Technology (OT) System Integrator

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Today, many of manufacturing system integrators are pursuing new business solution on information technology (IT) embedding Internet of Things (IoT) functionalities. However, how about conventional type of system integrators? Although their customers already require new innovative IoT solutions, such integrators tend to still provide traditional operational technology (OT) solutions that the customers are less interested in. This is a cause of lack of knowledge of IT technology that OT engineers have never experienced. This paper introduces a preliminary study for a method development on pragmatic workshop combining with business model definition and IoT technology training for such OT system integrators. This workshop method particularly focuses on convergence of OT and IT, defining a new business value chain and experiencing of commercial IoT technology as hands-on session. This paper is mainly discussed a real case study as a preliminary trial in an industrial city in Far East region.

IEEM17-P-0295

How to Improve Employee Education - Methodological Approach to Structure Specialist and Interdisciplinary Requirements

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The automobile industry and automotive supplier industry is confronted with large changes in connection with industry 4.0 and the increased focus on electric mobility. Changes involve not only modifications in the production line, but also an extended demand to employees. The following article describes a methodology on how requirements can be structured to ensure employee selection and education in the context of technological and organizational changes as needed.
In modern mining, it is imperative to have a real-time flow of information between enterprise level systems (ERP, CRM, SCM) and shop floor systems. The gaps that exist between the two spheres make it difficult for managers to have timely information for optimum decision making. A mining company needs instantaneous visibility on real-time visibility of overall mining status. The implementation of Industry 4.0 technologies fragmented shop floor systems and the enterprise level systems communicate seamlessly in delivering optimum operations. The research demonstrates Industry 4.0 technologies as the mechanisms for integrating business systems and processes. The methods researched are deployed in a uranium mining company to integrate all shop floor systems with SAP ERP. The results introduce a semi-smart Mine with real-time visibility of overall mining status.

Application of the Agile Energy Model to the Procure to Pay Process
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Multinational Manufacturing Corporations (MMC’s), which account for a fair percentage of the manufacturing industry encounter challenges with energy quantification and optimisation. Traditional energy models, which have long been used for energy system evaluations have limited application at MMC’s due to model characteristics of high level of expertise, data and time intensive, long time horizons and large spatial detail. The Agile Energy Model utilises business processes for energy evaluation and optimisation. The features of the Agile Energy Model supporting application at MMC’s are generic, reproducible, ease of use, minimum user input data and time requirements and transparency of the evaluation process. It enables the energy quantification of non-traditional activities of finance, HR, ICT and sales and marketing. The methodology of application of the Agile Energy Model is demonstrated with the established procure to pay process.

Usage Frequency of Product Configuration Systems Relative to Integrations and Fields of Application
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Product Configuration Systems (PCS) are automatic solutions that can support and facilitate the sales and engineering processes. PCSs have recently attracted increased attention both from the researches and practitioners. There are variety of challenges reported in the literature as consequences of using PCS, which reduces the usage frequency of the system. To address those challenges, IT integrations can be an effective solution to reduce the number of manual tasks and complexity inside PCSs and make PCSs more user friendly. However, the influence of integrating PCS to different IT systems on usage frequency has not been addressed in the literature. This paper aims to study the relationship of PCS usage frequency in terms of (1) different application area of the PCSs, and (2) integrations to different IT systems. The research method adopted in the paper is survey-based conducted in one company where the unit of analysis is operating PCS.

A Framework for Knowledge-Intensive Design Decision Support in Model Based Realization of Complex Engineered Systems
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Industry is experiencing the challenges of “data-driven” that bring a digital transformation in the industry. In order to facilitate competitiveness in the trend of the digital manufacturing, a method knowledge-intensive design decision support in the model based realization of complex engineered systems is suggested for manufacturing enterprises to support decision-centric meta-design in robust design, ontology-based knowledge management, and rapid design decision using modular process templates. A concept of DGS - Design Guidance System, as well as the associated operation scenarios, are also identified to increase the efficiency and effectiveness of a designer using platform PDSIDES for the decision-making.
The number of quay cranes allocated to each vessel at each time period. The berthing start and end time, and a quay crane assignment for each vessel calling the terminal. The quay crane assignment includes the number of quay cranes allocated to each vessel at each time period. The state-of-the-art models are run with same settings and benchmark.

IEEM17-P-0485
Integrated Supporting Cooperation Model with Fuzzy Approach for Staff Scheduling Problem in Service Supply Chain
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In the past few years, the multinational chain has risen widely. Facing up to the manpower shortage issue in the market, how to design an integrated efficient and responsive supply chain model to optimize personnel planning and staffing operations, and fulfill diverse requirements of product and service for satisfying customers has become one factor in the modern labor-intensive service industry system. In this study, we propose a framework that satisfying the supporting cooperation among members based on the service skill with the fuzzy clustering and objective function with the penalty evaluation to solve the human resource planning problem within multinational supply chain system. Unlike traditional staff scheduling that merely focuses on reducing the cost, the supporting cooperative framework provides proper integrated platforms for personnel flow in global logistics in respect of the customer service and partnership empathy to achieve the goal of the sustainable operation.

IEEM17-P-0430
Models for Continuous Berth Allocation and Quay Crane Assignment: Computational Comparison
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This paper reviews the state-of-the-art models for the continuous and dynamic berth allocation and quay crane assignment problem. This problem arises at the seaside of the container terminals, and it is mostly studied at the operational level. The problem aims at determining a berthing position in a kth-meter partitioned continuous berth, a berthing start and end time, and a quay crane assignment for each vessel calling the terminal. The quay crane assignment includes the number of quay cranes allocated to each vessel at each time period. The state-of-the-art models are run with same settings and benchmark. The results indicate that set-partitioning model and an enhanced compact model outperform the remainder.

IEEM17-P-0299
Determining Quality Refining Rice Mill Location with Disruption Risks
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The events of disaster caused the disruptions in supply networks. In 2011, Thailand also witnessed one of the worst floods in 50 years. This event reminds decision makers to consider all uncertainties when they decide to determine their facility locations of quality refining rice. Facility locations for quality refining rice play an important role for the logistic system cost especially for transportation cost. With these quality refining rice facilities, That’s rice can capture niche market in today’s fierce competition. This paper presents scenario planning models to address the uncertainty of travel distances and rice productions. The results show that only Bangkok, Chachoengsao, and Samut Prakan are common solutions from scenario planning models.

IEEM17-P-0351
Performance Analysis of Riceberry Rice Supply Chain in Thailand
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This research aimed to evaluate the performance of the Riceberry rice supply chain in Thailand – from producer to rice mill to end seller – using data collected from site visits and interviews. To evaluate the supply chain, we used the Logistic Performance Index based on Inventory Holding Cost per Sales, Transportation Cost per Sales, Average Inventory Day, Forecast Accuracy Rate, Rate of Return Goods, Warehousing Cost per Sales, Average Order Cycle Time, Average Delivery Cycle Time, and Transportation DIFOT Rate. The key factors that enhanced the performance and sales volume of the supply chain were market expansion, product processing, transportation plan, warehouse management, and customer demand forecasting. These factors can reflect the sales volume of Riceberry rice. A good transportation plan and better warehouse management can reduce the total cost and enhance the performance of the supply chain, while the accuracy of customer demand forecasting can also increase customer satisfaction.

IEEM17-P-0543
Framework of Supply Chain Simulation Using SCOR Model in Newspaper Industry
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This paper aims to review several possible methods in measuring supply chain performance of newspaper industry. In order to formulate the method, the whole business process in newspaper supply chain needs to be mapped properly. A particular brand of newspaper industry in Indonesia has been chosen as a case study hence a simulation can be conducted. Mapping of business process in newspaper industry involving supplier, manufacturer and distributor is elaborated in this article. The study result shows that SCOR simulation is the most suitable method in measuring supply chain performance in this case. Future research possibly can be a validation test of indicators used in the newspaper industry simulation method.

IEEM17-P-0253
Pricing Policy in Green Supply Chain Management with a Risk-Averse Retailer
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Green Supply Chain Management (GSCM) integrates environmental concept into supply chain management, such as, the design of green product. However, manufacturers require high investment to perform R&D green innovation, and the retailers may bear the risk of the consumers’ acceptance in the market. Combining the manufacturer’s investment of an environmental-friendly green product with the retailer’s risk aversion, this paper investigates the optimal decisions of a green supply chain with a risk-neutral manufacturer and a risk-averse retailer. Through Stackelberg game model, we use conditional value-at-risk (CVaR) criterion to evaluate the risk-averse behavior of the retailer under stochastic demand. The results show the great impacts of the retailer’s risk-averse behavior on the green degree, the wholesale price, the retail price and the order quantity of green products relative to certain key thresholds.

IEEM17-P-0271
Developing Innovative Supply Chain Using Crowdsourcing: A Conceptual Model
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The advancement in information technology has revolutionised the supply chains across the globe. It has enabled organisations to be more efficient and integrated, while continually improving by incorporating latest trends and technologies. Among the recent trends, crowdsourcing is contributing toward improved operations and innovation by seeking the involvement of users, customers and thinkers into generating new ideas and incorporating those into current or future processes. However, the application of crowdsourcing in the supply chain is very limited. Considering its potential benefits, this paper proposes a conceptual model to develop an innovative supply chain by incorporating crowdsourcing. This paper presents an innovative approach which enables researchers and practitioners to study the benefits of crowdsourcing on the supply chain. Identification of the conceptual relationship between crowdsourcing and the supply chain author hopes will contribute towards the development of new theoretical approaches in this field.
IEEM17-P-0339
Estimating Component Yield for CLT Production
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The emergence of cross-laminated timber (CLT) for building construction in North America may provide an additional and possibly more valuable product market for hardwood logs. Using the RaySaw sawing and ROMI rough mill simulators and a digital databank of laser-scanned low-grade yellow-poplar (Liriodendron tulipifera) logs, we examine the yield-recovery potential for components used in the production of CLT. Results include a saving yield of 65% and a rough-mill yield of 78%, for a total material yield of approximately 50%.
This study confirmed the usability of yellow poplar as a material for the production of CLT and allows to estimate the impact on our forest resource of increased use of yellow poplar CLT.

IEEM17-P-0619
Mesheres Optimization in Freeform and 3D Printing for Product Design
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Meshes optimization plays an important role in freeform surface reconstruction and 3D printing for product design. The purpose of this study applied the “Winner-take-all” method of Self-Organizing Maps (SOM) to classify the meshes in product model. SOM is to find the optimized feature points for the data points in model and reduce the points efficiently in the whole surface reconstruction process. An implicit surface based on radial basis function (RBF) kernel calculation reconstructed the meshes. Three case studies has been implemented to achieve an effective points data reduction and an error deviation acceptable process.

IEEM17-P-0266
Analysis and Mode Establishment of Information Integration Activities - A Case Study Perspective
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Influencing by the factors of sudden change of demand, unknown strategy, advancing technology and insufficient experience, enterprise’s information systems are lead to diversification and difficult integration. Although quite a few scholars thus proposed information integration frameworks, theories and suggestions, the lack consideration on internal operations, project operation mechanism and no complete information integration activity structure has resulted in too conceptual and principle outcome, leaving enterprise’s failure in getting the expected benefits. In this respect, this study (1) selects “the Key Success Factors of Information Integration Activity Structure” the literatures and qualitative interview methods to specifically emerge the implementation structure and items/factors of information integration project activities; (2) based on case study interview to explain the gains and losses of the information integration activities procedures for a famous vegetarian group in Taiwan; (3) follows the CREATER model, analyzes each activity procedure items/factors on the “structure table” to emerge possible problems and solutions; (4) dialysis the "project activity" mode of “organization operation surface” and the "importance difference" of “solution surface”; (5) elaborates the management implications and contributions of the research results. It's believed that the results of this study can effectively combine practical application with academic value. It also helps enterprises to enhance the possibilities of success on information integration activities.

IEEM17-P-0668
Adaptation of a Product Maturity Model to Highly Iterative Product Development
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Fast changing market conditions and shortening of product life cycle put pressure on producing companies. The resulting increase of complexity requires a new way to organize the entire product development process. One option to handle this is the highly iterative product development approach. Fast changing customer requirements lead to a continuous adaption of the products. Therefore, a frequent assessment of the product maturity level is necessary. In order to adapt a product maturity model to the highly iterative product development, this paper aims to present an approach how product maturity models need to be structured.

IEEM17-P-0455
Validation of an Optical System for Measuring the Absolute Angular Position
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The measurement of the absolute rotational angle and torque via sensors forms the basis for many industrial sectors. Until now, combined sensors have not been available, so that a lot of installation space is occupied by sensor setups. In addition, the sensor setups get expensive quickly. Therefore, an optical and non-contact measurement method to detect the absolute angle of rotation and torque was developed. This paper presents the validation methodology, the setup of the test bench and the validation results. With an angular resolution of 0.001 degree and an accuracy of more than 0.05 percent, the results are promising. However, for industrial application further investigations on determining torque and miniaturizing the optical setup are required.

IEEM17-P-0407
Integration of an Automated Load Management in a Manufacturing Execution System
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Today, many nations strive for further decoupling of economic growth and CO2 emissions by increasing their use of renewable energies. Because wind and solar power supply is volatile and puts strain on the electric grid, industrial consumers’ Demand Side Management (DSM) becomes crucial for balancing energy supply and demand. As DSM measures directly influence a production system’s performance, energy-related factors have to be weighed carefully against other production targets within a company’s production control. This paper presents methods for integrating load management into production control in order to minimize energy costs for companies. In order to promote the application of load management in production, these methods are implemented in a commercial Manufacturing Execution System.
IEEM17-P-0269
Data Analysis on Applying Real Time Tracking in Production Control of Construction
Jianyu ZHAO, Hyvon OLIVIERI, Obi SEPPANEN, Antti PELTOKORPI, Behnam BADHIL, Pontus LUNDSTROM
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The interest in production control has increased over recent years, especially among lean construction practitioners. Despite of advanced planning and control methods, the data of on-site processes are still typically collected manually. At the same time, technology has been developed to the point where it is possible to remotely locate people, equipment and products in supply chains. Therefore, how to obtain and manage data in construction based on real time tracking is critical to change production control to a more real-time and less laborious process. The availability of real-time, location-based data, opens possibilities to revolutionize production control. This paper proposes a prototype of an intelligent system for real time production control on construction site, defining the type of the tracking data and investigating the utility of them. The prototype combines Bluetooth and WIFI network as connection methods, and locates resources and their movements in real-time, which can be used as a reference to explore proper solution on construction projects and potentially improve production efficiency, sustainability and management of workers.

IEEM17-P-0168
Job Scheduling Integrated with Imperfect Preventive Maintenance Considering Time-Varying Operating Condition
Jiawen HU, Zuhua JIANG
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The integrated problem of preventive maintenance and job scheduling has drawn much attention during the past several decades. However, few researches have taken both the operating condition (OC) and imperfect maintenance (IM) into account. The OC of jobs can change production control to a more real-time and less laborious process. The availability of real-time, location-based data, opens possibilities to revolutionize production control. This paper proposes a prototype of an intelligent system for real time production control on construction site, defining the type of the tracking data and investigating the utility of them. The prototype combines Bluetooth and WIFI network as connection methods, and locates resources and their movements in real-time, which can be used as a reference to explore proper solution on construction projects and potentially improve production efficiency, sustainability and management of workers.

IEEM17-P-0528
A Genetic Algorithm for Unrelated Parallel Machine Scheduling Minimizing Makespan Cost and Electricity Cost Under Time-of-Use (TOU) Tariffs with Job Delay Mechanism
Bobby KURNIAWAN, Hyvon OLIVIERI, Obi SEPPANEN, Antti PELTOKORPI, Behnam BADHIL, Pontus LUNDSTROM
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An unrelated parallel machine scheduling problem under time-of-use electricity price is addressed in this paper. In this setting, price of electricity can be different among various periods of the day. The objective is to minimize total cost consisting of makespan cost and electricity cost. Genetic algorithm (GA) is used to solve the unrelated parallel machine scheduling under time varying tariffs. Chromosome decoding, inspired by greedy total cost, is proposed to transform individual into feasible schedule. Furthermore, generated schedule from the individual is improved by job delay mechanism that shifts jobs to other periods to avoid high electricity cost. Finally, numerical experiment is conducted to implement the approach. Preliminary result shows that our proposed approach is effective and efficient to solve the corresponding problem.

IEEM17-P-0719
Group Production Scheduling Model with Due Window and Maintenance
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A group production scheduling model considering preventive maintenance (PM) and due window is proposed so as to satisfy dual requirements of production cost and delivery date. In this integrated model, learning and forgetting effects between jobs and groups are involved, and an early/tardy delivery penalty membership function is introduced. With the objective of minimizing the total of early/tardy delivery penalty cost and maintenance cost, genetic algorithm is used to obtain the optimal job production and maintenance sequence. Finally, a case study is given to show the effectiveness and reliability of this proposed model.

IEEM17-P-0123
Product Variety Management Using Data-Mining Methods – Reducing Planning Complexity by Applying Clustering Analysis on Product Portfolios
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In decision making problems regarding production network design, product variety oriented planning of network structures and capacities is indispensable. Due to increasing product variety, related planning tasks have become more complex to account for the significantly varying production requirements of product variants. To create a consolidated and expressive decision basis, a methodology to apply cluster analysis on product portfolios is developed in this paper. The introduced clustering method is able to handle production process-related binary data and production capacity-related metric data simultaneously. By applying this methodology, the product portfolio is partitioned into clusters so that variants within a cluster have similar requirements regarding production capabilities and capacities. The developed method is applied to two data sets resulting in more efficient and more accurate problem solving in comparison to established clustering methods.

IEEM17-P-0132
Age-Differentiated Analysis of the Influence of the Duration of Breaks on Learning Sensorimotor Tasks
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In this paper, the influence of the duration of breaks on the learning time of sensorimotor tasks is investigated. For this purpose, a laboratory study with 48 participants in two age groups was conducted. The experimental task was the repeated assembly of a gear. After each trial participants had a break. Depending on the experimental condition the breaks were 2, 4, 8 or 16 minutes long. To evaluate the performance, execution times and assembly errors were measured in each trial. The results show significant learning effects and a significant difference between the execution times of both age groups. No significant difference was found between these groups concerning assembly errors. The duration of breaks did not influence performance.

IEEM17-P-0471
In Lean Manufacturing, if the Customer is a King, then the Frontline Worker is a “Knight”: A Case Study
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Worldwide, Lean manufacturing has been widely declared a success. In the industry, Lean manufacturing had been faced with lots of criticism which includes poor integration of human resource capital most especially in the shop floor level regarding the frontline worker. This paper examines the importance of the involvement of a frontline worker in Lean manufacturing resulting from the longitudinal field of study. Although in manufacturing, the focus is the customer however, quality of the product begins with the frontline worker. It proves that the frontline worker has control on the outcome of the product and that what the customer gets at the end of the day depends on the skills and motivation of the frontline worker. A South African multinational manufacturing company is used as a case study. At the company, the effect of frontline workers at the shop-floor level and their effectiveness and contribution to overall plant productivity are examined.
Effective Knowledge Management Strategy and Firm's Size: Evidence from Indonesia Construction Firms

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The objective of this study is to provide both theoretical propositions and empirical evaluations to the association between knowledge management strategy (KMS) and organizational performance within a project-based organization setting. Of particular interest, firm's size is included within the analysis as a possible moderating variable. Primary data is inquired by means of a cross-sectional survey within a specific context of Indonesia construction firms. Out of 262 invited firms, 106 provide usable data (40.5% response rate). The result shows that empirical data partially supports the hypotheses. It is found that in general, a positive relationship is observable between implementation level of codification strategy and organizational performance. An unexpected, significantly negative association between personalization strategy and performance is also observable. Further evidence also shows that for larger construction firms, management of knowledge which focuses on the codification strategy yields superior performance. Inconclusive results for smaller size organization suggest that more follow-up studies are required.

Context-Oriented Strategy for Modularization of Engineering Design Processes: An Automotive Case Study

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Project planning is a necessary but repetitive and time-consuming activity. Organizational reference process models are often only used as marginal input for project planning, which is mostly conducted manually by experts. Process Tailoring has been introduced in software engineering as a means to methodically instantiate project plans from reference models. However, corresponding approaches focus largely on the software-implementation of model transformations, less on the structured acquisition and derivation of tailoring-relevant knowledge. In this paper, we present a methodology for mapping a processes application context and deriving a process module architecture that satisfies variability-related requirements. The design approach is applied in an industrial case study at an original equipment manufacturer in the automotive industry.

Applicability of Earned Value Management for Deadline Energy Constrained Applications

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Earned Value Management (EVM) is a progress management method in project management. EVM is used as metrics to analyze execution statuses of projects that need to be accomplished within deadlines and limited budgets. By replacing budgets used in project management with energy used in applications, we can apply EVM as metrics to analyze execution statuses of Deadline Energy Constrained (DEC) applications that execute tasks within deadlines and limited energy. DEC applications are often seen in applications that need to consume energy within limits, for example, Wireless Sensor Networks (WSNs), Electric Cars (ECs), and Unmanned Aerial Vehicle (UAV). In this paper, we introduce new possibilities of applying EVM by showing that EVM can be used to analyze execution statuses of and make changes to DEC applications.
IEEM17-P-0550
Feature Importance-Guided Multi-Regression Ensemble with Application to Remaining Useful Life Prediction
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The paper proposes the use of multi-model ensemble in generating the final forecasts for the Remaining Useful Life (RUL), where the primary focus are in ensemble generation (to produce multiple base models) and ensemble integration (to design weighting methods for the base models). Upon generating the multiple base models, each base model is then weighted by incorporating the importance information of the features that are used. Six weighting methods were implemented and experiments were conducted on real data from eight induction motors. Results comparison with the commonly used equal weighting method showed the benefits of such ensemble methods incorporating feature importance information.

IEEM17-P-0336
Status Quo and Future Potential of Manufacturing Data Analytics – An Empirical Study
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Status Quo and Future Potential of Manufacturing Data Analytics – An Empirical Study

The study shows that especially data processing how they are dealing with them. Thus, the data analytics process was divided into four steps. The study shows that especially data processing and data exploitation are still challenging for most companies. Additionally, this study revealed that the current business performance impact of data analytics in manufacturing is not satisfactory for most companies due to problems across the data analytics process.

IEEM17-P-0104
Monitoring of an Aluminum Melting Furnace by Means of a 3D Light-Field Camera
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The melting process in an aluminum melting furnace cannot be monitored by contact sensors, since the furnace is not accessible due to the high temperatures (more than 700 °C). Therefore, monitoring the melting process by means of optical sensors is investigated for the first time in this research project. This article deals with an innovative optical measuring system that is able to monitor the melting bridge despite the red-hot furnace walls. For this purpose, a light-field camera is installed on top an aluminum melting furnace in order to monitor the process and to control a targeted heat input into the melting furnace using a rotatable burner. The light-field camera used can capture a 3D point cloud with only one image. To achieve this, a separate field of lenses is located between the image sensor and the main lens, projecting a virtual intermediate image onto the actual image sensor for further data processing. In addition, a self-developed image analysis program serves to monitor the height variation of the aluminum block and any melting rest on the melting bridge of the furnace [1].
Developing an Error Taxonomy System for Patient Handoff Events
Xiuzhu GU, Tsuyoshi SEKI, Kenji ITOH
Tokyo Institute of Technology, Japan
This paper develops an error taxonomy system for a framework of analyzing patient handoff events. The taxonomy was composed of four sections: event outline, outcome severity, background factors and prevention mechanisms. Each section included one or more dimensions, each of which had multiple categories. Applying the taxonomy to patient handoff incidents collected from five general hospitals in Japan, we identified several important characteristics of handoff failures. Two handoff types that most frequently failed were inter-department handoffs and nurse-to-nurse shift handoffs in the wards. And the failures were mainly due to insufficient or inaccurate information transfer about medication and patient conditions other than vital signs. Regarding inter-department handoffs, transfer failure of patients, medicines, materials and equipment was also frequently occurred. Staff human factors, organizational factors and busy work situations were three major contributing factors behind patient handoff incidents. Reliability of the taxonomy system was confirmed by inter-rater reliability.

Scheduling Patients in Emergency Department: A Case Study
Donal DALDOUL1, Issam NOUAOURP1, Hamen BOUCHRIHA2, Hamid ALLAOUIP1
1University of Tunis Elmanar, Tunisia
2University of Artois, France
Emergency Department (ED) is the center of the hospital management's efforts. It constitutes a complex system with limited resources and random demands, which affect ED patients' waiting time. This paper aims to find the optimal patients' scheduling in case of an ED in Tunisia. We propose a mixed integer linear programming (MILP) that minimizes patients' waiting time. We consider simultaneously four categories of patients. To solve this model, we use the solver ILOG CPLEX Optimization Studio. The program has been applied to a real case study. Numerical results show that patients' waiting time decreased by using the proposed approach compared to the current configuration.

Simulation Analysis to Improve Outpatient Turnaround Times in Specialty Clinics
Sung SHIM, Anur KUMAR1, J. JIAO2
1Seaton Hall University, United States
2RMIT University, Australia
This paper describes a case study undertaken at an outpatient specialty clinic of a hospital. In order to improve patient turnaround times in the outpatient clinic, the hospital management considers implementing changes in patient appointment scheduling, adopting a new patient registration system, and adopting a new billing system. Using computer simulation, the study first models the outpatient care process in the clinic and assesses patient turnaround times in the process. Then, it evaluates the effects of implementing the changes being considered by the hospital management on patient turnaround times in the process. The results of the study would be helpful to those considering improving patient turnaround times in the outpatient care process or other similar processes in hospital clinics.

Applying Lean Principles to Health Economics Transactional Flow Process to Improve the Healthcare Delivery
Ibrahim ALRASHED1, Parminder Singh KANG2
1De Montfort University, United Kingdom
2RMIT University, Australia
Defects reduction and end-to-end process improvement are key to successful delivery of key services such as healthcare. This research paper investigates the implication of Lean management for healthcare service improvement. Transactional process flow is one of the key processes within the Saudi Arabian healthcare system. Transactional flow process in health economics needs to be defect free to ensure an accurate healthcare delivery. This paper identifies and investigates two transactional flows within the health economics department. The anticipated outcome of this research paper is identification of two value streams and critical analysis of the Lean tools to improve the overall performance.

Does Policy of Delayed Retirement Affect Individual Health
Yan ZENG, Qihan JIA, Jie ZHUO
Chinese Academy of Sciences, China
In order to study how the policy of delayed retirement, -a very important reform for healthcare system and social security system in China-influences individual health, we got data from a sample of 703 people to investigate the relationship among policy acceptability and individual wellbeing and the moderating role of individual-relevance of policy. Results showed that the demographic variables and some individual social attitudes had important effects on individual wellbeing. More importantly, after controlling the demographic characters and some social attitudes, policy acceptability of delayed retirement still affected individual wellbeing significantly. In addition, individual-relevance of policy moderated the relation between policy acceptability and individual wellbeing. When people think the policy of delayed retirement was highly individual-relevant, policy acceptability would positively predict individual wellbeing. The present research has some implications for improving individual physical and psychological health by promoting policy acceptability in healthcare system management.

An Integer Programming Model for Radiographer Scheduling Considering Skills and Training
Hisashi YUURA1, Toshiyuki MIYAMOTO1, Kuniyuki HIDAKA1
1Osaka University Hospital, Japan
2Osaka University, Japan
Radiographers/radiology technicians, who operate medical image diagnostic apparatuses used for examination and treatment of patients in hospitals, are limited human resources. Appropriately allocating radiographers working on a variety of medical image diagnostic apparatuses considering their skills lead to providing high-quality services to patients and providing a good working environment to staff. On the other hand, staff training is also an important issue from the long-term perspective of hospital administration. We construct a new integer programming model of radiographer scheduling considering skills and training of radiographers, confirm correctness of the model, and measure the required time for optimization.
In this paper, the robust management, decrease in customer satisfaction, and poor on-time performance. Safety in runway configuration planning is a top priority in aviation management, and air traffic control adopts the risk analysis in handing flight schedules under uncertainty. The degree of conservatism in handling airborne delays and airport traffic should be increased, as any accident due to improper runway usage causes dramatic loss, delay propagation and disruption to the airport management and subsequent activities. In this paper, the robust aircraft sequencing and scheduling problem with runway configuration planning using the min-max regret approach is proposed. The adoption of the mid-point scenario heuristic as an initial solution is able to reduce the computational burden in the computational experiment compared to the solution by using lower bound scenario by solving instances of moderate size (10 – 30 flights) in a two-runways system.

An Assignment-Based Continuous-Time MILP Model for the Resource-Constrained Project Scheduling Problem

Tom RIHM, Norbert TRAUTMANN
The Hong Kong Polytechnic University, Hong Kong SAR

Unanticipated delays cause significant reduction of airport capacity management, decrease in customer satisfaction, and poor on-time performance. Safety in runway configuration planning is a top priority in aviation management, and air traffic control adopts the risk analysis in handing flight schedules under uncertainty. The degree of conservatism in handling airborne delays and airport traffic should be increased, as any accident due to improper runway usage causes dramatic loss, delay propagation and disruption to the airport management and subsequent activities. In this paper, the robust aircraft sequencing and scheduling problem with runway configuration planning using the min-max regret approach is proposed. The adoption of the mid-point scenario heuristic as an initial solution is able to reduce the computational burden in the computational experiment compared to the solution by using lower bound scenario by solving instances of moderate size (10 – 30 flights) in a two-runways system.

Comparison of PSO and DE for Truck Scheduling in Multi-Door Cross Docking Terminals

Warina WISITTIPANICH, Piya HENGMEECHAI
Singapore Institute of Manufacturing Technology, Singapore

This paper presents an application of the modified version of Differential Evolution, called 2-Stage DE (2S-DE), for solving the transshipment of multiple product types in a multi-door cross docking system when a storage is allowed to be temporarily held at the shipping dock. The objective is to find the truck schedule that minimizes the makespan. The performances of the proposed 2S-DE are evaluated and compared with the original DE and the GLNPSO previously published in literature.Using a set of generated instances, the experimental results show that all algorithms are able to find optimal solutions in small-size problems easily. However, when the problem becomes more complex, 2S-DE is superior to the GLNPSO and the original DE since it statistically shows outstanding results in terms of solution quality and convergence behavior.

A Robust Optimisation Approach to the Aircraft Sequencing and Scheduling Problem with Runway Configuration Planning

Kam Hung NG, Carman Ka Man LEE, Felix CHAN
The Hong Kong Polytechnic University, Hong Kong SAR

Unanticipated delays cause significant reduction of airport capacity management, decrease in customer satisfaction, and poor on-time performance. Safety in runway configuration planning is a top priority in aviation management, and air traffic control adopts the risk analysis in handing flight schedules under uncertainty. The degree of conservatism in handling airborne delays and airport traffic should be increased, as any accident due to improper runway usage causes dramatic loss, delay propagation and disruption to the airport management and subsequent activities. In this paper, the robust aircraft sequencing and scheduling problem with runway configuration planning using the min-max regret approach is proposed. The adoption of the mid-point scenario heuristic as an initial solution is able to reduce the computational burden in the computational experiment compared to the solution by using lower bound scenario by solving instances of moderate size (10 – 30 flights) in a two-runways system.

A Cut-Off Grade Optimization Model in the Open Pit Mining Considering Reclamation and Valuable Waste Materials

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Universitas Sebelas Maret, Indonesia

Cut-off grade is one of the decision variables that must be determined correctly by the open pit mining company in order to generate the maximum total profit. This study develops a cut-off grade determination model by using analytical solution approach by considering cost and revenue components such as mining cost, waste removal/rehabilitation cost, processing cost, reclamation cost, marketing/selling stage cost, fixed cost and income/revenue from selling the valuable wasted materials. To illustrate the application of the model, this study also presents the numerical example for the iron ore mining case along with the sensitivity analysis of the sales price. The sensitivity analysis result shows that the optimal cut-off grade and profit obtained by the company are sensitive to the sales price. Using the model in this study, it is expected that the company can make right decision of the cut-off grade value in a mining location easily and quickly.
Factors Influencing Research in an Engineering Faculty
Nicolline REYNECKE, Amrilize MARNEWICK, Jan-Harm PRETORIUS
University of Johannesburg, South Africa
In the last few years, universities have been changing from traditional teaching universities into research ones to accommodate the rapid advances in knowledge and technology. Research and knowledge cannot be left without some form of management to direct the performance and outcome of researchers. Identifying the factors that influence research output and then finding ways to manage these factors through the use of support systems and managerial approaches can lead to an increase in research outputs. According to staff members surveyed, the factors that have the most impact on research are working with top-quality colleagues and linking some form of monetary or non-monetary rewards with doing research. Staff members also indicated that having free time during working hours to do research would be beneficial, along with knowing how resources are allocated and attending time management workshops.

Visualization of the Influence by Conceptual Leadership Promoting High Quality Output
Miwa NISHINAKA, Kamio SHIRAHADA, Youji KOHDA
1The Graduate University of Advanced Studies, Japan
2Japan Advanced Institute of Science and Technology, Japan
This paper presents theoretical implications regarding conceptual leadership in group work that provides the team concept as a centrality of discussion. Work of conceptual leadership is regarded as one of the influences. Experimental workshops were conducted with teams composed of members assigned to follow different communication network structures to simulate various types of interactions. We obtained both qualitative and quantitative data, including records of the conversations during the group work, for analysis. As a result of the analysis, we visualized the influence of a conceptual leadership function that appeared autonomously in a successful team. The conceptual leadership served as the centrality of discussion as a team concept, and influences on the output. The results are useful for building and operating a team in situations where high-quality discussion is required, such as a meeting of project leaders or workshops in higher education.

Emotional Intelligence and Information Technology Professionals
Chang Boon LEE, Wing Han Brenda CHAN, Chi Ming LEE
University of Macau, Macau
Emotional Intelligence (EI) has garnered much popularity among researchers and practitioners as EI is widely believed to be associated with positive outcomes such as job satisfaction and good work performance. The intuitive explanation for the association is that EI creates good human relations and so EI results in positive outcomes. This research focuses on EI among information technology (IT) professionals and validates a model on EI and work outcomes. IT professionals are highly achievement-oriented and therefore the key hypotheses of this research posit that EI is positively related to personal accomplishment and job satisfaction, and that personal accomplishment is positively related to job satisfaction. Data were collected among IT professionals to test the hypotheses. The results show that personal accomplishment mediates the relationship between EI and job satisfaction. Further analysis of the results also indicate that personal accomplishment mediates two dimensions of EI – regulation of emotion and use of emotion – and job satisfaction. This study provided implications for the results obtained.

Vocational Pedagogy Among Technical Vocational Education and Training Teachers
Jailani MD. YUNOS1, Siti Nur Kamariah RUBAN2, Faizal AMIN NUR YUNUS2, Maizam ALIAS2, Syahril ST2, Marina IBRAHIM2, Lee MING FOONG2, Tee TZE KONG2, Sri SUMARWAT2, Dedy Irfan D3, Junita SULAIMAN1
1University Tun Hussein Onn Malaysia, Malaysia
2University National Padang, Indonesia
This concept paper discusses selected factors that affect vocational pedagogy among Technical Vocational Education and Training (TVET) teachers. In the process of teaching and learning, teachers have a very important role. To understand the scope of the vocational pedagogy teachers, all components of vocational pedagogy in the Note for the UNESCO-UNEVOC e-Forum have been used in the study as the basic theory. Documents analysis is used in this research such as scientific journals, previous studies and scientific books. Therefore, this concept paper will elaborate on the selected factors that affect vocational pedagogy i.e., teaching and learning strategies, pedagogical decisions and the pedagogy wheel.

Group Technology Application to Investigate Job and Competency Requirements
Fanny TANG1, Anne O'GRADY2, Andrew CLAPHAM2
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2Nottingham Trent University, United Kingdom
As the world transitions, we are pulled in different directions by the challenges of globalization. Dynamic and ever-changing technologies, global supply chains, product safety, and traceability are some of the main issues that concern society. Testing and certification (T&C) play a vital role in guaranteeing quality and credibility when dealing with these global challenges. In view of the importance of testing and certification, manpower demand and employment opportunities to support the testing and certification industry are discussed by studying the statistics published by the Census and Statistics Department of the HKSAR Government. This paper studies four main areas: testing and certification industry job requirements, competency, employability skills, and the skills gap.
Knowledge Engineering: Exploring Evacuation Behavior During Volcanic Disaster

Bertha Maya SOPHA1, Anna Maria Sri ASIH1, Dini Graita ILMIA2, Hari Agung YUNIARTO2
1 Universitas Gadjah Mada, Indonesia
2 Gadjah Mada University, Indonesia

Efficient evacuation is one of the most important factors to reduce casualties in disaster. However, evacuating is not an easy task because it involves heterogeneous human behaviors, which take into account not only socio-demographic but also psychological aspects. Despite the importance of human behaviors affecting the effectiveness of evacuation plan, studies on evacuation decision-making is little explored. The present study therefore seeks evacuation behaviors of volcanic disaster and their underlying attributes. Knowledge Engineering (KE) was applied both to obtain attributes of decision-making and to formulate decision-making behavior during volcanic disaster. Results reveals that the evacuation behaviors can be categorized into four behaviors, i.e., adaptive, non-adaptive, altruistic, and leader-following. Vulnerability, perception of danger, previous disaster experiences, disaster training, ownership of livestock/valuables, traditional belief, trust on cultural/community leader, and social concern are all underlying behavioral attributes in which each evacuation behavior is associated to different attributes. Future potential researches are also discussed.

Multi-Control and function Design of Ergonomic Electric Wheelchair for Reducing Pressure Ulcer Problem

Seng Fat WONG, Bin LIN, Z. C. LIO
University of Macau, Macau

Barrier-free facility is very important for handicapped daily life. Nevertheless, a good wheelchair design is helpfully supporting them. Unfortunately, sitting posture made handicapped perplexing, because the pressure ulcer problem occurs in their lower portion of body by traditional wheelchair. Since the major of the elders and the mobility patients are lower portion of body muscle or joint problems generated the travel inconvenience, therefore, it is necessary to design and study an innovative wheelchair that can aid the elders with mobility disability daily travelling a convenient transportation with multifunctional, easy-control method and superior user experience contributing to their lives. This investigation is going to discuss the possibility and feasibility of the smart wheelchair by Human Factors Engineering Technology to provide a comfortable and safety circumstance to the users, which can reduce the pressure ulcer problem by changing sitting posture with muscle signal control (EMG) and brain wave control (EEG).

Ergonomic Assessment and Design Improvement of Shopping Carts for the Satisfaction of Buyers in Grocery Stores and Supermarkets

Rene ESTEMBER, Mara Hiyasmin BERDAN
Mapua University, Philippines

Buyers are dependent on the use of shopping carts when buying their grocery items. At present, studies have yet to focus mainly on the effects of shopping carts to the satisfaction level of buyers in different grocery stores and supermarkets in the Philippines. This paper aimed to assess the existing design of the shopping carts, determine significant factors affecting the satisfaction level of the buyers, and design and improve shopping carts based on the significant features. Various ergonomic and statistical tools were used to determine significant factors with respect to ergonomics, usability, safety and sanitation, and aesthetics satisfaction of buyers. These significant factors were used as basis in proposing an improved design of the shopping cart that contributed to the satisfaction level of buyers in the grocery stores and supermarkets.

Research on Low Cost Virtual Assembly Training Platform Based on Somatosensory Technology

Shengqian JIANG, Peng LIU, Dawei GAO, Yang XU, Xian MENG, Zhaoyi LIU, Zhuo HUANG, Ruoan XU
Jilin University, China

This paper presents a method to design a virtual assembly training platform basing on the analysis of the model of virtual assembly system with somatosensory interaction and the Kinect V2 interaction technology. And in this platform, Unity 3D is used as the interaction engine, MAYA and CATIA are used to build scenes, and Kinect V2 is used to capture the coordinate of the user’s spine point. This coordinate is the basic point to unify the virtual location and real location. Besides, we will find the prospect of the virtual assembly training platform by testing the effect of the virtual assembly and the actual assembly of scissors.

A Short Review of Mental Models of Operators in Main Control Rooms of Nuclear Power Plants

Yingzhi ZHANG, Zhizhong LI
Tsinghua University, China

Definition, classification and measurement of team mental model are reviewed in this paper. This study also provides a practical method to analyze operators’ mental models in main control rooms of nuclear power plants, including the definition and the measurement method.

An Identification of Dimensions Able to Attract the Potential Workforce for I.T. Industry in India

Bharathri PANDYA, Vijaysinh TEWARI, Richa SINGH DUBEY
Indian Institute of Information Technology, Allahabad, India

The objective of this paper is to review the present literature in the emerging area of employer branding and to list the antecedents capable of alluring the prospective employees by their future employers. A scale of employer branding is developed to evaluate the employer attractiveness in the I.T. sector. The approach involves reviewing conceptual and empirical research papers from academic journals and other available literature. The review provides the insight as to which antecedents are important for the employees and to what extent. The various facets of job components discussed by the various researchers were identified and analyzed. The relative worth will be studied and their response can be an eye opener to the changing demands of the next generation of the employees. The uniqueness of the review is that it provides the base for a new scale in employer branding in the I.T. sector in the Indian context.

Design Thinking and Semiotics to Increase Socio-Cognitive-Affective Engagement: An Inclusive Design Human Factors Case Study

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2Daniel Wireless Software Pte. Ltd, Singapore

Successful aging with and into disability is a challenge in various countries due to an increasing aging population. Prior research indicate that brain training may stimulate but significant improvement may take time. To sustain improvement, this exploratory study suggests adopting a technology-assisted affective socio-cognitive approach to arrest cognitive and social decline holistically. WHO’s International Classification of Functioning, Disability and Health (ICF) supports the holistic dimensions to adaptive, and engaging sustenance of quality of life. We scope our study to the participation aspect; extending context and various context-aware interactions. This study reports on the use of semiotics for inclusive design to increase cognitive engagement with youth and some seniors with Mild Cognitive Impairment (MCI), forming the bases for design thinking-based technology-assisted scaffolds/affordances.
IEEM17-P-0809
Topology Optimization as an Innovative Design Method for Additive Manufacturing
Dinh Son NGUYEN, Frederic VIGNAT
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2 University of Grenoble Alpes, France
Additive Manufacturing (AM), popularly called 3D Printing, enables the manufacture of nearly any complex geometries by adding layer by layer of material. Advances in AM technologies are the ability to fabricate products without the need for process planning, the removal of tooling compared with the conventional manufacturing technologies. AM opens opportunities for product designers so they can freely create any complicated geometries of their products without thinking about manufacturability constraints. However, it is necessary to have a method to design a product for additive manufacturing technologies. Thus, a novel approach as an innovative design tool using topology optimization is presented in the paper. It is to help designer create an optimal structure of product with the least amount of material used, but still ensure the mechanical properties of product.

IEEM17-P-0084
Neural Network Analysis of Behavioral Agent-Based Service Channel Data
Karthik SANKARANARAYANAN, Ralph LAITE, Nataliya PORTMAN
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2 TradeRev, Canada
When developing an agent-based model for service channel design, the individual decision-making process of the agents is a vital part of the simulation. Additionally, due to the nature of agent-based models and the communication networks that exist between agents, the micro/macro-dynamics are heavily linked. To better understand this link, we propose the use of integrated neural networks trained in a supervised learning environment. Training these networks on data collected from human based experiments, and implementing these networks into the model will capture the irrational behavior not captured by traditional models, while improving on traditional agent-based decision-making processes.

IEEM17-P-0505
Agent Based Simulation of a Payment System for Resilience Assessments
Areen LARSSON1, Osama IBRAHIM2, Leif OLSSON1, Joeri VANNALAERE3
1 Mid Sweden University, Sweden
2 Stockholm University, Sweden
3 University of Skövde, Sweden
We provide an agent based simulation model of the Swedish payment system. The simulation model is to be used to analyze the consequences of loss of functionality, or disruptions of the payment system for the food and fuel supply chains as well as the bank sector. We propose a gaming simulation approach, using a computer based role playing game, to explore the collaborative responses from the key actors, in order to evoke and facilitate collective resilience.

IEEM17-P-0417
A Hybrid Regression Technique for House Prices Prediction
Slei LI1, Zengxiang LI1, Zhen QIN1, Xulei YANG1, Rick Siew Morgn GOH1
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Usually, House price index represents the summarized price changes of residential housing. While for a single family house price prediction, it needs more accurate method based on location, house type, size, build year, local amenities, and some other factors which could affect house demand and supply. With limited dataset and data features, a practical and composite data pre-processing, creative feature engineering method is examined in this paper. The paper also proposes a hybrid Lasso and Gradient boosting regression model to predict individual house price. The proposed approach has recently been deployed as the key kernel for Kaggle Challenge “House Prices: Advanced Regression Techniques”. The performance is promising as our latest score was ranked top 1% out of all competition teams and individuals.

IEEM17-P-0440
Modeling of Power Profiles of Milling Machines for the Use in Factory Models to Optimize Energy Efficiency
Matthias MEISSNER, Andreas WIRTZ, Johanna MYRZIK
TU Dortmund University, Germany
The analysis of the interdependencies of production processes in factory systems in relation to their energy efficiency requires a modeling of the different processes. Consequently, it is required to know the power consumption of the different production processes and to abstract these for the simulation model. Various existing modeling methods are thus presented and analyzed by means of milling processes. Furthermore, a comparison between three methods, which work with the arithmetic mean value, a ramp function and the approximation by a polynomial is presented. As an indicator of the quality of the methods the deviation between the measured and modeled energy consumption is used.

IEEM17-P-0448
A System Model to Improve the Productivity of a South African Steel Industry
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2 Tshwane University of Technology, South Africa
South African steel manufacturers are now under pressure to stay functional within the competitive business environment, since the productivity in this industry over the past couple of years has been dwindling. However, productivity measurement and monitoring, which plays an important role in driving steel productivity improvement has not been explored. The present research work therefore developed a system model capable of measuring and monitoring the productivity of these industries. This was achieved by modelling and simulating the South African Steel Industry using the real life manufacturing operating conditions of this industry. Simulation results of the virtual South African Steel Industry showed that the saw master and milling machines, with a total number of 241 and 304 unprocessed workpiece at their respective stations are the bottlenecked machines. Hand sawing machine and relatively cheap milling machine were recommended to support the existing steel production process in order to alleviate the bottlenecks.
Employed to categorize fact or effect-behavior as attitude, perceived mass transit system in Bangkok. Theory of planned behavior (TPB) poses a question on the effectiveness of BTS which lead to our increased from approximately 55 millions in 2000 to 220 million in 2014, ridership records report that the number of riderships are significantly the popularity as a major mode of transportation in Bangkok. The King Mongkut’s to enhance the service level to the retailer as well.

Bullwhip effect on the supplier. Surprisingly, this strategy also happens retailer orders, and thus diminishes the aggregated impact of the paper that this control method can reduce the variance of individual especially where information sharing, vendor managed inventory the supplier in order to mitigate the bullwhip effect in its supply chain, this strategy also happens to enhance the service level to the retailer as well.

Factors Influencing Attitude Toward Behavior in Using Mass Transit System in Bangkok: A Case Study in Car Users Panisara VANCHITFITSA,N, Chivalai TEMYASATHIT King Mongkut’s Institute of Technology Ladkrabang, Thailand Bangkok Mass Transit system (BTS) is launched in 2000 with the aim to solve congestion problem by reduce number of cars on streets. Due to BTS characteristics of rapid and punctuality, it is believe that BTS gain the popularity as a major mode of transportation in Bangkok. The ridership records report that the number of riderships are significantly increased from approximately 55 millions in 2000 to 220 million in 2014, whereas the number of registered cars in Bangkok also increased. This poses a question on the effectiveness of BTS which lead to our investigation on factors affecting attitude toward behavior in using mass transit system in Bangkok. Theory of planned behavior (TPB) are employed to categorize factor-effect- behavior as attitude, perceived behavior control, and habit. Attitudes toward behavior were attained through various literatures, then they were categorized according to the Marketing Mixed (4Ps) framework. Questionnaires were designed according to best-worst scoring framework. The result shows that car users consider speed of travel (A1) and distance between station and ridership’s origin/destination (D1) as the most influencing factors affect attitude toward the use of BTS.

IEEM17-P-0032
Mitigating the Bullwhip Effect in Supply Chains Using Variance Reduction Techniques
A. A. EL-TANNIR
Beirut Arab University, Lebanon
This paper proposes a new strategy that can be unilaterally applied by the supplier in order to mitigate the bullwhip effect in its supply chain, especially where information sharing, vendor managed inventory (VMI), and other collaboration methods fail. This strategy is similar to the use of control variates in simulation analysis. It is shown in this paper that this control method can reduce the variance of individual retailer orders, and thus diminishes the aggregated impact of the bullwhip effect on the supplier. Surprisingly, this strategy also happens to enhance the service level to the retailer as well.

IEEM17-P-0035
Factors Influencing Attitude Toward Behavior in Using Mass Transit System in Bangkok: A Case Study in Car Users
Panisara VANCHITFITSA,N, Chivalai TEMYASATHIT
King Mongkut’s Institute of Technology Ladkrabang, Thailand

Bangkok Mass Transit system (BTS) is launched in 2000 with the aim to solve congestion problem by reduce number of cars on streets. Due to BTS characteristics of rapid and punctuality, it is believe that BTS gain the popularity as a major mode of transportation in Bangkok. The ridership records report that the number of riderships are significantly increased from approximately 55 millions in 2000 to 220 million in 2014, whereas the number of registered cars in Bangkok also increased. This poses a question on the effectiveness of BTS which lead to our investigation on factors affecting attitude toward behavior in using mass transit system in Bangkok. Theory of planned behavior (TPB) are employed to categorize factor-effect- behavior as attitude, perceived behavior control, and habit. Attitudes toward behavior were attained through various literatures, then they were categorized according to the Marketing Mixed (4Ps) framework. Questionnaires were designed according to best-worst scoring framework. The result shows that car users consider speed of travel (A1) and distance between station and ridership’s origin/destination (D1) as the most influencing factors affect attitude toward the use of BTS.

IEEM17-P-0904
Towards a Collaborative Supply Chain Balanced Score Card Framework to Analyse Collaborative Value-Added
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2University of Strasbourg, France
3ES-Sup, France

For years, academics have been widely focused on the collaboration as an effective factor of performance in Supply Chains. However, the quantification of the added value brought by the collaboration is extremely challenging. In fact, some studies have been dedicated on unilateral analysis, some others on bilateral investigations. Moreover, almost of these works lacked in a mutual consensus, and did not arrange on a common set of attributes in their analysis of collaboration. For this purpose, this research paper proposes a new framework that is able to carry out a Collaborative Value-Added analysis. This solution is based on a set of attributes that have been identified from the related literature. The methodology we set out, can measure the value-added to assess the collaboration between two partners. Furthermore, upon the initial aforementioned outline, we present an extended framework based on the Balanced ScoreCard.

IEEM17-P-0673
Development of Fuzzy Logic and Genetic Fuzzy Commodity Price Prediction Systems – An Industrial Case Study
Joseph C. CHEN, Xiaoyun WANG
Bradley University, United States
Supply Chain Managers in major automobile or construction industries often rely on the forecasted commodity prices to negotiate with suppliers where products are produced via respective commodity. For example, the natural rubber price is a key factor affecting cost in buying tires in automobile industries. This industrial case study proposes two commodity pricing prediction systems, Fuzzy Logic and Genetic Fuzzy Systems. By reviewing five main factors for this predictive model: (1) historical quarterly NR price; (2) the prices for crude oil; (3) China GDP growth rate; (4) synthetic rubber price index; (5) world natural rubber consumption/production ratio, the Genetic Fuzzy system outperforms the Fuzzy Logic system.
IEEM17-P-0517
S.C. Johnson LIM, Izzat Syahmi GHAZALI
Universiti Tun Hussein Onn Malaysia, Malaysia
Bibliometric analysis is a useful approach to identify key authors, research themes, and evolution of a research field. Previously, there exist a number of related studies on field development of engineering education and design engineering using various analytical approaches. Nevertheless, bibliometric analysis of the design engineering education (DEE) field, an emerging cross-disciplinary research sub-field under the field of engineering education, is still absent. In this study, we suggest a methodology to analyze the research themes and its evolution in the DEE field. A case study that illustrate our methodology is performed using DEE’s bibliometric data downloaded from the SCOPUS database. Upon data pre-processing steps, research evolution of the DEE field is presented visually using strategic mapping and thematic evolution network over the years 2010-2015 with discovered insights discussed. We summarize our findings with some discussion on future works.

IEEM17-P-0909
A Cloud-Based Dynamic Random Software Testing Strategy
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1City University of Hong Kong, Hong Kong SAR
2Beihang University, China
Cloud testing has emerged as a new technology in corporate world and organization, which generates virtual machines for application demands, and employs resource allocation strategies to dispatch the test tasks. Traditional resource allocation strategies usually concern on static assignment, which lacks dynamic adjustment functions. Dynamic Random Testing (DRT) strategy employs feedback mechanism to guide the selection of test cases, which is shown to be effective and has great potential in theoretical as well as practical terms. Therefore, planting the idea of DRT into cloud testing can allocate the test tasks in a dynamic way. In this paper, a cloud-based dynamic random testing strategy is proposed to enhance the testing process and promote the testing efficiency, in which the virtual resource allocation is in accordance with the testing results. A framework of cloud-based DRT strategy is constructed and contrast experiments are conducted on the CloudSim platform. The experimental results show that the proposed cloud-based DRT strategy has better performance than the traditional testing strategies.

IEEM17-P-0222
The Effective Route Selection for West-East Economic Corridor in the Greater Mekong Subregion: Machine Vision Approach
Woratom Choawarat WATANABE, Takumi ASADA1, Mikiharu ARIMURA
1Naresuan University, Thailand
2Marunau Institute of Technology, Japan
Due to the economic cooperation of the six countries in the Greater Mekong Subregion Economic Cooperation Program (GMS Program), the improvement of transport linkages between GMS countries has become a priority, especially for the cross-border section. For effective transport, it is necessary to consider the quality of the route pavement. It heavily affects travel time and cost. Previously, there have been difficulties of adequate qualitative survey methods for classifying data like route quality. In this research, a machine vision method is introduced to classify the pavement quality of West-East Economic Corridor routes in Thailand, and alternative route which promotion is being considered. The methodology proposed classifying pavement quality using the provided images. Classification results indicate that all routes in Thailand’s section contain more than 90% of pavement and there are still non-pavement parts, especially at the border area. However, the proposed method presents an interesting application using open data, in terms of condition or state of pavements and determination of maintenance needs, the real-time data is needed.

IEEM17-P-0401
Analyzing the Impact of Investor Sentiment in Social Media to Stock Return: Survival Analysis Approach
Aldila RIZKIANA, Hasrini SARI, Pameodji HARDJOMIJOJO, Budhi PRIHARTONO, Titah YUDHISTIRA
Bandung Institute of Technology, Indonesia
In the era of information technology, stock related information can be easily found on the internet, especially on social media. Thus, data in social media hold an important information to predict the movement of stock price. In addition, the research about the time of stock fulfillment, that is the time until stock gives the expected return, is very rare. For this reason, in this research, we will use Survival Analysis to model time aspect of trading strategies using investor sentiment as the predictor. The result shows that investor sentiment in Stockkt can be used as the predictor of return in Survival Analysis Model we developed and can be used as an alternative method to make stock buying and selling process. We also find Cumulative Twitter Investor Sentiment Hazard (CTIS) ratio of less than one indicates that an increase of CTIS will reduce the hazard.

IEEM17-P-0302
Business Process Modelling Tool Selection: A Review
Chuks MEDOH, Arineh TELUKDARIE
University of Johannesburg, South Africa
The interest in business process modelling has increased in the last decade. Numerous business process modelling tools for developing business processes exist. These tools serve a wide range of business functions and applications. There exist limitations in effectively selecting the appropriate business process modelling tool relative to corporate functions and applications. This research explores this specific limitation and serves as a guide to mitigate this specific limitation relative to prioritizing and selecting a business process modelling tool. This investigation explores the limitations in the currently designed business process modelling tool based on local, regional and global modelling of corporate processes. Results prove essential prioritization constituents relative to selecting a more enhanced business process modelling tool for enterprise professionals. The applicability of the proposed prioritization approach is demonstrated.

IEEM17-P-0834
Implementing Industry 4.0 - A Technological Readiness Perspective
Premaratne SAMARANAYAKE, Krishamurthy RAMANATHAN, Tritos LAO Sirichonghong
1University of Johannesburg, South Africa
2Thammasat University, Thailand
This paper identifies the relative importance of key enabling factors for implementing industry 4.0 from a technological readiness perspective. The research involves the identification of enabling factors, their categorization into technological readiness dimensions, followed by the determination of the relative importance of both technological readiness dimensions and key objective measures. The results show a strong relationship between technological readiness and design principles of Industry 4.0. The findings suggest that process-related objectives are more important than economic-related and environmental-related objectives when implementing industry 4.0. The results also show that “the knowledge of humans in technology and how to leverage it” and “improving the ability of machines and devices in connecting to the internet” are the most important factors for achieving all objective measures. Practitioners can use the apparent relationship between process related objectives and key technological dimensions for setting appropriate strategies and policies when moving towards Industry 4.0.
Finally, the computational results indicate that this optimization model is proposed to pre-distribute the jobs to balance the machine capacity. Then greedy algorithm with water injection model is developed through the descriptive analysis of feedback received from key stakeholders within the organization.

IEEM17-P-0490
A Benders Decomposition-Based Heuristic Algorithm Framework for Unrelated Parallel Machine Scheduling Problem with Weighted Maximum Earliness and Tardiness
Shijin WANG, Benyan YE
Tongji University, China
Problems about parallel machines are researched a lot and have a wide application. An unrelated parallel machine scheduling problem is discussed in this paper: there're m unrelated parallel machines that have different processing speeds and opening costs. N jobs are assigned to the machines, meeting distinct due windows. The objective is to minimize the total cost including the machine opening cost and the cost related to maximum earliness and tardiness. The scheduling progress takes both machine utilization and customer satisfaction into consideration. The proposed method in this paper is a benders decomposition-based heuristic algorithm that can solve mixed-integer linear programming problem efficiently. The algorithm is based on a partition of the problem, which is suitable to solve our problem. The algorithm framework is established to solve large-scale problems.

IEEM17-P-0236
Parallel Machines Scheduling Problem with Maintenance Using Greedy Algorithm
Wen-Zhu LIAO, Xiaoxia YANG
Chongqing University, China
This paper aims to deal with parallel machine scheduling problem considering machine reliability. The objective is to minimize the maximum completion time with different deteriorating machine. Firstly, machine preventive maintenance policy is determined by considering machine reliability. Then greedy algorithm with water injection model is proposed to pre-distribute the jobs to balance the machine capacity. Finally, the computational results indicate that this optimization model for parallel machines scheduling problem is reliable and effective.
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IEEM17-P-0022

An Integrated Approach for Automatic Execution of BIM-based Assemblies Using Light-Framed Constructions
Boya JIANG1, Lau SSY2, Qanning ZHANG2
1Nanjing University of Science and Technology, China
2Nanjing Tech University, Singapore

This research suggests that the construction operation logic of industrialization is simulated by setting the family hierarchy to establish a BIM-based process simulation model for light-framed prefabs. Besides, Revit API technology and C# advanced programming language technology are used as means of implementation to develop an interface program of Revit Software for data statistics.

IEEM17-P-0287

Towards an Integrated Controlling Tool Based on a Time-Varying Project Risk Management Concept
Zoltan SEBESTYEN1, Tamas TOTH2
1Budapest University of Technology and Economics, Hungary

This article focuses on risk decreasing and disappearing with time, based on value-based risk monitoring. In a project, in order to maintain a value-based risk management process, a continuous valuation method is necessary which is able to capture the value of the project deliverable (e.g., building) in its current state. The objective of this paper is twofold. On the one hand a continuous, integrated monitoring and reassessment tool for risk management processes is briefly introduced. This extension of the original concepts defines the project goal by the owner’s minimum requirements to be achieved, then objectively identifies risk factors with measurable financial variables. On the other hand, based on this framework of an automated risk management process that delivers a more effective practical tool to reduce project risks, we seek future directions for research to develop and integrate risk management. This time the emphasis is more on the future possibilities than the promotion of the new concept.

IEEM17-P-0245

Exploring Risks Causing Schedule Overrun in Upstream Natural Gas Projects–A Critical Review and Implications for Future Research
Munmun BASAK1, William Vaughan COFFEY1, Robert PERRONS1
Queensland University of Technology, Australia

Schedule overruns in oil and gas projects are a serious concern worldwide because of the detrimental effects of delays, severe cost increases, and reduced return on investments that these slips cause. Despite the increasing occurrence of delays in natural gas projects globally, limited research exists concerning delays in oil and gas projects, and no attention has been paid to the upstream project phases though industry reports have been highlighting those phases as a significant part of the problem. Towards making scholarly literature reflect this emerging truth, this paper critically reviews existing literature to provide comprehensive understanding of risks causing delays in upstream gas projects. Findings are: (1) literature is still inconclusive about impact of non-technical risks on schedule performance; (2) project performance is influenced by numerous exogenous risks; and (3) absence of sophisticated tools to analyze different dimensions of project delays. This paper accordingly makes a contribution by providing research-driven suggestions for areas requiring further investigation.

IEEM17-P-0341

An Approach for Managing Project-Communicated Content
Wen-Lung TSAI1, Bo-Wei DU1, Ying-Hsi CHEN1, Yu-Xun LIN1
1Oriental Institute of Technology, Taiwan

Project documentation is a crucial but effort-consuming task in business related projects. To prepare, to write, and to maintain project documents is often considered a time-consuming and tedious work, especially during times of fleet project with the emphasized regarding short period and limited human forces. However, the context among most Project-communicated content and engineering management is highly interrelated. Based on the context among project-communicated content in projects especially for information development projects, this paper applied the concept of single sourcing and presents an effective approach utilizing object oriented method to clarify project-communicated content. This paper also implemented a prototype environment, OPPDE, with a case study and discussed results to illustrate the approach. The results were usable and applicable for managing project-communicated content.
IEEM17-P-0580  
**Is Big Data for Everyone? The Challenges of Big Data Adoption in SMEs**  
Li JIN, Zheng LIU, Jieqiong CHEN, Yuning ZHAO  
Qingdao University of Science and Technology, China  
The aim of this paper is to present an investigative study on the concept of Big Data and its challenges towards implementation in manufacturing SMEs. Big Data aims to facilitate the collaborative approach in SMEs through the creation of real-time data visualization to address key challenges to many of the market variations for every sector SMEs. Although, earlier research studies have highlighted the importance of Big Data from technological perspectives, this study focuses towards SMEs due to its feasibility and flexibility within the market space. This research aims to investigate the use of case study approach for the re-use, adoption, and understanding of strategic future direction from the findings. The findings and early analysis from this paper could be referred by researchers when addressing the use of big data analytics within manufacturing SMEs. Finally, the paper provides a key strategic point towards the exploration of Big Data within SMEs.

IEEM17-P-0891  
**Spatial-Temporal Traffic Speed Bands Data Analysis and Prediction**  
Shen REN, Lin HAN, Zengxiang LI, Bharadwaj VEERAVALLI  
1Agency for Technology and Research (A*STAR), Singapore  
2National University of Singapore, Singapore  
The development of Intelligent Transportation System (ITS) requires insightful information and predictions from spatial-temporal traffic data. In order to improve commuters’ experiences by forecasting and proactively taking actions on city traffic, in this paper, we analysed temporal and spatial patterns of low-resolution traffic speed bands and predicted future traffic status based on SVM learning models. Real speed bands data of Singapore were used for analysis and prediction. The performance of machine learning models were evaluated by speed bands data of road segments in Central Business District (CBD) and Tampines area at Singapore. The results demonstrated that multiple kernel learning (MKL) combining both temporal and spatial patterns showed better performance in predicting next 5 minutes and 1 hour traffic conditions in both CBD and rural areas (Tampines). In short-term prediction (next 5 minutes), SVM learning using temporal pattern showed better performance in both CBD and Tampines than using spatial patterns. However, the long-term prediction (next 1 hour) of CBD area has lower accuracy than rural area (Tampines). In general, we can achieve up to 88% prediction accuracy of traffic speed band at entire Singapore.

IEEM17-P-0194  
**A New Data-Driven Intelligent Fault Diagnosis by Using Convolutional Neural Network**  
Long WEN, Liang GAO, Xinya LI, Minzhao XIE, Guomin LI  
Huazhong University of Science and Technology, China  
Along with the boosting of big data in manufacturing, applying the data-driven analysis method to support the intelligent fault diagnosis becomes a new trend. Recently, deep learning emerged as a potential artificial intelligence technique. It can obtain the features of raw data automatically, which provides a new way to reduce the expert’s bias as much as possible and to mine the inherent relationships hidden in data. Convolutional neural network (CNN) is a promoting kind of deep learning. A new intelligent fault diagnosis method based on CNN is proposed in this paper. Firstly, a transformation from signals to images is investigated to deal with the raw signal data in a simple way. Then these images are trained by CNN. The proposed method is tested on the motor bearing dataset from Case Western Reserve University. The results show that the proposed method achieves as high as 99.51% of results show that the proposed method achieves as high as 99.51% of accuracy on the prediction accuracy. The good performance of proposed method is also proved by comparing it with other deep learning methods and traditional methods.
Managing and Evaluating Different Projects in a Hospital Through the Analytic Hierarchy Process: Methodology and Test Case

Carlotta PATRONE1, Adriano LAGOSTENA1, Roberto REVETRIA2
1E.O. Ospedali Galliera, Italy
2University of Genoa, Italy

Nowadays hospitals work in the context with decreasing resources over time, and unfortunately not all the projects can be implemented. For this reason healthcare area needs tool to decide on which project invest. The current paper has been developed in one of the major hospital in Genoa (Italy): Galliera. The Galliera hospital has a board of directors who need to know the sustainability of the projects. The aim of this paper is to implement a method to measure in a quantitative way the projects sustainability, with an innovative application of the Analytic Hierarchy Process (AHP). This method allows to compare the quantitative and qualitative items of the projects at the same time. These projects are extremely heterogeneous. The authors involved also all the employees having a strategic position in the hospital determining in this way the success of the work as the results show.

IEEM17-P-0565

Applying Bayesian Network for Noncommunicable Diseases Risk Analysis: Implementing National Health Examination Survey in Thailand

Kanogkan LEEROJANAPRAPA1, Watailak ATTHRAWONG2, Wichai AEKPLAKORN2, Kittawat SRIKASEMSUK3
1King Mongkut’s Institute of Technology Ladkrabang (KMITL), Thailand
2Mahidol University, Thailand

We propose using a Bayesian network to capture and understand the dependency risk factors affecting the prevalence of chronic diseases. By applying a Bayesian network model, we can visualize inter-dependencies between risks and their effects on the Noncommunicable disease (NCD) prevalence. By using a Bayesian network to model the prevalence of diabetes, we can define the top three risks as family history of diabetes, obesity, and age. Furthermore, the risk classification results can help to determine the managing strategy. For the Thai population, problems arising from family history of diabetes and obesity can be met by employing a transfer strategy. For the Thai population, the risk incurred by low intake of fruits and vegetables should use a reduction or mitigation strategy. Physical activity should apply a retain strategy.

IEEM17-P-0870

Exploring the Internet Resource for Senior Citizens in Taiwan

Shann-Bin CHANG1, K. Y. HUANG2, Shu-Min CHANG2
1Changung University of Technology, Taiwan
2Ling Tung University, Taiwan

Aging is a trend of global population structure. Taiwan’s seniors aged above 65 will become more than 20% to super-aged society in 2025. In recent years, the ICT also developed rapidly. The elders use computers and mobile device to Internet is also getting higher and higher. However, the needs of the elders have their particularity, whether the current Internet resources can meet the needs of the elders is an important issue. This study based on the traditional Chinese website resources in Taiwan, used search engines and keywords to find the website and social media fan pages resources for elders. Three conclusions were provided for government, private organizations and social media.

IEEM17-P-0888

A Deeper Look at the Causes of Hospital Readmissions

Zhongyuan YU, William B. ROUSE
Stevens Institute of Technology, United States

The US Centers for Medicare and Medicaid Services (CMS) penalizes hospitals that readmit patients within 30 days for several diagnoses. Hospitals argue that readmissions are driven by the nature of populations served. Traditional statistical analyses support this assertion. In this article, we show that a deeper analysis, using clustering, provides a richer and more nuanced explanation of readmissions. Specifically, while patient population is a significant factor, the effectiveness of care and patient satisfaction are also contributors. Hospitals that invest in improving effectiveness and satisfaction should be able to lower readmission rates.
Contingency have produced adverse effects to bundling optimization. Mixed individual appears to have a significant effect on the number of interaction of degree of contingency and the reservation price of a model. The results were able to show that an increasing degree of proposed optimal pricing models considering the customer segments. Car rental business is used as a case study. The capacity of car rental business is dynamic since the number of cars available might dynamically change due to the dynamic return time of the customers. Two scenarios are proposed, with substitution and with substitution. Since the models are non-linear programming with constraints, KKT procedure is applied to get the optimal solution. Results from the case study show that the proposed model enables to increase significantly. Furthermore, substitution scenario has the opportunity to obtain higher revenue.

**IEEM17-P-0597**
Optimal Pricing Considering Customer Categories: Case on Car Rental Industries
Nur Ainai MASRUROH, Vivian Prislyane TJAakra, Ririn Bahma RATINGHAYU
Gadjah Mada University, Indonesia
Segmentation of the customer provides an opportunity to offer more than one class with the different price. However, the most occurring problem is the loss of demand for lower class due to its high demand but limited capacity, while the utility of the higher class is low due to its high price. Thus, setting the right price becomes critical. This paper proposed optimal pricing models considering the customer segments. Car rental business is used as a case study. The capacity of car rental business is dynamic since the number of cars available might dynamically change due to the dynamic return time of the customers. Two scenarios are proposed, without substitution and with substitution. Since the models are non-linear programming with constraints, KKT procedure is applied to get the optimal solution. Results from the case study show that the proposed model enables to increase significantly. Furthermore, substitution scenario has the opportunity to obtain higher revenue.

**IEEM17-P-0840**
A Comparison of Integer Programming Formulations and Variable-Fixing Method for the Nurse Scheduling Problem
Masaya Hasebe, Takamasa Yamazaki, Masakazu Ryumae, Wei Wu, Keji Nonobe, Atsuko Ikegami
1Seikei University, Japan
2Hosei University, Japan
The nurse scheduling problem (NSP) aims to optimize a schedule of work periods (shifts) for nurses so that the schedule simultaneously balances the workload among nurses and maintains the skill level of the nurse team in each shift. In this paper, we present several mixed integer programming models for the NSP and compare them through computational experiments. The results are given for a typical benchmark instance with 25 nurses. In practical use, some constraints cannot be easily modeled, and on-site schedulers often require either a flexible schedule or multiple good solutions so that they can adjust the final shift schedule. To satisfy this need, we propose a variable fixing method to list the common features among all the optimal solutions and to generate solutions that are optimal with respect to divergence.

**IEEM17-P-0522**
Optimization of Product Bundling Strategy Decisions and Inventory Allocation with the Integration of the Degree of Contingency and Dead Stock Levels in a Multiple Time Period Setting
Edward John Franco, Mikhaela Carissa Santos, Denise Ericka Suyom, Dennis Cruz
De La Salle University, Philippines
This paper considers a multiple integer non-linear programming model that aims to optimize the three types of bundling strategies while considering the selection of components for the bundles that integrates the degree of contingency and the dead stock component of the product. The proposed model is validated through different scenarios with varying incremental input parameters in order to determine the effects of the variables to the objective function and the sensitive points in the model. The results were able to show that an increasing degree of contingency is able to affect the pure component variable while the interaction of degree of contingency and the reservation price of a mixed individual appears to have a significant effect on the number of pure bundles. In addition, the dead stock level and degree of contingency have produced adverse effects to bundling optimization. These results have shown that integrating component selection, dead stock level and bundling strategies gave the model the flexibility to change through its varying parameters improving its profitability.

**IEEM17-P-0768**
Agent Scheduling of Call Center Using Decomposition Technique
Netnawee U-MIN, Wipawee Tharmaphornphilas
Chulalongkorn University, Thailand
This research studies an agent scheduling of a call center where the number of agents and skills are predetermined and varied during each period. Agents must be assigned into work shifts in order to minimize labor related cost and also satisfy working constraints such as worker availability, work duration and break requirements. We decompose this problem into two parts which are solved sequentially. First is to determine the minimum number of required agents for each shift across a month that covers the predetermined number of agents in each period. The outcomes from the first part are used as input for the second part which is to assign agents into work shifts. Mixed integer programming models are proposed to find solutions for both parts.

**IEEM17-P-0767**
A Mathematical Model for Double Layer Precast Production Scheduling
Nanitaya Iamsumang, Wipawee Tharmaphornphilas
Chulalongkorn University, Thailand
This paper involves a precast production with double layer in identical parallel molds. The precast production consists of 5 processes to be produced sequentially. Each process requires a specific resource that must be shared among molds except the curing process which does not require any resources. There are 5 concrete formulas for considering that do not effect on the precast quality. Nevertheless, each formula results in different costs and different processing time. The more expensive formula requires the shorter processing time. We propose a MIP model to select formulas and schedule all jobs to finish within due date.

**IEEM17-P-0065**
A New Two-Stage Stochastic Model for Reverse Logistics Network Design Under Government Subsidy and Low-Carbon Emission Requirement
Hao Yu, Wei Deng, Suiyang Uist – The Arctic University of Norway, Norway
Nowadays, increasing number of companies incorporates the reverse logistics decisions into their supply chain design in order to cope with the enforced international and national legislation and improve the resource efficiency and public image. This paper investigates a new stochastic optimization model for designing a single-period multi-product multi-level reverse logistics system under government subsidy and low-carbon emission requirement. In order to resolve the stochastic optimization problem, a modified multi-criteria scenario-based approach is proposed to maximize the profit generation while simultaneously improve the stability of the decision-making under uncertainty. The model and solution method are tested with several numerical experiments, and managerial insights are obtained with respect to the carbon emission requirement, governmental subsidy, economy of scale, and system flexibility.

**IEEM17-P-0318**
Supply Chain Network Reconfiguration in New Products Launching Phase
Hamed Jahani, Babak Abbasi, Farzad Alaviparad
RMIT University, Australia
This paper examines the impact of new products launch on the optimal supply chain network (SCN). We formulate a stochastic mixed integer nonlinear model that considers product demand and price uncertainties in the markets to optimally reconfigure the SCN. In addition, the correlation between demand and price is considered in the proposed model. The integration of network redesign and new products development (NPD) process is intended to propose a framework to define target markets for each new product respecting demand and maximisation of the profit of the company. A numerical case study is used to illustrate the applicability of the proposed mathematical model.
Satellite constellations are increasingly making their presence in the space due to their use in telecommunication, navigation, earth observation, scientific data collection and many other services. The size of the constellation is also growing with the requirement of high quality data and extensive coverage. The problem of scheduling satellite launches for a moderate-sized constellation deployment with various operational and resource constraints are considered in this paper. We develop an optimal launch strategy, via mathematical programming approach, to minimize the constellation deployment cost. The work in this paper is based on the European Space Agency (ESA) challenge problem [1] published in 2015 accompanied by real data.
A Framework for Lean Knowledge Dissemination: Enhancing Innovation Excellence

In collaboration with the Sangikyo Corporation, the present authors completed a web-based questionnaire assessing how perceived distance, from failure can be effective in a working system. Sangikyo employees have not received much attention, especially in Indonesia. In the face of obstacles, Small and Medium Enterprises (SME) owners should be able to improve their competitiveness. Innovation process that was done was not separated from human resources within the organization. Innovation process is not separable from the human resources in an organization. The existence of new knowledge is an absolute condition for innovation to happen, and as the continuation, the process of knowledge sharing will be highly important. Therefore the process of knowledge sharing must be well-managed to achieve an optimal result of innovation. This research produces a conceptual model picturing relation between sources of knowledge sharing, open innovation and green production.

The former verified cooperation's effect on management performance, while the latter studied cooperation’s effect on innovation performance. The results of analyses showed that the cooperation with competitors, comparing with other types of cooperation, enhanced the innovation performance such as process innovation between the cooperative activities and management performance. In this context, we applied the structural equation analysis by integrating regression model and logistic regression model. The former verified cooperation’s effect on management performance, while the latter studied cooperation’s effect on innovation performance. The results of analyses showed that the cooperation with competitors, comparing with other types of cooperation, enhanced the innovation performance such as process innovation. Additionally, the analysis demonstrated that such cooperation positively related to the management performance. These results indicate the significance of strategic openness even to the competitors as business environment changes dramatically. Such cooperation would provide the windows of opportunity for sustainable growth through the field-based innovation.
Creating an Ability to Respond to Changing Requirements
by Systematic Modelling of Design Assets and Processes
Samuel ANDRE, Fredrik ELGH
Jönköping University, Sweden

System suppliers, e.g. original equipment suppliers, are important for the success of many products. They design a unique solution, often in close collaboration with other companies, based on different product concepts and/or core technologies. The solution can then be manufactured in different quantities depending on the client’s need. High level of customization is required as the interfaces are not standardized, the performance is not negotiable, requirements are not initially fixed and the specific system interacts with, is affected by, or affects other systems that are simultaneously developed. A system supplier commonly designs and manufactures solutions for different OEMs and must support many models and variants in their product portfolios. Efficiency, short lead-time, continuous technology development, and adaptability are essential for the competitive edge. A product platform approach has been a success for many companies to enable variety at low cost, however, it is not applicable for system suppliers. This work describes the result from a case study where a platform approach enabling a new way of structuring, publishing and managing design assets and processes was introduced at a company with the purpose to improve the ability to respond to changing requirements in the quotation process and the subsequent product development activities.
R&D workforce. Organizations are able to make effective decisions to develop exceptional R&D organizations although the patterns of implementation are...implementation of HPWP in Malaysian R&D organizations. It is...creative talents in R&D organizations. This paper describes the existing performance work practices (HPWP) as an HR strategy to nurture the quality of R&D workforce. Studies have suggested high...Multimedia University, Malaysia.

Multimedia University, Malaysia

Arnifa ASMAWI, Kok-Wai CHEW

Augmenting Malaysia’s innovation and R&D capabilities is a major national priority. At present, the level of R&D and innovation in Malaysia is not encouraging. Hence, there is a critical need to enhance the quality of R&D workforce. Studies have suggested high performance work practices (HPWP) as an HR strategy to nurture creative talents in R&D organizations. This paper describes the existing implementation of HPWP in Malaysian R&D organizations. It is reassuring to know that HPWP is already being implemented by these R&D organizations although the patterns of implementation are slightly different from one to another. By learning how HPWP works, organizations are able make effective decisions to develop exceptional R&D workforce.

IEEM17-P-0788
Reflective Learning in Engineering Education: A Case Study of Shell Eco-Marathon

Sune VON SOLMS, Hannelie NEL
University of Johannesburg, South Africa

Globally, universities are reinventing STEM education where traditional classroom methods are substituted or supplemented with practical learning methods such as problem-based learning and project-based learning. Another method, not often employed in STEM, is learning through reflection. This paper presents a case study where a group of engineering students participated in an international competition, the Shell Eco-Marathon, and partook in reflective learning before and after the event. The results indicate that students who learn through reflection value the inclusion of project-based learning in their curricula, which emphasizes the importance of this study for the future of engineering education.

IEEM17-P-0558
Implementation of High Performance Work Practices (HPWP) in R&D Organizations: Empirical Evidence from Malaysia

Amrita ASMAWI, Kok-Wai CHEW
Multimedia University, Malaysia

As the complexity of work tasks rises for maintenance workers in modern production facilities, new technologies will be required to support and integrate the service worker of tomorrow. This paper gives an insight into an ongoing research project examining the potential of state-of-the-art augmented reality smart glasses used as a component of assistant systems for workers performing maintenance tasks in an industry 4.0 context. A human centered design process is used to identify the needs of workers and to specify requirements for the assistant system being developed. Thereby, the maintenance of a CNC lathe is used as an example and assistant functions were developed for one specific maintenance task. The architecture of the assistant system proposed in this paper is based on an analysis of the work system including the tasks of the maintenance worker. Finally, the implementation of a first prototype, using state-of-the-art augmented reality smart glasses, is described.

IEEM17-P-0460
Design of an Assistant System for Industrial Maintenance Tasks and Implementation of a Prototype Using Augmented Reality

Ruben SCHLAGOWSKI, Claudia MEITINGER, Lukas MERKEL
1 University of Applied Sciences, Germany
2Composite and Processing Technology IGCV, Germany

As the complexity of work tasks rises for maintenance workers in modern production facilities, new technologies will be required to support and integrate the service worker of tomorrow. This paper gives an insight into an ongoing research project examining the potential of smart glasses used as a component of assistant systems for workers performing maintenance tasks in an industry 4.0 context. A human centered design process is used to identify the needs of workers and to specify requirements for the assistant system being developed. Thereby, the maintenance of a CNC lathe is used as an example and assistant functions were developed for one specific maintenance task. The architecture of the assistant system proposed in this paper is based on an analysis of the work system including the tasks of the maintenance worker. Finally, the implementation of a first prototype, using state-of-the-art augmented reality smart glasses, is described.

IEEM17-P-0459
A Soft Approach Towards Gaining Employability in IT Professionals

Richa SINGH DUBEY, Vijayshri TEWARI, Bharteerhri PANDIYA
Indian Institute of Information Technology Allahabad, India

IT industry is a knowledge based industry where human capital is considered as vital factor that enable organisation to gain competitive advantage and calls for necessity to develop workforce through enhanced employability. Thus employability links with the individual performance and satisfaction; organisation’s growth and economic well being of the nation. Though there are many factors that affect employability, in this paper we are discussing influence of soft skills on employability in IT professionals.
Developing Advanced Traffic Violation Detection System

Session: IEEM17-P-0397
Date: 11/12/2017
Time: 15:45 - 17:30
Room: MR330
Chairs: Feng Fat WONG, University of Macau, Karthik SANKARANARAYANAN, University of Ontario Institute of Technology

Fahad ALI1, Yuexiang JIANG1, Kashifullah KHAN2

University of Macau, Macau

This study aims to develop a system to instantly detect traffic condition using computer vision with RFID technology for obtaining vehicles data. The system detects the presence of vehicles and also calculates the detected objects. The method of background subtraction on motion objects detection is proposed. By taking samples from the objects, background models are being set and extracting foreground areas from background subtraction and reducing the shadow in the foreground. A threshold method is presented to divide standard to the image and improve the detection effect. The experiment results indicate that the performance of the background subtraction method is more stable on dynamic objects detection. This advanced method can contribute the smart traffic control and analysis for smart city development.

Feasibility Analysis of Renewable Based Hybrid Energy System for the Remote Community in Pakistan

Session: IEEM17-P-0637
Date: 11/12/2017
Time: 10:30 - 12:00
Room: MR330
Chairs: Feng Fat WONG, University of Macau, Karthik SANKARANARAYANAN, University of Ontario Institute of Technology

Fahad ALI1, Yuexiang JIANG1, Kashifullah KHAN2

1Zhejiang University China, China
2University of Science and Technology of China, China

phenomenon in Pakistan, and it is more severe in rural communities where load shedding ranges up to 18 hours a day. A conventional method of electricity generation is inadequate to meet the load demand. Pakistan is one of the best places in the world from the perspective of solar irradiance. The exploitable estimated potential of wind energy in Pakistan is also quite sufficient, i.e. 132,000 MW. The key object of the study is to utilize the renewable energy resources and produce electricity at lower cost. In this paper, we will present the heuristics algorithm to find the best path locations at the container terminal with an arbitrary configuration. From the computational results, our proposed approach can find better path location than the path location with same interval as the existed case, not only at irregular shape but also at rectangular shape.

An Integrated Customer-Manufacturer Optimization Model to Determine the Optimal Product Price and Quality Level Using Theory of Utility

Session: IEEM17-P-0397
Date: 11/12/2017
Time: 15:45 - 17:30
Room: MR330
Chairs: Feng Fat WONG, University of Macau, Karthik SANKARANARAYANAN, University of Ontario Institute of Technology

An integrated customer-manufacturer optimization model is considered. HOMER software is used for simulation, economic optimization, sensitivity analysis, optimal design, DG running period and the net electricity supplied by the grid.

Modelling and Simulation of Agricultural Production System Based on IoT Cultivated Fields Information

Session: IEEM17-P-0454
Date: 11/12/2017
Time: 10:30 - 12:00
Room: MR330
Chairs: Feng Fat WONG, University of Macau, Karthik SANKARANARAYANAN, University of Ontario Institute of Technology

Yusaku MATSUMOTO1, Hirobono HIBINO2, Nasuki KUBO2, Makoto KIMURA2, Yousuke MIYUKA1

1Tokyo University of Science, Japan
2HAYAKE Company Inc., Japan

A stable continuous supply of products is required to improve consumers’ quality of life; thus, the development of agricultural production systems has become critically important. In agriculture (cultivated fields), goods disposals or shortages can result from exceeding the consignment criteria owing to differences in the goods supplied and the amount in demand. In this research, we develop a numerical simulation based on cultivated field information derived from the Internet of Things to conduct an advanced business evaluation of the lack of stock and the crop loss due to uncertainty regarding the amount of produce harvested.

Reliability Analysis of Cyber-Physical Systems Considering Cyber-Attacks

Session: IEEM17-P-0926
Date: 11/12/2017
Time: 10:30 - 12:00
Room: MR330
Chairs: Feng Fat WONG, University of Macau, Karthik SANKARANARAYANAN, University of Ontario Institute of Technology

Zihui FANG1, Huadong MO2, Yong WANG2

1University of Science and Technology of China, China
2ETH Zurich, China

A general framework is proposed for cyber-physical system reliability modeling and evaluation considering some typical cyber attacks. The impacts of attacks from cyber space on physical space are analyzed, including the denial of service attack and deception attack. The cyber intrusion is modeled by a semi-Markov process, which decides the occurrence probability of cyber-attacks. The occurrence probability is related to the attacker level and defender level, therefore the cyber intrusion process is more practical and applicable for most attack situations. A case study on industrial heat exchanger system is provided to quantify the influences of cyber attacks on system performance and reliability. Some important conclusions are also drawn, which will be useful in designing resilient cyber-physical systems.
IEEM17-P-0812

The Effect of Uncertainty Avoidance on Lean Implementation: A Cross Cultural Empirical Study Involving Toyota

Nihal JAYAMAHA, Nigel GRIGG, Nisansala PALLAWALA
Massey University, New Zealand

This study tests hypothesized relationships between Uncertainty Avoidance (UA) and the elements of Toyota Way-People Development, Continuous Improvement, and Operational Results-in a cross cultural context. The study uses responses obtained from 2196 Toyota employees engaged in logistics, sales and marketing functions in 22 countries. The study is important because scholars question the generalizability of Japanese management philosophies (these philosophies evolved in high UA and collectivist cultures) across diverse national cultures. The study confirms that there is greater level of acceptance of People Development, Continuous Improvement, and Operational Results in high UA cultures (e.g. Greece, Belize) than in low UA cultures (e.g. Denmark, Iceland). However, the effects of UA (mean score differences) were found to be practically small, suggesting good transferability of TW principles across international boundaries.

IEEM17-P-0429

Inventory Control Model of a 4-Echelon Production-Distribution System

Moumita TEWARY,, Debabrata DAS, Nirmal Baran HUI
1National Institute of Technology Durgapur, India
2Asansol Engineering College, India

Present paper proposes a reorder interval-based mathematical model for a four-echelon inventory system of deterministic demand. It has four different echelons and 10 installations. The problem is posed as an optimization problem to determine the minimum inventory cost subject to different constraints. The model resulted in a mixed integer non-linear programming problem with some constraints. The optimal solution with lowest supply chain cost is obtained using an exhaustive search method. The best solution and corresponding variables are noted. Further reorder intervals and lot-sizes of all installations are also determined in the paper.

IEEM17-P-0831

Reference Process for the Continuous Design of Production Networks

Günther SCHUH, Jan-Philipp PROTE, Stefan DANY
RWTH Aachen University, Germany

Over the past decades manufacturing companies have developed complex production networks. The design of these networks is a major challenge. Although decisions in the context of production network design have a long-term impact on manufacturing companies, there is no continuous and integrated planning of the production network in many cases. By a discussion of relevant approaches for an integrated design of production networks exiting research gaps are identified. In order to support companies in this complex planning task the aim of this paper is to present a reference process for the continuous design of production networks.

IEEM17-P-0532

Additive Manufacturing Impact for Supply Chain – Two Cases

Sobolev IVAN, Yong YIN
Doshisha University, Japan

The purpose of this research devoted to the problem of spare parts management in automotive industry. The high costs for inventory and transportation and also increased lead time arise the question to change the current scheme with implementing of Additive Manufacturing. 3D Printing as a part of Additive Manufacturing is innovative method of production of final details. It is also expected to be a disruptive for the current spare parts supply chain in automotive sphere. The biggest obstacle in implementing the 3D printers remains the high price of the professional equipment. Within this paper, we will create a simple mathematical model to understand the feasibility of 3DP implementation on distributor site for printing the plastic spare parts. The proposed model of value analyzes would be tested on a cross case study with the real data from two automotive companies.

IEEM17-P-0171

Coordination in Supply Chain Finance Under CVaR Criteria

Nina YAN, Ye LIU, Chongqing LIU, Hongyan DAI
Central University of Finance and Economics, China

In this paper, a supply chain finance (SCF) system incorporating a bank, a manufacturer and a capital-constrained retailer is constructed. Considering the retailer’s risk aversion and the role of buyback contract in coordinating operational and financial decisions, we analyze each participant’s optimal strategies. Based on Stackelberg equilibrium analysis, the results reveal that super-coordination can be achieved with buyback contract.

IEEM17-P-0434

Continuous Improvement of Complex Process Flows by Means of Stream as the “Standardized Cross-Enterprise Value Stream Management Method”

Christof OBERHAUSEN, Meyesam MINOUFEK, Peter PLAPPER
University of Luxembourg, Luxembourg

In numerous sectors and industries worldwide, there is a trend towards an intercompany and often international division of value creation and related work tasks. To overcome the challenges of complex cross-enterprise supply chain networks, innovative approaches to visualize, assess and enhance value streams are sought. The Stream method, which is described in this paper, enables a comprehensive analysis, design and planning of cross-company product and information flows on different levels of value stream detail. At the same time, the entire methodology is based on a common understanding of key symbols, parameters and calculation procedures. In addition, the use of the developed Stream method and the associated model in a case study proves its practical applicability in an industrial setting. In further validation projects, the transfer of the “Standardized cross-enterprise Value Stream Management Method” to other industry sectors is envisaged to continuously improve energy, trade or service processes.

IEEM17-P-0763

Relationship Between Stringent Customer Environmental Requirements and Environmental Performance in Sustainable Supply Chain

Md Reazul Hasan SHUMON, Shams RAHMAN, Kamruddin AHSAN
RMIT University, Australia

The recent move towards environmental sustainability around the world forced firms to adopt environmentally sustainable practice in their operations along the supply chain. The objective of this research is to critically comprehend and establish the concept of ‘stringent customer environmental requirements’ and to explore its impact on the environmental performance of suppliers in garment supply chain. Considering the retailer’s risk aversion and the role of buyback contract in coordinating operational and financial decisions, we analyze each participant’s optimal strategies. Based on Stackelberg equilibrium analysis, the results reveal that super-coordination can be achieved with buyback contract.

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Allocation of College Students to Business Majors with the Aid of a Linear Programming Model
Ahmed EL-BOURI, Asma AL-ZAHDI
Sultan Qaboos University, Oman

The problem of assigning business students to program majors in a Middle Eastern College is considered in this study. An important characteristic that usually appears in this problem is a high variation in the demand for different programs. The allocation method currently used by the College is evaluated, in terms of overall satisfactory of student program preferences, by comparison with optimal allocations obtained from a linear programming formulation. The evaluation demonstrates the current method to be effective in assigning high-GPA students to their first choice programs, yet mediocre in overall satisfaction of the student preferences. Consequently, a hybrid approach that combines the current method with a linear programming model is proposed and analyzed. The results show that the hybridized method provides a solution that successfully integrates the strengths of the LP solution with the currently used method.

Procedures to Accommodate System Fluctuations that Result in Buffer Compromised Systems Governed by the Theory of Constraints
Jivashan REDDY1, Amesh TELUKDARIAF
1Aerosud Aviation, South Africa
2University of Johannesburg, South Africa

Decision making support in a stochastic environment represents a challenging aspect for any manufacturing organisation. Disturbances in manufacturing supply chains shift operational risks as a function of time. The development of Industry 4.0 related technologies enables manufacturers to more efficiently mitigate operational risks and improve end to end efficiencies. The current research investigates technologies and concepts in the emerging blueprint of 4.0 through use of agent based simulation modelling and analysis.

Optimization of Decision Support System Based on Three-Stage Threat Evaluation and Resource Management
Afshin NASSEEM, Shoaib Ahmed KHAN, Asad Waqar MALIK
National University of Sciences and Technology (NUST), Pakistan

This paper demonstrates a novel decision support system for threat evaluation and weapon assignment (TEWA). The knowledge-based system is built on threat perception, optimal schedules and assignments of weapons available for the threat neutralization. Mostly, in real warfare circumstances, the quantity of threats targeting vulnerable assets/points (VA/VPs) is large in comparison with the deployed resources. Therefore, performing threat analysis and weapon assignment is critical in real-time scenarios. In this research work, an integrated unique technique is proposed for automatic TEWA technique for effective threat neutralization. Our results show that the proposed approach significantly improves on traditional manual system. In previous studies, threats are categorized based on the type assumptions and weapons are assigned accordingly. In this paper, an efficient TEWA-DS5 is presented for (1) threat perception and optimum (2) multiple threat scheduling problem. This process is comprised of three stages. At first stage, threat is perceived. At the second stage, threats are evaluated. At third stage, weapons are scheduled and assigned optimally.

Objective Measurement for Attractiveness of Sightseeing Spots under Minimization of Maximum Error among Pairwise Comparisons
Takashi HASUIKE1, Hideki KATAGIRE, Hiroshi TSUDA1
1Waseda University, Japan
2Keio University, Japan
3Doshisha University, Japan

This paper proposes a minimax problem to determine an attractiveness of each sightseeing spot based on pairwise comparison by the tourist. A tourist can subjectively and qualitatively compare two sightseeing spots, and the ranking of candidate sightseeing spots can be obtained from the standard AHP. However, it is almost impossible to set the numerical values of attractiveness of each sightseeing spot strictly. Furthermore, it is also difficult to evaluate the attractiveness objectively according to the tourist’s feelings. On the other hand, by using sightseeing plans which include some popular sightseeing spots, a tourist can simultaneously do a qualitative and quantitative evaluation of multiple sightseeing spots. The main step of the proposed approach is to propose a mathematical programming problem to minimize the maximum error from the tourist’s pairwise comparison and to determine the attractiveness of sightseeing spots objectively. Furthermore, the synergy effect among sightseeing spots also is considered.

A Further Improved Support Vector Machine Model Along with Particle Swarm Optimization for Face Orientations Recognition Based on Eigeneyes by Using Hybrid Kernel
Yonglu DING1
1Shandong University of Science and Technology, China
2State Key Laboratory Breeding Base for Mine Disaster Prevention and Control, China

The learning vector quantization (LVQ), back propagation neural network (BPNN), and support vector machine (SVM) models were established to recognize face orientations. A precision function (P) was proposed to compute each model’s precision with confusion matrix. The abovementioned models were improved by intelligent algorithms to become LVQ with K-fold cross validation (CV-LVQ) model, BPNN with GA (GA-BPNN) model, and SVM with particle swarm optimization (PSO-SVM) model. The kernel function in the PSO-SVM model was assumed to RBF kernel which had relatively weaker learning ability. Hence the PSO-SVM model was further improved with a hybrid kernel that was fused with the generalization performance of global kernel and the learning ability of local kernel. The further improved PSO-SVM (PSO-SVM) model possessed a 1.63 to 9.25 percent higher precision than PSO-SVM model. There were no obvious differences in the average elapsed time (AET) between IPSO-SVM model and PSO-SVM model. The results show that IPSO-SVM model not only reaches an outstanding precision of 98.14%, but also was practicable for the recognition of face orientations.

Fuzzy AHP Method for Prioritizing Logistics Barriers of Exporting Eggs
Pornwasi SIRSAWAT, Narat HASACHOO, Phattaraporn KALAYA
 Mae Fah Luang University, Thailand

This research aims to evaluate logistics barriers of exporting eggs from Thailand to the Myanmar market in which in-depth interviews and unstructured questionnaires were used for collecting data from six logistics experts related to the eggs research field. The results of this study show interesting situations and logistics barriers are found, which include five main barriers: customer barriers; exporter barriers; cost barriers; legal barriers; transportation and infrastructure barriers. To prioritize logistics barriers for exporting eggs in the Myanmar market. Hence, the proposed results from this study will help to understand the real situation of logistics barriers for exporting eggs to the Myanmar market and it could be a guideline for the exporters and other related companies who need to export eggs; it will also be useful information for the researcher who needs to study other related issues in the future.
An Analytical Study on Horizontally Collaborative Transportation Strategies
Long ZHENG, K. G. BAE
University of Louisville, United States

Companies are continuously searching for competitive advantages. Horizontal collaborative transportation among companies brings feasible benefits in distributing products to the market. However, each company's specific cost structure has an influence on the decisions concerning whether horizontal collaboration (HC) strategy should be adopted. This is an analytical study of conditions for adopting the HC strategy in competitive circumstances. The study investigates applying different strategy scopes for balancing costs and optimizing profits.

Implementation of a Role-Based Decision Support System in an Integrated Petrochemical Enterprise
Eyad BUHULAIGA, Arnesh TELUKDARIÉ
University of Johannesburg, South Africa

Delivering business optimization via systems requires integration of the enterprise and manufacturing systems. Manufacturing Operation Management (MOM) Systems bridge the gap between plant systems and Enterprise Resources Planning Systems. Traditional MOM consists of a set of standalone applications that are living in silos with minimum interaction. This causes functional replication and overlap among the MOM applications, which usually lead to minimizing the full utilization of these applications. This paper describes the philosophy of the Role-Based Decision Support System (RB-DSS). This research details the process of knowledge modeling, which is based on the ISA-95 functional decomposition, extending ISA-95 into the implementation of workflow applications to execute and coordinate operations tasks and streamline plant operations with ever-changing supply chain processes. The last aspect of this research focuses on demonstrating the benefits of applying the RB-DSS together with changes to traditional MOM operations by providing standard role-based execution templates.
Time Dynamic Mission Reliability Modeling of Multi-State Manufacturing Systems Based on Universal Generating Function

Rongjun GAO1, Changzhao GU1, Yihai HE2
1PLA91872, China
2Beihang University, China
Existing studies on reliability modeling of manufacturing systems pay more attention to the basic reliability of component, while ignoring the output and input characteristics of the manufacturing system, which cannot provide the prerequisite to implement condition-based maintenance of complex manufacturing system from a system-based view. In order to resolve this dilemma, a novel method of time dynamic mission reliability modeling of multi-state manufacturing system is proposed in this paper. First, the connotation of mission reliability of the manufacturing system is given from the viewpoint of system engineering. Second, the equipment performance is represented based on the theory of multi-state. Third, the mission reliability modeling method based on the combination of performance degradation process and universal generating function (UGF) is proposed. Finally, a case study is conducted to illustrate the effectiveness of the proposed method.

Implementation of Lean Principles for Performance Improvement: Use of VSM+WID for Waste Identification

Jose DINIS-CARVALHO1, R.M. Chandima RATNAAYAKE2, Luis FERRETE1
1University of Minho, Portugal
2University of Stavanger, Norway
This article demonstrates the implementation of lean principles for performance improvement in a manufacturing firm. Value stream mapping and waste identification diagrams (VSM+WID) are integrated to assess the level of currently existing waste and the overall current status of the manufacturing flow. The VSM+WID enables an increase in the awareness of relative waste distribution among different processes in the selected case study manufacturing unit. This manuscript demonstrates how to use VSM+WID to understand the current status of the manufacturing flow related challenges such as overproduction, work-in-process, inefficient use of man-hours (e.g. unbalanced work distribution), etc. It also demonstrates the effectiveness of visualization of the performance gap between the current and future state. The aforementioned type of performance assessment enables effective identification of waste present in a manufacturing flow in order for future improvement initiatives to be taken.

Challenges and Opportunities in Implementing Engineering Systems Thinking in Design, Manufacturing and Process Industries in Zimbabwe

Wilson R. NYEMBA1, Charles MBOHWA2
1University of Johannesburg, South Africa
2University of Zimbabwe, Zimbabwe
Engineering and manufacturing companies in industrializing countries such as Zimbabwe, largely employ traditional methods as well as conventional machine tools. Research carried out at five companies in Zimbabwe specializing in different business operations, similarly revealed that although such methods and tools are still applicable and productive, the processes are time consuming and the conventional machines often break down thereby delaying production. However, the research, which was conducted through interviews, direct observations as well as surveys, also revealed disconnections in 3 aspects of company policies, techniques employed and continuous professional development training. The research focused on establishing the challenges faced by the companies in implementing holistic approaches encompassing and integrating these 3 aspects. Recommendations were made for turning the various challenges into opportunities through adopting engineering systems thinking for integrating these aspects in order to improve capacity utilization, productivity and efficiency in the various companies.
Towards Just-in-Time (JIT) Production System Through Enhancing Part Preparation Process

Mohd Norzaimi CHE ANI¹, Shahrul KAMARUDDIN², Abdul Azid ISHAK²
¹Universiti Kuala Lumpur, Malaysia
²Universiti Teknologi Petronas, Malaysia

In this paper the improvement activity in manufacturing plant has been conducted by focusing outside of production process which is part preparation activity in warehouse area. The Plan-Do-Check-Act (PDCA) cycle has been adopted to identify, analyze, verify and implement the improvement activity with the purpose of creating better management of the part preparation activity. To ensure the successful adaptation of PDCA cycle, a small group consisting of cross-functional team members has been formed to analyze and solve the issue. The ultimate objective is to ensure the process improvement will optimize the efficiency of production systems and achieving the Just-in-Time (JIT) concept. Based on the investigation and implementation of the case study industry, the result shows a successful adaptation of PDCA cycle outside of the production process. The waiting time of the production due to misaligned time of the pre-preparation part had been identified as a root cause and successfully eliminated.

Product Design for Mass Individualisation for Industrial Application

Ravi K. SIKHWAL, Peter R. N. CHILDS
Imperial College London, United Kingdom

In the last few years, a demand for renewed product personalisation to satisfy the exact need of the customers has been observed in some markets. As opposed to customisation, which put emphasis on the satisfaction of explicit needs of a defined market segment, individualisation aims at satisfying the specific needs of a customer. Product design for Mass Individualisation (MI) is a new product design paradigm that comprises an open hardware platform and multiple modules that are integrated with the platform, as per end-users’ choice. This paper identifies key areas and components which need to be focused to realise this approach and convert it into an industrial practice by an explorative study of existing product design and customisation approaches. A questionnaire survey has been conducted and results are presented for the industrial implication and insights on this approach. The findings clearly show that MI provides most individualised and technologically advanced product.
IIEEE17-P-0002
Quantifying Leaness Combining Value Stream Mapping with a Data Envelopment Analysis Based Method - A Case Study at a Swedish Logistics Company
Victoria HJALMARSSON, Leif OLSSON
Mid Sweden University, Sweden

By describing companies through their processes it is possible to get a well-established overall understanding of the company. This case study is based on the daily operations of a small logistics company specialized in international transportation. We perform Value Stream Mapping in order to propose improvements leading to reduced processing time. Afterwards a Data Envelopment Analysis based method is used to calculate the leanness score of the current system and estimate how much the leanness can increase by the proposed improvements. Results show that waste produced by bad workplace layout and over-processing can be eliminated. A suggested solution is to introduce standardization processes and to invest in technical instruments in order to automate production. According to this study the business is 45 percent lean at present and could with simple improvements soon become 61 percent lean and finally reach an ideal state at 100 percent leanness if production is automated.

IIEEE17-P-0582
An Integration Method of MFCA, Dynamic Programming, and Multiple Criteria Decision Making in Operations Improvement: A Case Study
Chompoonoot KASEMSET, Chawis BOONMEE
1Chiang Mai University, Thailand
2Munoran Institute of Technology, Japan

This study proposed an integrated method of three concepts: MFCA, DP, and MCDM in operations improvement. The proposed procedure starts from performing MFCA calculation to evaluate material losses along the current production line and identify operations that need to be improved. The cost of positive product can be calculated for each solution. This value was subsequently used in DP with two additional criteria as the amount of investment and the score of difficulty in implementation. Three criteria were transformed to single objective in DP for finding the optimal solution. To demonstrate the application of the proposed method, one small textile company was selected as a case study. The results showed that the optimal solution was to implement only two from three solutions that can help the company to increase the cost of positive product from 84.26% to 94.73% with less investment and score of the difficulty in implementation.

IIEEE17-P-0154
Quality Attributes of Robotic Vehicles and Their Market Potential
Bjoern FRANK, Shane J. SCHWANEVELD
1Sophia University, Japan
2Weber State University, United States

The development of robotic, self-driving vehicles is set to revolutionize the automotive industry. While automotive manufacturers, automotive suppliers, and IT firms are pushing the technical development of this new technology, there is a gap of knowledge in the literature on the customer perceptions of quality attributes of this new technology and on how these quality attributes influence purchase intentions positively or negatively. Therefore, this study aims to analyze what customers perceive as functional, economic, hedonic, and symbolic benefits and drawbacks of robotic vehicles and how these benefits and drawbacks influence customer intentions to purchase and recommend robotic vehicles. Based on cross-national customer data, this study identifies what drives customer intentions to purchase and recommend both fully autonomous and partially autonomous robotic vehicles for different legal scenarios. The results are relevant for managers, policy makers, and researchers interested in improving customer orientation in the development of autonomous driving technology.

IIEEE17-P-0438
Application of Quality Function Deployment for Halal Food Products
Iwan VANANY, Ghoifar Albah MAARIF, Adi SOEPRIJANTO, Bilqis AMALIAH
Institut Teknologi Sepuluh Nopember, Indonesia

The objective of this paper is to develop the tool of halal food control by applying Quality Function Deployment (QFD). The modification of House of Quality (HOQ) matrix in QFD model are necessary to be conducted in order to fit the proposed QFD model with halal food control in the company. The proposed QFD model is composed of three HOQ matrices. The matrix 2 represents the relationship between attributes of halal assurance system and product process. The matrix 2 represent the relationship between attributes of halal assurance system and the halal critical. Finally, matrix 3 explains the relationship between product process and halal critical. The case study in chicken meat processing company is used to test the applicability and how to work the proposed QFD model for halal food control.

IIEEE17-P-0432
Implementation of Shainin’s DOE: A Case of Plastic Injection Molding Process
Tossapol KIATCHAROENPOL, T. VICHIRAPRASERT
King Mongkut’s Institute of Technology Ladkrabang, Thailand

Shainin’s Variable Search DOE is one of practical experimental designs which is simply used in industry fields. The less numbers of experiments and basic calculation are the advantage over the classical DOE. In this work, Shainin’s method is used to study factors effecting displacement of plastic work-piece in Injection model process. The implementation steps of experiments are provided in detail. After 22 experiments were carried out, it is found that Packing time (E), Cooling time (G) and interaction of EG are significant factors. The fraction factorial, 27-3, is also employed as a comparison to Shainin’s method. The results of Shainin’s method in-line with those of fractional factorial. It imply the usefulness of this practical DOE.

IIEEE17-P-0207
Developing a Total Quality Management Model for Healthcare Industry: An Indonesian Hospital Case Study
Jonny, Kriswanto
Bina Nusantara University, Indonesia

This research is aimed to develop a Total Quality Management (TQM) Model for Healthcare Industry. In order to achieve this objective, several previous studies have been reviewed in order to identify eight best practices of TQM implementation in healthcare industry such as Top Management and Commitment (TMC), Teamwork and Participation (TWP), Process Management (PM), Customer Focus and Satisfaction (CFS), Resource Management (RM), Organizational Behavior and Culture (OBC), Continuous Improvement (CI), Training and Education (TE). In turn, these best practices are modeled as conceptual model and tested in order to evaluate its fitness to healthcare industry in Indonesia. A SEM (Structural Equation Modeling) - LISREL software was used to serve this objective. After administering a purposive questionnaire to several related stakeholders of an Indonesian Hospital, the LISREL software was run to see whether the model is fit or not. As a result, because the p-value 0.23 is larger than required 0.05 then the model can be confirmed to be fit.

IIEEE17-P-0177
State Space Modeling of Multi-Scale Variation Propagation in Machining Process Using Matrix Model
Kun WANG, Yaxiang YIN, Shichang DU, Lifeng XI, Tangbin XIA
Shanghai Jiao Tong University, China

Multi-scale variation quality control of mechanical products has become one of research hotspots, but little research constructs variation propagation model under multi-scale error. This paper proposes an extended stream of variation (SoV) model considering geometric error by matrix model representation. New constraint conditions are introduced into the model for Monte Carlo calculation. To verify the accuracy and applicability of this model, a case study simplified from a machining process of automotive engine head is provided. The results indicate that this method has a great engineering value in machining process.
Developing Community-Based Engagement in Smart Cities: A Design-Computational Thinking Approach
Chien-Sing LEE, K. Daniel WONG
1Sunway University, Malaysia
2Daniel Wireless Software Pte. Ltd, Singapore
Smart Cities development has progressed rapidly with Internet of Things (IoT), ambient intelligence and increasingly, crowdsourcing. Engaging the community thus plays a key role in developing meaningful communal growth along with other stakeholders. This paper briefly presents a pilot study on developing computational perspectives for community-based engagement and innovations in Smart Cities for the young and thereafter, to explore possibilities of engaging seniors in self and community development, and the young and old in community-based engagement and possibly in the future, the development of viable values-based innovations in information systems.

Application of Queuing Theory in Service Design
Dinh Son NGUYEN
The University of Danang, Viet Nam
The requirements of clients are more complex with higher expectations and tightened schedule due to rapid development of science and technology. In the context of concurrent and global economy, satisfaction of customers' requirements is an important key in the engineering product-service design process. One of the requirements from customers is to reduce the costs, including cost of development, material costs and conversion costs. Thus, cost reduction has become an important challenge in product-service design while the satisfaction of the customers' requirements is still ensured. An approach based on the queuing theory is proposed in this paper to solve these problems. A mathematical model analysis to determine the important parameters as the mean waiting time, number of service platforms, probability of customer waiting in queue is presented in the paper. The service designer can use them to find the optimized solution for the designed service.

Examining the Application of Standards for Information Technology Service Management Practice: An Empirical Study
Gregory CHIN, Younes BENSILMANE, Zijiang YANG
York University, Canada
This paper examines the application of Information Technology Service Management (ITSM) standards and provides an integrative view on how ITSM is executed in practice. Content analysis of 150 relevant job postings is used to assess the demand for ITSM standards, identify and rank the ITSM standards applied in organizations and identify the ITSM processes commonly implemented. Findings show a high adoption rate for ITSM standards and a large preference for ITIL. Findings also show that most commonly implemented processes are those that improve compliance with service level agreements and customer satisfaction. Details for such findings and their implication are discussed.

Library Facility Layout Design for Digital Native Generation
Felecia, Siana HALIM, D. WULANDARI
Petra Christian University, Indonesia
Digital native generation grows up with information technology attached to their daily life. This advantage changes their way to find information, only with a click they have all the answer on their gadget. This situation effect library that used to be the source of information, numbers of library visit has been reduced significantly in the last century. Therefore library needs basic changes to accommodate digital native generation. Library needs to facilitate their need by repositioning itself as a community hub, a place to meet, interact, learn and collaborate. Anish I and Arish Ibrahim (2014), propose to use Systematic Layout Planning (SLP) to design library facility layout. The purpose is to maximize the satisfaction of employee, management, and library users. This paper gives the framework for systematic layout planning but has not applied it using computer simulation tool such as CRAFT. Research is conducted to four universities owned libraries in Surabaya, Indonesia. Two from state universities and another two from private universities. A heuristic improvement algorithm CRAFT (Computerised Relative Allocation of Facilities Technique) will be applied to re-layout library facilities. Adjustment to each facility will also be done and as the result, new library facility layout will be more suitable to meet digital native generation needs. The implication of this adjustment is additional investment in new facilities and repositioning current layout.

A Study on Entrepreneurial Education Regarding College Students' Creative Tendency, Entrepreneurship Self-Efficacy and Entrepreneurial Motivation
Feng-Ming SU1, Jen-Chia CHANG2, Hsiao HSI-CHI1, Sheng-Chu SU1
1Hua Hao University of Technology, Taiwan
2National Taipei University of Technology, Taiwan
The goal of this study is to explore the differences in creative tendency, CT, entrepreneurial self-efficacy, ESE, and entrepreneurial motivation, EM after college students receive entrepreneurial education. This study explores whether or not college students' CT, ESE, and EM were enhanced after taking entrepreneurial education courses, with the “creative tendency scale”, “entrepreneurial self-efficacy scale”, and “entrepreneurial motivation scale” as research instrument. According to the research results, the following conclusions are drawn: 1. The students' pre-entrepreneurship training intentions decreased after receiving entrepreneurial education; 2. The students' entrepreneur competition intentions decreased after receiving entrepreneurial education; 3. The students' risk-taking increased after receiving entrepreneurial education; 4. Entrepreneurial education significantly affects students' ESE, but it has no significant impact on CT and EM.

Performance Assessment System Development Based on Performance Prism in Social Services
Rui ESTRADA, Sergio D. SOUSA, Isabel LOPES
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This paper aims to study the practical application of Performance Prism in the social services sector. To achieve this, a performance assessment system is developed in a Portuguese private institution of social solidarity.

Establishing Suitable Process Improvement Methodologies for Optimizing Servicing Operations in the Banking Industries
Olasumbo MAKINDE, Thomas MUNYAI, Boitumelo RAMATSETSE
Tshwane University of Technology, South Africa
The banking industry plays a vital role in the safe-keeping and delivery of various financial transactions required by the customers. Servicing problems such as queues and other various forms of customer complaints are the major threats which limit the efficiency of service operations in the banking industry. In light of this, the aim of this paper is to propose suitable process improvement methodologies capable of alleviating these complaints in the banking industries. To achieve this, heuristic searching and benchmarking of suitable process improvement tools and other strategies from the literature desk was explored. The results of the heuristic benchmarking exercise revealed that 5Ys, Fishbone Diagram, Value Stream Mapping, Line Balancing, workshops/training, flexible and reconfigurable service operation systems, modular and flexible banking system layout and queuing theory model are the strategies capable of reducing or alleviating the common customer complaints that are rampant in the banking industry.
IEEM17-P-0200
Modelling Water Distribution Network Failures and Deterioration
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2Mendel University in Brno, Czech Republic
3Renzo University of Technology, Poland

In this article we deal with field data modelling. The data have been recorded during the operation of a drinking water distribution system. Numerous records about water distribution network failures are available. They contain failures during single months in the period of approximately 15 years. Our effort is to observe the failure rate of a water pipeline distribution mains development. To do so, two approaches are used. One is based on modelling the system behaviour when applying the Markov chain with a discrete parameter, and the other one applies a state space model. The article contains not only the description and the design of the behaviour model of water mains, but also the prediction of the water mains behaviour and state in the following period.

IEEM17-P-0670
OEE Improvement of Thermoforming Machines Through Application of TPM at Tibaldi Australasia
Vickram CHUNDOHO; Gopinath CHATTOPADHYAY, Indra GUNAWAN; Youssef IBRAHIM
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2The University of Adelaide, Australia

Overall Equipment Effectiveness (OEE) evaluates quantitatively how effectively a manufacturing operation is utilised. Total Productive Maintenance (TPM) was considered by Tibaldi, a leading food manufacturer in Australia for achieving OEE. This research project has identified performance gaps, developed plan and implemented it in Thermoforming area of the business. The developed methodology helped Tibaldi in improving productivity and quality through TPM involving machines, equipment, processes, and employees. This paper demonstrates how this can be achieved by reducing lead time and establishing lean environment. Productivity improvement through the devised methodology led to further enhancement of competitiveness of the organisation for domestic and international markets of processed food manufactured by Tibaldi Australia. Lessons learned from application of TPM in Thermoforming, a key asset area, is rolled out to other sections of the plant and results from this pilot study are presented in this paper.

IEEM17-P-0529
Birnbaum Importance Measure of Network Based on C-Spectrum Under Saturated Poisson Distribution
Yongjun DU, Shubin SI, Hengyi GAO, Zhiqiang CAI
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Importance measures usually provide numerical indicator to decide which component is more important for network reliability improvement or more critical for network failure. The concept of C-spectrum is a useful tool to implement the importance measures for networks, which solely depends on network structure. In this paper, we analyze a network that consists of n components (edges). Under the condition that the distribution of the number of failed edges is given, the properties of traditional Birnbaum importance measure (BIM) are generalized and investigated. First, we derive a formula for BIM based on C-spectrum and establish a sufficient and necessary condition for comparing two edges according to their BIMs. Secondly, under the special case where the number of failed edges follows a saturated Poisson distribution with intensity λ, for enough small λ the BIM ranking is structural ranking, i.e., depending solely on the network structure through the C-spectrum. Finally, an example is presented to explain how we can rank edges according to their BIMs.

IEEM17-P-0468
Reliability Analysis of Rectification on Electromagnetic Compatibility Test
Dan LI, Wei DANG, Li SUN, Ye TIAN, Jiaqi FENG
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Electromagnetic compatibility is a branch of reliability discipline. In this paper, taking the EMC test problem of the integrated product as an example, rectification measures and its reliability issues are the core content. The relevant issues involve the circuit principle, reliability impact factor, improvement on rectification analysis. Finally, a comprehensive consideration on EMC in reliability design is put forward by recommendations of the EMC rectification.

IEEM17-P-0193
Mandeep Singh PAHWAA, Anisur RAHMAN
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The threat of the changing climate conditions has pushed the world’s interest in the renewable energy systems. Solar energy is considered as an ideal renewable energy since it is considered as more cleaner and sustainable sources of energy. However, higher capital cost of installation of ‘off’ grid solar photovoltaic (PV) system and lack of perception of system reliability are the major drawbacks of the solar systems which can also have a negative effect on the manufacturer’s reputation and in some cases, on the technology. Hence the reliability estimation of the solar PV system becomes extremely important. The aim of this research paper is to design and estimate the reliability of an off grid solar PV system. The greatest challenge for the PV system reliability estimation is the changing input to the system which is solar radiation. This research study designs a solar PV system for a house located South east Queensland (Australia) and later estimates the reliability of this designed system. The study used both mathematical and software tools while designing and reliability estimation of the off grid solar PV system. The result of this research can be used to model any other Off grid solar PV system's reliability and availability with some modifications based on climatic factors.

IEEM17-P-0201
Modelling of a Transport Belt Degradation Using State Space Model
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In this article we deal with modelling diagnostic data. They are the data measured during the operation of a conveyor belt. To be specific, we observe how the distances between measuring points change in time. The development of the distance between these points reflects the process of degradation at the point where the belt is connected with the other part. When the distance reaches its critical value, there is a threat of conveyor belt break leading to serious consequences. The modelling of belt degradation is performed with the Kalman filter applying the Local Linear Model (LLM).

IEEM17-P-0533
Ant Colony Optimization for Component Assignment Problems in Circular Consecutive-k-out-of-n Systems
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The Circular Consecutive-k-out-of-n (Cir/Con/k/n) system consists of n components arranged in a circular sequence and each component has different reliability. The purpose of optimization is to obtain an optimal assignment which can make the Cir/Con/k/n system most reliable. As the number of components n increases, the computation time for the optimization of Cir/Con/k/n system will increase considerably. In this paper, we propose applying the Ant Colony Optimization (ACO) algorithm to obtain quasi optimal assignments for such problems. First of all, we describe the basic principles and the operation procedures of ACO through pseudo code. After that, a large number of simulation experiments on different types of systems and components are carried out to verify the effectiveness of the ACO. The results of simulation experiments demonstrate the advantage of ACO in the optimization of Cir/Con/k/n system.
In recent times, many organizations have been implementing maintenance management but they have been failing in their attempts to get adequate success. The aim of this study is to find out benefits of modern maintenance management (MMM) over traditional maintenance management (TMM) which leads to the development of World-Class Modern Maintenance Systems (WCMMS). Implementing modern maintenance management needs resources and other operational changes. Therefore, deciding about its implementation is major task for organizations. To solve this critical situation, the authors used Analytic Hierarchy Process (AHP). By using this approach, global desirability index of modern and traditional maintenance management have been calculated for justification of study.
Multi-Objective Stable Matching with Ties
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3Indian Institute of Technology, Bombay, India

Stable Matching (SM) has received a lot of attention from researchers due to its useful applications in practice; Gale and Shapley were the first to propose a polynomial-time algorithm to find an SM solution, for matching with strict preferences. However, their algorithm often produces extreme stable solutions, favouring either men or women. In practice, the real-life problems have multiple objectives (equitable and welfare) and preferences are not strict, consequently ties occur. With the inclusion of ties and objectives, the problem becomes NP-hard. A few researchers proposed local search and evolutionary algorithms to solve multi-objective SM problem with ties, but these methods were not scalable. In this paper, we propose an efficient Goal Programming and Repair Heuristics based approach to solve this problem. On comparing with other related works, our approach shows significant improvement in respective objectives (equity and welfare). This approach with slight modification can be proved useful for solving other hard variants of the SM problem.

Key Performance Indicators for Manufacturing Operations
Management in the Process Industry
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The international standard ISO 22400 has defined a set of Key Performance Indicators (KPIs) to evaluate the performance of manufacturing operation. However, the defined KPIs seem to be inspired from the discrete production context, and hence do not automatically fit the process industry context. The process industry is defined as the industry in which the raw material undergoes conversion during a continuous process in order to become finished products. To make the defined KPIs more suitable for evaluating the operational performance in process industry, this paper analyzes the different characteristics of process industry and discrete industry, and proposes a new framework for organizing KPIs in process industry. Some modifications are discussed to make the proposed ISO 22400 KPIs fit to the process industry. Such a study can provide useful ideas for manufacturing engineers and decision-makers to define and measure suitable KPIs for performance evaluation in process industry.

Supply Chain Coordination and Revenue-Sharing Contract with Backlogs for a Perishable Product
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We consider a supply chain system involved in a perishable product with a fixed lifetime. The retailer is using a periodical reviewed (s, S) policy to manage the inventory and sell the products with backlogs. The supplier and the retailer coordinate the system using a revenue-sharing contract in order to improve the channel performance and maximize the total profit of the system. We show that coordination between supplier and retailer with revenue-sharing contract is possible to improve the performance of the system. Considering the risk of product expiration, the optimal coordination contract is different for system selling perishable product compared with normal long lifetime product.

A Capacitated Location-Routing Problem with Customer Satisfaction Under Facility Disruption
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University of Tehran, Iran

This paper presents a mixed-integer programming model for a capacitated location-routing problem with customer satisfaction under disruption risk. The aim of this problem is to find the location of medical service centers (MSCs) and the best route of vehicles to serve customers. To solve the problem, a hybrid NSGA-II algorithm is proposed and the related results are compared with the traditional NSGA-II as a well-known evolutionary algorithm. The Taguchi method is used to tune the best values of parameters to run the algorithms. The computational results represent that the hybrid NSGA-II has a better performance than the NSGA-II.

Time-Varying Hyperparameter Strategies for Radial Basis Function Surrogate-Based Global Optimization Algorithm
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Radial Basis Function (RBF) surrogate-based global optimization has been shown to be efficient for complex problems with computationally expensive and high-dimensional functions. Based on the DYnamic COordinate search using Response Surface models (DYCORS) algorithm framework, this paper proposes two Time-Varying Hyperparameter Dynamic COordinate search using Response Surface models (TVDYCORS) strategies to accelerate RBF surrogate-based optimization algorithms, which include a time-varying perturbation strategy and a time-varying weight pattern strategy. The TV-DYCORS algorithm is evaluated by a 124-variable benchmark problem from the automotive industry as well as six other high-dimensional optimization test problems. The computational results demonstrate that the proposed algorithm has potential to achieve better solutions, compared with conventional genetic algorithm and two previously proposed RBF surrogate-based optimization algorithms.

A New MILP Formulation for Rebalancing Enhanced Index-Tracking Portfolios
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The enhanced index-tracking problem consists of revising, i.e., rebalancing, a portfolio such that it achieves a given excess return over a financial index and minimizes the tracking error, i.e., the deviation of the portfolio returns from the index returns. Several mixed-integer linear programming (MILP) formulations of this problem have been proposed. However, these formulations may lead to portfolios with a negative excess return or a high tracking error. We present a new MILP formulation to rebalance a portfolio such that it replicates the value development of an appropriately constructed tracking target over a historical in-sample period. The resulting portfolios achieve a high excess return and a low tracking error, both in-sample and out-of-sample, which is demonstrated in a computational experiment based on 27 real-world problem instances.

Two-Dimensional Lease Contract Model with Coordination for New and Used Equipment
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This study proposed a two-dimensional lease contract – age and usage limits – for new and used equipment. Under the lease contract, the lessee agrees that an additional cost will be charged when the usage rate exceeds a threshold value. The lessor performs both preventive and corrective maintenance actions. The decision problem for the lessor is to find the optimal price of each lease option offered, and for the lessee is to select the best lease option. We modeled using a cooperative game theory formulation, and the optimal decisions for the lessor and the lessee are coordinated in order to reach a win-win solution.
IEEM17-P-0478
Constraints Driven Reverse Logistics Model for Plastic Solid Waste (PSW)
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The recovery and recycling of Plastic Solid Waste (PSW) is an important aspect of achieving sustainability. The study reviewed technical constraints (Modeling levers) that influence households’ participation in waste recovery and recycling programs from both developed and developing economies. A questionnaire based on the identified levers is developed and distributed to test the validity and significance of the levers. The results are adopted in the development of a lever’s based reverse logistics (RLs) model for PSW in the Zambian context. The model provides a new and useful engineering approach for the management of PSW in both developed and developing economies influenced by similar levers.

IEEM17-P-0666
Customer Supplier Relation: Towards a Constraint-Based Model for Bids
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During a bidding process, bidders have to submit offers that will suit the best to the customers’ requirements. The OPERA project aims at developing method, model and tools to help bidders to develop more accurate offers. One of the major tasks during the bidding process is the elaboration of offers. In this paper, we present a first version of a constraint-based model for offers (bids) elaboration which gathers three types of data: (1) general data characterizing the potential customer and the overall context, (2) data defining the technical system and (3) data defining the delivery process relevant to the technical system. The system will be limited to a 3-level decomposition. The process is composed of activities characterized by a couple (resources, workload). Four end user companies are involved in the OPERA project: two in the industrial sector and the two others in the service one.

IEEM17-P-0373
Knowledge Sharing in Thai SMEs in Manufacturing Sector
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The establishment of the AEC in 2015 is expanded market, increase opportunity for SMEs, however, the market is more competitive in ASEAN. Nowadays, SMEs play significant roles in country economic. In order to survive during the transition period, SMEs need the correct supporting tools to improve their productivity and efficiency. Globally, the adoption of KM in SMEs is becoming widespread. Despite, a large number of studies on KM, only a few studies focus on SMEs especially in Thailand. Knowledge sharing is a key step in KM approach. Therefore, the aim of this study is to identify the current practice of Knowledge Sharing in Thai SMEs within the manufacturing sector. Questionnaires were distributed to SMEs in Thailand, via online and paper based version. The total numbers of responses were 311 respondents from 20 Thai SMEs in manufacturing sector. Overall, the result shown is the biggest cultural and practical barrier sharing is Knowledge sharing is an extra workload and lack of time, respectively.

IEEM17-P-0216
Lean Execution of Engineering Projects: The Potential Application of Case- Based Reasoning to Facilitate Cross-Project Knowledge Transfer
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Engineering firms have not completely utilized the potential advantages of inter-project knowledge transfer. The lack of knowledge transfer from past projects to new arrivals creates a wasteful endeavor, the form of reworking previously solved problems in new projects. This situation increases firms’ operational expenses, especially in the era in which efficient and effective project delivery gives an advantage over competitors. The difficulty of retrieving relevant historical projects in a timely manner is one reason why firms struggle to learn from past projects. Therefore, there is a need for a mechanism to effectively retrieve project experience. This manuscript proposes case-based reasoning (CBR) as the methodology to counter this problem and facilitate the reuse and adaptation of prior project experience, to avoid the occurrence of repeated problems. A case study from an engineering firm, providing asset integrity management solutions in the energy sector, is provided to illustrate a CBR development.

IEEM17-P-0297
Transformation of Working Environments Through Digitalization: Exploration and Systematization of Complexity Drivers
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Digitalization has a significant impact on our working life and it allows whole industries to rethink their value chains. This paper examines how digitalization relates to complexity in work systems with respect to relevant organizational fields of work organization. 23 semi-structured interviews with experts from science and economy were conducted and analyzed. Key findings are that digitalization has far-reaching, interrelated implications for all organizational fields. Moreover, digitalization-related aspects were identified which have the potential to increase complexity in work systems.

IEEM17-P-0562
Extended CAD-Models – State of Practice Within Three Companies
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Product platforms and product family design have been recognized as successful methods to enable mass-customization strategies. However, companies working with products where pre-defined product variants are not feasible require a more generic platform with re-usable components as well as engineering resources. Extended CAD-models is an approach where CAD-models are utilized as carriers of information to support re-usability of both geometric content and engineering activities, decreasing product development lead-time and enabling the definition of a product family within Engineer-To-Order business contexts. The following paper presents the approach in more detail and the results of a multi-case study where three Swedish industrial companies were interviewed. Results show that all companies store information within the CAD-models to support re-usability. Several challenges were expressed such as managing responsibilities and modeling flexible CAD-models. Future trends involve the concept, but to which extent is not clear.

IEEM17-P-0361
Analysing Service Quality Using Customer Expectations and Perceptions in the South African Telecommunication Industry
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Service quality is a differentiator for organizations in the South African telecommunications industry. This is in no doubt as a result of increasing competition. The competition is influenced by new participants such as Internet Service Providers. In addition, the sudden rise of over-the-top applications creates a new form of competition. This paper seeks to ascertain what customers expect from telecommunications providers and how they feel about the service after consuming it or interacting with the telecommunications organization. The study looks at the influence from the customers’ perspective. The assumption is that the quality of the service leads to future customer behavior. The SERVQUAL model is used to analyse the customers’ expectations of the services before interacting with the telecommunications provider and the customers’ perceptions of the services after interacting with the telecommunications provider. The research findings show that consumers value assurance from their telecommunications service providers. In essence, it is of paramount importance that telecommunications organization focus on assurance and responsiveness if they are to remain relevant.
IEEM17-P-0535
The Extended Framework of Kansei Engineering, Kano and TRIZ Applied to Logistics Services
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As one of the most rapidly growing service sectors in today’s business, providing excellent quality in logistics services is a must. In services, recent research shows that affect/emotion (known as Kansei) and Kano’s attractive performance are deemed to be sensitive in dealing with total satisfaction, rather than usability and functionality. However, the ideas for service improvement are often contradictory. Hence, this study proposes an integrated model of Kansei Engineering and Kano incorporating TRIZ (Teorinya Resheniya Izobreteletsikh Zadach) which contributes to the improvement of logistics services. A case study in IT-based logistics services has been conducted. The service attribute ‘cleanliness of helmet for customer’ has been regarded as the most critical, which dealt with Kansei professional, innovative, cheap, and Kano's sensitive in dealing with total satisfaction, rather than usability and functionality. However, in addition, the modularity-based helmet cover and inner sponge has been proposed for TRIZ-based improvement.

IEEM17-P-0920
A Low-Cost Portable 3D Human Motion Analysis System: An Application of Gait Analysis
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Human movement is fast and complicated. Human movement analysis systems are used in occupational biomechanics to have a better understanding of the kinematics of human movement. The purpose of the current research project is to create a low-cost portable human movement analysis system that can be used to investigate human movement for three-dimensional (3D) kinematics analysis using two cameras in an application of gait analysis. This gait analysis system performs image analysis with MATLAB. The design and development method has five major steps, which include (1) the design and calculation of XYZ coordinates (body segment), (2) the design and development of human movement analysis system, (3) the design and development of system calibration, (4) the determination of a 3D Cartesian system, and (5) the design and development of human movement tracking and recording systems. Findings indicate that the total costs of a human movement analysis systems are currently less than 1,500 USD. In addition, this human movement analysis system has many practical uses for outdoor research projects.

IEEM17-P-0894
Information Security in Communication Network of Memory Channel Considering Information Importance
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The authors of this paper have described the structure of a communication network between people, using Shannon entropy, and developed it from a memoryless channel model to a memory channel model in recent years. They have also described the internal sharing of corporate information and information security using a memory channel model. However, organizations have information of both high and low importance, which is an aspect that previous models were unable to describe, creating a discrepancy between the proposed model and reality. This study addresses this problem by incorporating the importance of information in the model, and quantitatively analyzes how different types of communication network structures and information security measures influence the information sharing policies of organizations. In this study, the model gives important suggestions for information security measures within the organization.
IEEM17-P-0495
Application-Specific Design of Assistance Systems for Manual Work in Production
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Due to rising demand for customer-specific products, a growing number of product variants is increasing complexity in production systems. Since automated production systems are often not economical in high-variant production scenarios, human flexibility plays an important role. In recent years a variety of assistance systems have emerged that support manual work by collecting, processing and providing information. However, this technological leap is not widely applied in the industry yet. This paper presents an approach to application-specific design of assistance systems for manual work in production. Required assistance functions, application-specific requirements and a technology database are used for the preselection of technologies and components for an assistance system. Alternative assistance system solutions are generated according to application-specific needs and compared through an economic evaluation. An application of this approach is shown for a manual assembly system in the learning factory for cyber-physical production systems.

IEEM17-P-0033
Introducing Process Building Blocks for Planning the Division of Labor in Human Robot Work Systems
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The approach of hybrid automatization offers with the interaction of humans and robots new improvement potentials in production and assembly from an ergonomic, flexibility and cost point of view. Indeed just a couple of such hybrid solutions were implemented practically yet. On the one hand empirical knowledge is missing and on the other hand only a few planning solutions for the division of work in human-robot work systems are available. This paper introduces a planning approach to describe and design work systems in Human Robot Interaction. For this purpose Process Building Blocks for robot motions are defined. In combination with the existing process building block system MTM-1 for human motions, it is possible to describe, design and assess hybrid work systems taking mutual motions of human beings and robots into account and directly generate cycle time information. This is especially useful in the early planning stage of work systems, where different alternatives can be assessed with a relatively low analyzing effort.
Improving the Material Flow of a Manufacturing Company via Lean, Simulation and Optimization

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Companies are continuously working towards system and process improvement to remain competitive in a global market. There are different methods that support companies in the achievement of that goal. This paper presents an innovative process that combines lean, simulation and optimization to improve the material flow of a manufacturing company. A description of each step of the process details the lean tools and principles taken into account, as well as the results achieved by the application of simulation and optimization. The project resulted in an improved layout and material flow that employs an automated guided vehicle. In addition, lean wastes related to transport, inventory levels as well as waiting times were removed, and the utilization of the process that combines lean, simulation and optimization was considered valuable for the success of the project.

A Multi-Commodity Flow Model for Guide Path Layout Design of AGV Systems

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In this paper, we consider the guide path layout design problem for automated guided vehicle (AGV) systems. Two types of mathematical models: the detailed model and the multi-commodity flow model are proposed. The detailed model considers the detailed pickup and delivery routing of AGVs in the design of guide path layouts whereas, the multi-commodity flow model considers the multi-commodity flow from the pickup node to the delivery node. We compare the performance of these two models for the guide path design problem in a real case. The computational results show the multi-commodity flow model can solve large scale layout model with sufficient accuracy.

Simulation Study on Evolvement Mechanism of Group Events in Large Projects

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Group events triggered by the construction of large projects always have a bad effect and in urgent need to reveal its evolvement mechanism and find ways to handle them. To analyze the evolvement mechanism of these events systematically, in this paper: first, the core factors influencing the large projects group events are analyzed and identified. Then integrating previous studies and practical situations, a complete factor system is built on three levels. Second, a nonlinear simulation model is constructed to quantify the core factors. The mood function is applied to describe the conflict degree of group events. Then the simulation process is carried out to reveal the intrinsic evolution among group events. Finally, two sets of scenario experiments are designed to simulate the evolution of group events in large projects. The results both conform to the practical situation, which proves the effectiveness of the model.

A Modelling Approach for Maintenance Resource-Provisioning Policies in a Wind Farm Maintenance System

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In this paper, the application of combined system dynamics and a life-cycle cost model is discussed. The main purpose of this paper is to highlight that the combined model is capable to serve the optimization process for a complex engineered asset at the corporate level instead of local department optimisation. The application of the model is supported by a case study about maintenance and resource-provisioning system of generator in a wind farm. The research method follows the established method for system dynamics modelling combined with the development of a life cycle cost analytical model in the output analysis. The result shows that the combination of system dynamics and life-cycle cost model is capable to overcome the modelling complexity associated with interrelated maintenance programs of engineered assets in a complex technical system and it is a suitable modelling approach for providing an integrated decision support model for maintenance resource-provisioning management.

A Review of Modelling Approaches for Conceptual Design of Complex Engineering Systems (CESs)

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It is proven that the conceptual design has high impacts on performance of Complex Engineering Systems (CESs). Designers devise models as a key artifact in engineering design. Different modelling approaches have different ontologies serving different purposes in design process. However, it is hard to find many scholarly papers that comprehensively review existing modelling approaches which can be applied in conceptual design of the aforementioned systems. This article aims at reviewing the existing literature in this context to understand fundamental concepts of existing modelling approaches and formalisms, how they can serve conceptual design and what their relative strengths and shortcomings are. The review also suggests possible future directions in this research context.

Crowdsourced Delivery for Last-Mile Distribution: An Agent-Based Modelling and Simulation Approach

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Crowdsourced delivery is considered a possible solution to the last-mile on-demand delivery challenge. The purpose of this paper is to investigate the performance of the crowdsourced last-mile delivery with regard to service level and assets utilization. An agent-based simulation model is developed and two parameters are studied: (1) supply/demand ratio, the ratio between the number of crowd couriers delivering packages and the number of packages and (2) maximum detour time accepted by crowd couriers. The main findings are twofold. Firstly, high supply/demand ratio enables the crowd to achieve high service level with very little time spent on detour. Secondly, high levels of maximum detour time accepted by the crowd can increase service level when the supply/demand ratio is comparatively low, but it may also create competition among crowd couriers for delivery orders.

Predicting Atmospheric Corrosion Rates of Copper in Taiwan Industrial Zones Using Artificial Neural Network

Chien Ming LO, Ya-Ping CHIU, Min-Der LIN

National Chung-Hsing University, Taiwan

This study employed artificial neural network (ANN) to develop a regional forecasting model to predict atmospheric corrosion rates of copper within general industrial zones and coastal industrial zones in Taiwan. Analyzed data are based on the results of metal atmospheric corrosion rates monitoring project executed by The Institute of Harbor & Marine Technology Center in Taiwan. The results reveal that among the different models utilized in this study, the winter and annual corrosion rates predicted by ANN have the most accurate performance. For the corrosion predictions of C5 and CX levels, all of the models have the highest correlation and the winter and annual corrosion rates predicted by ANN have the most accurate performance. But for C3 and C4 levels, none of the models can obtain the corrosion rates predicted by ANN have the most accurate performance. For the corrosion predictions of C5 and CX levels, all of the models have the highest correlation and the winter and annual corrosion rates predicted by ANN have the most accurate performance.
The contemporary supply chain is complex and interrelated. Agricultural supply chain has started to make use of advanced technology in broad areas. Internet of Things (IoT) refers to the inter-networking of embedded devices (things), which enable these things to collect and exchange data so as to streamline the value chain. The advantages of IoT adoption include real time monitoring and control, thereby increasing the operation efficiency. However, the application of IoT in the Chinese agricultural supply chain remains at an early stage. The evaluation of influencing factors of the IoT practices in a structural model is conducted to investigate their interrelationship.

In this study, we adopt the interpretive structural modelling to analyze the interrelationship among factors that influence IoT adoption in Chinese agriculture. Ten factors have been inputted into the proposed model, and MICMAC analysis is further conducted to visualize the relationship based on the study that have been derived.

IEEEM17-P-0481
An Integrated Process and Digitalization Perspective on the Shipping Supply Chain – A Literature Review
Diana FEIBERT, Mette Sanne HANSEN, Peter JACOBSEN
Technical University of Denmark, Denmark
The maritime transport industry operates in an environment characterized by fluctuating fuel prices and low freight rates in a dynamic competitive market. Shipping companies must therefore adopt responsive supply chains whilst containing costs. This study investigates what extant literature can offer from an integrated digitalization and business process management perspective to enhance supply chain performance for shipping companies. The main themes identified in literature have been categorized according to their contributions to achieving responsive and efficient supply chains. Furthermore, the drivers of enhanced supply chain performance have been identified and an agenda for future research is proposed. This study therefore contributes to the research field of maritime transport by enfoldling extant literature and guiding decision makers in their efforts to achieve responsive and adaptive shipping supply chains.

IEEEM17-P-0695
Blockchain Application in Food Supply Information Security
Daniel TSE, Bowen ZHANG, Haoran MU, Shenli CHENG, Yuchen YANG
City University of Hong Kong, Hong Kong SAR
With the increasingly serious problem of food safety in China. It directly or indirectly endangers people’s health, quality of life and safety of life, the global economy, politics and society as a whole have a greater impact. As an effective means of product quality and safety management and control, many countries and regions have been researched, developed and operated of the traceability system. On the one hand, these technologies have not been able to achieve more accurate traceability, these results cannot be directly used in Chinese market. Therefore, the article introduces the concept of Blockchain technology, puts forward the application of Blockchain technology in information security of the food supply chain and compares it with the traditional supply chain system.
Toward Sustainable Reverse Logistics Implementation: A Conceptual Framework of the Quattro Bottom Line Approach

Hesti MAHESWARI, Gatot YUDOKO, Akbar ADHIUTAMA
Institut Teknologi Bandung, Indonesia

Reverse logistics activities are staying as the form of the environmental protection often that fail to reach the lofty ideas in maintaining i.e. the balancing of profit achievement, planet conservation, and people harmony. Therefore, it is important to show the shifting of reverse logistics phenomena through this conceptual paper expected to be useful in building the novel theories to ensure the firms to implement it thoroughly. The results are showing the first-time people began conscious with the idea of returning the electronic products as the research topic, then the awareness of firms’ capability, resource commitment, and stakeholder motivation in reverse logistics. Afterwards, most of firms failed to integrate the goals since their target solely for profit and reputation. At the end of this paper, the need for the firms’ readiness toward sustainable reverse logistics through the Quattro Bottom Line approach will be found.

Vendor Managed Inventory on Two Echelon Inventory System with Optimum Accelerated Lead Time and Component Commonality

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1Institut Teknologi Bandung, Indonesia
2Telkom University, Indonesia

We propose a model to manage VMI supply chain which has multi items product with certain commonality degree where it facilitates buyer to control the lead time. We present a solution technique to solve VMI supply chain problems by comparing lead time as parameter and lead time as decision variable that is possible to be accelerated. Before lead time acceleration is considered, the optimal solutions are obtained simultaneously. On the other sides, we have developed an algorithm for finding solutions when lead time acceleration is allowed. This proposed model is suitable for an organization which implements continuous review on its inventory policy. It can be implemented when the market is monopolistic because back-ordered is allowed and buyer is willing to delay demand fulfillment in order to reduce holding cost.
Session | Decision Analysis and Methods 2  
Date | 12/12/2017  
Time | 09:00 - 10:45  
Room | MR333  
Chairs | Kasin RANSIKARBUM, Ubonratchathani University, Thailand  
Alberto BELLINI, University of Bologna

**IEEM17-P-0029**

Multi-Criteria Selection Problem of Part Orientation in 3D Fused Deposition Modeling Based on Analytic Hierarchy Process Model: A Case Study

Kasin RANSIKARBUM, Namhun KIM†  
†Ubonratchathani University, Thailand  
‡Ulsan National Institute of Science and Technology, South Korea

Additive manufacturing (AM) or 3D printing (3DP) is now perceived as an industrial revolution technology in this digital 4.0 era. It has become popular in various industrial fields thanks to its key advantages in almost unlimited design freedom and material efficiency. However, challenges in AM process planning still exist and require substantial studies. In this research, we study an operational-level, decision-making problem for the orientation selection of the 3DP part to understand process instability and efficiency issues. In addition, as quantitative methods to determine the part orientation accounting for user's knowledge and preferences are limited, we illustrate economical and mechanical-desire preferences from a decision maker using analytic hierarchy process (AHP) framework. Trade-offs among conflicting criteria for parts produced from fused deposition modeling (FDM) are analyzed and compared to obtain the optimal part orientation to be produced. The robust result shows that a perpendicular direction affects how part is to be selected.

**IEEM17-P-0659**

The Determinants of Asset Mothballing in the Offshore Supply Market

Roar ADLAND, Oda SVÆREN  
Norwegian School of Economics, Norway

We evaluate the determinants of the mothballing (lay-up) decision for Offshore Supply Vessels (OSV) in the North Sea using panel logistic regressions and Cox proportional hazard models. We find that the market condition is the most important determinant and that the probability of layup is increasing with lower oil prices, spot dayrates and fleet utilization. Age, fuel efficiency and vessel size also influence the probability of a vessel being mothballed. Our results are important for fleet managers in assessing the attractiveness of vessels and for the banks that finance them.

**IEEM17-P-0232**

An Extended TODIM Method Under Probabilistic Dual Hesitant Fuzzy Information and its Application on Enterprise Strategic Assessment

Zhiliang REN†, Zeshui XU‡, Hai WANG§  
†Nanjing Audit University, China  
‡Nanjing Audit University, China  
§University of Johannesburg, South Africa

In this paper, an extended TODIM method under the probabilistic dual hesitant fuzzy environment is proposed based on a revised score function and an equiprobability distance measure. The TODIM method can deal with multi-criteria decision making problems considering the DMs' psychological behavior. The probabilistic dual hesitant fuzzy set (PDHFS) is a very useful tool to handle the uncertainty in decision making process due to its ability that can describe the aleatory uncertainty and epistemic uncertainty in a single framework simultaneously. A revised score function of the probabilistic dual hesitant fuzzy element (PDHFE) is proposed to distinguish different probabilistic dual hesitant fuzzy information. In addition, we give an axiomatic definition about the distance measure of the PDHFEs and propose an equiprobability distance measure, which satisfies people's intuition better. Finally, we develop a new TODIM method and use a numerical case on enterprise strategic assessment to show its effectiveness and availability.

**IEEM17-P-0233**

Dual Probabilistic Linguistic Term Set and its Application on Multi-Criteria Group Decision Making Problems

Wanying XIE, Zeshui XU, Zhiliang REN  
Southeast University, China

In real life, multi-criteria group decision making problems are usually tend to be qualitative. Decision makers (DMs) prefer to express their decision making information with natural language. The probabilistic linguistic term set (PLTS) is one of the most popular tools to assist DMs to display their respective decision-making information. To extend the PLTS, in this paper, we give the definition of dual probabilistic linguistic term sets (DPLTSs), which can reveal the complexity and uncertainty of this real world more accurately. In addition, we define some basic operation laws of the DPLTS. A score function and an accuracy function of the DPLTS are defined to compare two DPLTSs. Finally, we develop an aggregation operator of DPLTS for information fusion and use a specific case to demonstrate its availability and effectiveness.

**IEEM17-P-0956**

Modelling the Emergence of Modularity and its Limits, Markov Decision Process and Agent Based Modelling Approach

Imane BOUAMAMA, Tomatsu SHIBATA  
Tokoku University, Japan

With increasingly competitive markets and technological advances driving the world towards a “converging commonality”, adopting “modularity” seems to be more and more appealing for companies and businesses wishing to adapt to various market conditions and to benefit from decentralized innovations. However, the decision to adopt a modular product architecture often comes with a need to carefully analyze the implications of such a decision on the firm’s performance, considering the current market state and the future technological shifts. This paper will propose a way to meet this need by constructing mathematical definitions to model the factors influencing the performance of firms before and after adopting modularity.

**IEEM17-P-0697**

Towards a Data-Driven Enterprise: Effects on Information, Governance, Infrastructures and Security

Alberto POLZONETTI, Matteo SAGRATELLA  
University of Lecce, Italy

The way towards an enterprise whose actions and strategies are truly based on the centrality of data and information requires investing in the information governance front, reshaping the corporate infrastructures according to a hybrid cloud perspective, as well as changing the security approach. This paper provides an overview of the opportunities, challenges and critical issues that companies have been facing and, in addition, it briefly tackles the very topical subject of cognitive computing.

**IEEM17-P-0771**

An Artificial Intelligence Based Model for Implementation in the Petroleum Storage Industry to Optimize Maintenance

Tawanda MUSHIRI, Robin HUNGWE, Charles MBOHWA  
University of Johannesburg, South Africa  
University of Zimbabwe, Zimbabwe

Sporadic equipment breakdowns and unplanned downtime due to the predominant use of Reactive Maintenance and Preventive Maintenance at Company X necessitate the enhancement of the maintenance management system. This paper presents an Artificial Intelligence based model for optimizing the conventional maintenance strategies currently employed. Critical equipment at the fuel depot was identified through the Nowlan and Heap risk analysis matrix procedure. The critical equipment identified was pumps, storage tanks, valves and the standby power supply system. Ishikawa diagrams and FMECA analysis were then used in optimizing the Preventive Maintenance strategy and developing the Intelligent Maintenance model for each critical equipment. The focus of the AI Maintenance model was on pumps, as pumps were identified to be the most critical equipment. An Expert System was developed, tested and run for the pumps. The pump diagnosis application developed was programmed using Jess, a rule based system that accepts input from the operators.
Experiment. The work explored the feasibility of indirect rapid tooling investigated and reported using Grey Taguchi method of Design of Application of AM and conventional manufacturing. Recently raised technology in IIoT, to enhance the smart maintenance we propose a platform using the fog computing technology, as a requirement that cannot be accomplished by solely the cloud required services. In this paper, we argue that maintenance processes traditionally completed by the cloud computing technology to serve the impairment. In our computational study we show that the DCFLP is easier as special cases. We model the DCFLP as a Linear Ordering Problem and solve it using an Integer Linear Program and a Tabu Search heuristic. In our computational study we show that the DCFLP is easier to solve for both exact and heuristic approaches than other related layout problems.
Automated Generation of Orienting Devices for Vibratory Bowl Feeders
Cosima STOCKER, Melanie HELL, Raven REISCH, Gunther REINHART
Technical University of Munich, Germany

Vibratory bowl feeders (VBF) are most frequently used to sort and feed bulk material in automated production systems. To correctly orient the parts for further manipulation, a set of orienting devices has to be selected and sequenced. Today, the design process is expensive and time-consuming, as it is based on a manual trial-and-error approach and requires experienced specialists. Therefore, the goal is to develop a method for the automated, computer-aided generation of orienting devices based on physics simulation. This paper presents the concept of an automated configuration system, starting with a part-specific library of possible traps. For each of these traps, the distribution of orientations after passing the trap is calculated. Based on these distributions, an adapted algorithm solves the configuration task automatically. The paper closes with the discussion of this concept and gives an outlook on future work.
week 8, and organisational photography was utilised as a research tool. The audit score showed an increase from a score of 50 in week one to 90 in this case study, a 6S audit was conducted over an 8-week period and the addressed in applying Industry 4.0 model to product safety. Industry 4.0 technological development process proactively. An overview of product recalls and researches are focusing on increasing the productivity and monitoring safety is seldom documented in the Industry 4.0 applications as most of the number of product inspections has been growing in the past decade but the number of product recalls has been increasing conversely. Product safety is seldom documented in the Industry 4.0 applications as most of the studies suggest that the characteristics of these industries can be the barrier factors to develop traceability systems in the bulk food industry. However, the challenges of implementing a traceability system for each industry are different. Food industries with continuous processing and bulk product are chosen as the research objects because many previous studies suggest that the characteristics of these industries can be the obstacle in implementing traceability system. This paper explores the influence of implemented traceability system to the company's product recall capability. This paper explores the influence of implemented traceability system to the company's product recall capability. For this purpose, two cases of the food industries which have implemented traceability system are compared. The methods used to collect information from the companies are interview with insiders and observation. Through this methods combination, barrier factors to develop traceability systems in the bulk food industry can be revealed. Thereby, those will support the discovery of solutions in improving product recall capability.

The impact and effectiveness of participating in external quality assurance programmes in quality management and improvement at a local institute medical laboratory, South Africa
Sambil Charles MUKWAKUNGU, Charles MBORWA
University of Johannesburg, South Africa
This study was conducted in a Medical Laboratory in Johannesburg, South Africa, to evaluate the effectiveness and impact of participating in External Quality Assurance (EQA) programs towards improving the correctness of lab results and continuous quality improvement. The study followed a quantitative approach whereby survey questionnaires were emailed and handed out to laboratory personnel. The participant's responses were summarized and analysed using frequency tables and histograms. The data analysis results indicated that the EQA programs play a vital role in quality management and improvement. Most participants indicated that they understood the role the EQA programs play and felt that it is necessary for a medical laboratory to participate in such programs, coupled with other quality assurance and quality control procedures such as IQC, daily QC procedures, corrective action and continuous education. This research showed that EQA plays a vital role in the correct interpretation and reporting of the lab results.

The Influence of Traceability System Practice to Product Recall Capability in Bulk Food Industry: Observation and Interview
Ivan GUNAWAN, Ivan VANANY, Erwin WIDODO
Institute of Technology Sepuluh Nopember, Indonesia
Technological advancement and the increasing of food recalls should be drivers for improving the companies' traceability system performance. However, the challenges of implementing a traceability system for each industry are different. Food industries with continuous processing and bulk product are chosen as the research objects because many previous studies suggest that the characteristics of these industries can be the obstacle in implementing traceability system. This paper explores the influence of implemented traceability system to the company's product recall capability. For this purpose, two cases of the food industries which have implemented traceability system are compared. The methods used to collect information from the companies are interview with insiders and observation. Through this methods combination, barrier factors to develop traceability systems in the bulk food industry can be revealed. Thereby, those will support the discovery of solutions in improving product recall capability.

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Factors Affecting a South African Construction Company's Suppliers' Performance
Sambil Charles MUKWAKUNGU, Kabelo NKOAGATSE, Charles MBORWA
University of Johannesburg, South Africa
The aim of the paper is to present the finding of an investigation conducted at a local branch of an international company involved in the construction of renewable power plants in South Africa. The study followed a qualitative design approach to identify the correlation between the organizations internal controls and its supplier's performance. Therefore, a purposive sampling technique i.e. questionnaires, was electronically sent out by email to 40 employees involved in the construction of renewable power plants. The results of the study revealed the organization failed to define and implement an effective supplier selection process. The results also revealed that the expected quality performance of the supplier was not clearly documented and quantified in the contract documents. There was no consideration taken by the organization about employee's capability and competence in managing the project. Due to the nature the study, the results cannot be generalised throughout the whole industry.
Design of Mass Customized Paratransit Services

Daniel MO, Yue WANG, Tommy CHEUNG
Hong Kong SAR

In the decades characterized by ageing population, many community transportation organizations face challenges to serve various needs of people sustainably because of limited social welfare expenditure. This research aims to design mass customized services that provide multiple types of paratransit service through better system design and optimization of vehicle resources. In this paper, we focus on integrating scheduler route (SR) service with dial-a-ride (DAR) service, along with the option of a shared ride program. In the first part, we study how different types of paratransit services can be represented systematically under the same family structure. The identified commonality of processes among different service types will lead to the optimization of vehicle scheduling. Then, in the second part, we will develop a mechanism for scheduling vehicles to serve different types of passengers. Illustrated in a numerical example, 20% more passengers could be served by the integrated model of two service types.

Categorization of Business Model Patterns and Mapping of Their Relations with Business Model Building Blocks

Huey Yuen NG
Singapore Institute of Manufacturing Technology (SIMTech), Singapore

Most cases of business model innovation (BMI) are actually enabled by a limited number of business model (BM) patterns. Hence, a good understanding of the extant BM patterns and their contexts of application is extremely important. In the literature, many BM patterns have already been identified but they have not been systematically arranged based on firm’s strategic intents for BMI, which makes comparison among them cumbersome. Also, there is no clear linkage between these BM patterns and the BM building blocks. These two limitations combined reflect many firms’ challenges in applying the BM patterns in practice. The “Integrated BMI Model” developed in this study categorizes the BM patterns based on firm’s strategic intents for BMI, and map out the specific BM building blocks affected by the BM patterns. This model has two practical applications: (1) systematic selection of BM patterns for BMI, and (2) assessment of firms’ current BM patterns.

Modelling the Core Areas of Municipal Performance Towards an ‘Ideal’ Municipality

Bingwen YAN¹, Ogyochukwu Irsmoa NZEWIP²
1Cape Peninsula University of Technology, South Africa
2University of Fort Hare, South Africa

Municipal performance plays a vital role in measuring an ideal municipality (IM) in South Africa. The IM includes a democratic and accountable government, the needs of local community, sustainable services, etc. However, the existing studies reflect a lack of sufficient models showing the relationship between these core areas of concern (CAC) and their significance to key performance areas (KPAs). This paper presents a conceptual model that represents the CAC and KPAs and the key determinants of an IM. The model was tested through Structural Equation Modelling to determine the relationships among the CAC, KPAs and IM. A comprehensive multi-layered approach to the complex issues facing local government in South Africa was utilised. The model shows that it is crucial for local municipalities to look into the CAC for continuous improvement of KPAs. The paper further recommends that the model can be used to measure KPAs at national level.

Improving Project Management Practice: An Engineering and Construction Case Study

Sofia CARVALHO, Anaabela TERESO, Gabriela FERNANDES
University of Minho, Portugal

The implementation of project management best practices is a preponderant factor for the success of companies. Organizations need to respond quickly, efficiently and in an integrated way to the challenges emerging from daily routines. This paper focuses on presenting a solution for the implementation of project management initiatives in an Engineering and Construction company, which was at an embryonic stage of project management maturity. The company aimed at improving its project management maturity level, in order to increase the likelihood of success of its projects. Six project management improvement initiatives in which the company should focus its efforts were identified, considering its organizational context, through four research methods: survey, document analysis, observation and focus groups. Three dimensions were considered for the development of this proposal: People and Organizational Knowledge; Processes, Tools and Techniques and General Management System.

Evaluation of the Influencing Factors on General Aviation Tourism Industry of Xi’an Based on AHP and Fuzzy Comprehensive Evaluation Method

Hongru YAN, Haqiu CHAI
Northwestern Polytechnical University, China

Tourism industry has enormously flourished owing to the development in the economic conditions as well as with the improvement in the people’s living standards. General aviation tourism has become a new form of tourism. This paper evaluated the factors which influence the general aviation tourism industry of Xi’an using Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation method, and the following primary factors are considered for evaluation, supply resources of the system, industrial policies, economic level and market demand. The main objective of this research is to promote the development of general aviation tourism industry.

Creativity in Organization: A Literature Review

Retno INDRAINTININGTIAST, Subagyo ², Budi HARTONO³
1University of Gadjah Mada, Indonesia
2University of Trunojoyo, Indonesia
3University of Gadjah Mada, Indonesia

This paper aims to report the results of a literary review on research in the field of creativity. The study was conducted systematically on 35 articles in the field of creativity using systematic review methods. The results show that the research area of creativity with the object of general organization has been widely practiced. Most of these studies utilized qualitative methods. In contrast, similar studies within the context of creative study is still limited, both in qualitative research and in quantitative research. Results show the importance of research on creativity, especially in the creative industries. The direction of future research, put forward by researchers is expected to extend understanding on creativity in creative industries.
and thus improves both the reliability and product quality. In this case, maintenance (PM) is effective on mitigating the machine deterioration as the machine deteriorates with age and usage. Preventive essential performance indicators. These two indicators usually decline For manufacturing systems, reliability and product quality are two potential areas of improvement for cost sustainability of these trains.

IEEM17-P-0534 Intelligent Fault Diagnostic Model for Rotating Machinery Masdi B. MUHAMMAD, Umair SARWAR, Mohammadreza TAHERI, Zamil Ambri A KARIM Universiti Teknologi PETRONAS, Malaysia The aim of this paper is to present an intelligent fault diagnostic to assess the changes and detect malfunctions in rotating machinery using real-time data. This developed model interprets performance condition monitoring data and determines machine health status with the use of Artificial Neural Networks (ANN). The ANN networks were trained for principle performance parameters from which actual system performance can be predicted based on given set of input parameters. The validity of the proposed model was evaluated through a case study on twin-shaft 18700 KW industrial gas turbine engine to detect a fault happened in engine bell-mouth. The results show the networks trained using Levenberg-Marquardt (LM) training function can achieve a more accurate results compared to Bayesian regulation (BR) and scaled conjugate gradient (SCG) training functions. In addition, the results also showed that both power output parameter and the fuel flow rate can be effectively used to monitor the performance of gas turbine.

IEEM17-P-0753 Reliability Analysis for Gap Null Gate by Bivariate T-Distribution Houbao XU, Mei LI Beijing Institute of Technology, China The length of the reliability window is the key problem in designing the gap explosive null gate. Either too long or too short of the length will lead the gap null gate failure. This paper regards the two threshold values of the gap null gate as variables and formulates the reliability window as a triple response problem. Using bivariate t-distribution, this paper presents the probability model of the successful response. The parameters in the model are estimated by constructing score test statistics. To illustrate the effectiveness of the method presented in the paper, an example of how to derive the reliability window based on experimental data is shown at the end of the paper.

IEEM17-P-0120 Performance-Oriented Preventive Maintenance Policy for Deteriorating Single-Machine Manufacturing Systems Biao LU, Xiaojun ZHOU Shanghai Jiao Tong University, China For manufacturing systems, reliability and product quality are two essential performance indicators. These two indicators usually decline as the machine deteriorates with age and usage. Preventive maintenance (PM) is effective on mitigating the machine deterioration and thus improves both the reliability and product quality. In this case, this paper proposes a performance-oriented PM policy for the single-machine systems. PM is triggered whenever the machine failure rate reaches the failure rate threshold (FRT), or the product defective rate reaches the defective rate threshold (DRT). The optimal PM plan is obtained by minimizing the total cost, including PM cost, minimal repair cost and quality loss, with FRT and DRT as the decision parameters. The defective rate and quality loss are quantitatively evaluated based on a process model developed to mathematically describe the impact of machine deterioration on product quality. The effectiveness and superior performance of the proposed PM policy is demonstrated through a case study.

IEEM17-P-0415 Cost Sustainability of TFR Electric Locomotives Operating on the Natal Corridor Bhekis MAKHANYA, Renju MATHEW, Hannelie NEL, Jan-Harm PRETORIUS1 University of Johannesburg, South Africa 2Transnet Freight Capital, South Africa Transnet Freight Rail, one of the largest railway companies on the African Continent, is revamping itself to be amongst the top five railway enterprises in the global market by the year 2020. However, studies and publications suggest that the company is facing the challenge of increasing rolling stock maintenance cost whilst committing lowering the cost of doing business in South Africa. In the literature reviewed, little research has been conducted to understand the factors affecting the enterprise. This study examines factors affecting the performance and sustainability of the TFR electric locomotive fleet operating in the Natal Corridor; and highlights the potential areas of improvement for cost sustainability of these trains.

IEEM17-P-0922 Nonparametric EWMA Chart for Simultaneous Monitoring of Event Frequency and Magnitude Shuo HUANG, Jun YANG, Amitava MUKHERJEE1 University of Nottingham, UK Traditionally, control charts for joint monitoring of the event frequency and magnitude are designed on the assumption of a parametric distribution. However, when there is a lack of knowledge about the underlying distribution, the parametric control charts may not be suitable in some real applications. Therefore, distribution free control charts have attracted much attention in recent years. In this paper, we propose a nonparametric EWMA chart based on Mathur statistic. The control limits can be obtained via simulation method. Some in control and out of control performances are discussed and the results indicate the proposed chart can successfully detect shifts in different general bivariate processes. Finally, an example is given to illustrate the implementation of the proposed method.

IEEM17-P-0908 The Characteristic of Cold Metal Transfer (CMT) and its Application for Cladding Nelson Edoh IMOUDU1, Yonas Zewdu AYELE2, Abbas BARABADI1 1UJ The Arctic University of Norway, Narvik, Norway 2Østfold University College, Norway Cold Metal Transfer (CMT) process has been selected as a weld technique in most manufacturing industries, because of its low heat inputs that makes it a promising method for manufacturing application. The aim of this paper is to study the competence of CMT welding process in cladding of mild steel. Furthermore, fault tree analysis was performed for hot cracking that can probably be experienced during cladding.

IEEM17-P-0927 Study on Fault Diagnosis of SVM for Mechanical and Electrical Product Based on Improved Conjugate Transformation Hui ZHENG, Jun-xia ZHANG Tianjin University of Science & Technology, China In order to avoid the fault diagnosis of human error, and improve the accuracy of fault diagnosis, this paper proposes the concept of key fault characteristic units on the basis of fault characters of mechanical and electrical products based on the theory of extensics and support vector machine method. Besides, according to the theory of conjugate analysis, the paper provides representation for key fault characteristic units. On this basis, an improved SVM global optimization classification algorithm based on conjugate transformation is proposed. Take fault diagnosis of rotary vane pump as an example to compare sample classification accuracy under different kernel functions and verifies the feasibility and effectiveness of the method.
A container terminal is a location comprising of a seaside and container storage yard areas. In seaside areas, there are two tactical level planning decisions: berth allocation and quay crane assignment problems. Meanwhile in container storage yard area, the planning of yard templates is concerned with the allocation of container storage space to each container vessel. These three tactical level decisions are interrelated and dependent on each other. This paper discusses the development of integrated planning of these three tactical level decisions at container terminals, namely berth allocation problem, specific quay crane assignment and multi-period container storage yard templates. The objective of the optimization model takes into consideration the balance of the requirement of shipping liners owners and port container terminal managers. This integrated tactical planning model is developed by using a functional integration framework with feedback loop structure. A numerical example is used as an illustration of the application of the integrated planning decision model in a container terminal that can result in a good solution.
**IEEM17-P-0439**

**The Impact of Digitalization on Product Lifecycle Management: How to Deal with it?**

Yan XIN, Ville OJANEN

Lappeenranta University of Technology, Finland

This paper aims to create a comprehensive understanding on the impact of digitalization on product lifecycle management, and provide suggestions for manufacturing companies to achieve competitiveness in the digital age. Based on an analysis of 35 journal articles and conference papers, it was found that digitalization closes the product information loop and extends the traditional PLM to the whole product lifecycle, which makes Closed Loop Lifecycle Management possible. To achieve competitiveness, actions related to partnership, standardized and industry-wide accepted data, security, and people should be considered by the manufacturing companies.

**IEEM17-P-0199**

**How Knowledge Management Impacts Performance: An Empirical Study in Chinese Knowledge-Intensive Enterprises**

Yana YUAN, Huaqi CHAI, Liang LIU

Northwestern Polytechnical University, China

Developing an understanding of relationship between knowledge management and organizational performance is of central important to management scholars. In this paper, based on a sample of Chinese knowledge-intensive enterprises engaged in aviation and aerospace sectors, we test our hypotheses through a combination of qualitative and quantitative analysis, as well as the composed method of normative analysis and empirical research. More specifically, we consider how knowledge management impacts organizational performance in enterprise by two routes, the knowledge management process and the environmental impact factors. We find that the knowledge management process and the environmental impact factors positively affect organizational performance, respectively. This paper is one of the empirical supports for the role of environmental impact factors as a mediator between knowledge management and organizational performance. We further outline the implications of these findings for practice and future research.

**IEEM17-P-0469**

**Factors Influencing Intention to Use of Smartphone Applications in Thailand**

Manosod MOSLEHPOUR1, Rhoitul AMRF2, Paoleena PROMPRASORN2

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This study aims to investigate customer behavior and attitude by exploring factors that influence smartphone users’ intention to download and use applications. Structural Equation Modeling is used to test the model and the proposed hypotheses. Descriptive analysis and factor analysis are also conducted to verify validity and reliability of the data. The results showed that perceived ease of use (EU), perceived image (PI) and perceived cost (PC) show significant influence on CS. Perceived cost (PC) and customer satisfaction (CS) show significant influence on intention to use (IU), however perceived ease of use (EU) and perceived image (PI) didn’t have significant influence on intention to use (IU). This study analyzed a total sample of 400 Thai respondents. The results of this study can be useful for the marketers and other researchers to distribute, improve and study more about smartphone applications and user behavior. The app developers can use this research to improve and develop new applications based on consumers’ needs.

**IEEM17-P-0385**

**Technology Management, R&D Investment, and Small and Medium-Sized Enterprise Growth**

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Using an augmented version of Gibrat’s law, we theorized and examined the persistence of firm growth when firms increase their research and development (R&D) investment. Using 17 years of data from 1361 firms (616 small and medium-sized enterprises [SMEs] and 745 large firms), this study analyzed the effect of the dynamic interaction between past growth rate and R&D investment on the current growth rate of firms. Based on a quantile regression analysis, study findings suggested that SMEs showed declining growth after high growth. However, we also found that high-growth SMEs that increased their R&D investment could achieve persistence of growth in the following year. Implica-tions are discussed for research, practice, and policy.

**IEEM17-P-0404**

**Research on Foreign Capital R&D Ecosystem in China Based on Dissipative Structure Theory**

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Innovation Ecosystem has been a new model of technological innovation. Currently, foreign capital R&D ecosystem in China is one of the most important components of the national innovation system. Dissipative structure theory and Brusselator Model are introduced to describe the evolution of the ecosystem composed of multiple R&D networks. This paper evaluates the foreign capital R&D ecosystem's entropy nationwide based on an investigation about 351 foreign capital R&D institutions in China. It further analyses the ecosystem's deviation degree from the dissipative structure. The paper confirms that the status of foreign capital R&D ecosystem has not reached dissipative structure; while the status in Eastern China is closer to the optimal status than in Western China. The empirical conclusion indicates relative maturity of the ecosystem in Eastern China. In both Central China and Western China, the deviation degree is obviously higher than other regions.

**IEEM17-P-0530**

**Collaboration Between SMEs and its Stakeholders: Cross-Tabulation Analysis for Indonesian SMEs Using GEM Data**

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This research aims to map collaboration activity in Indonesian SMEs, using GEM (Global Entrepreneurship Monitor) data in 2013. Collaboration was defined as an evolving process that happens as a result of interaction between two or more entities through joint activity with common goals. Data was collected using survey with random sampling method in 16 cities/districts in Indonesia. Using cross-tabulation analysis, characteristics that were distinguish SMEs which collaborate with its stakeholders and those which doesn't, were identified. This research also found that collaboration in SMEs can be divided into two forms, which is formal collaboration and informal collaboration. Based on the output, SMEs collaboration can also be classified into four forms which are (1) produce goods and services, (2) material supply, (3) marketing activity, and (4) increasing effectivity. Further analysis was done to map SMEs activities and method in each collaboration form. This research found that SMEs that participate in collaboration was mostly were in established business stage (more than 42 months). SMEs on this stage did collaborate with its stakeholder, mainly to produce/sold goods/services, develop product/services, and to sell products/services.
New product development (NPD) is inherently a risky endeavor due to competitive gain in all business organizations, yet risks and threats are inherent in any NPD project. Thus, understanding, detecting, handling, and diminishing risk is imperative for organizations. Suitable risk management policies can considerably advance the chances of success of NPD project. This study starts with the revision of literature to identify major risk sources in NPD process and then suggests applicability of fuzzy failure mode analysis (FFMA) approach to state priority of risk sources in a case of automotive new product development process. It highlights key risk sources, their prioritization and categorization on the basis of criticality. Also, a risk alleviation strategy is suggested for risk mitigation.

New Product Development Project Risks in Saudi Firms - Preliminary Findings
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New product development (NPD) is inherently a risky endeavor due to increasing customer demands and dynamic business market. There are considerable evidences that NPD projects suffered from risks and were prone to over cost, schedule overrun and poor technical performance. Although the research on risk in NPD project is extensive, the literature about risks associated to NPD projects conducted in Saudi context is scarce. Keeping in mind the current complexity, turbulence and dynamism in Saudi economic environment, it is essential that Saudi firms effectively manage NPD project risks to enhance NPD operations. With data collected from Saudi firms developing new products, this paper provides an assessment of the likelihood of occurrence of NPD project risks and their potential negative impact. Overall, this research provides the foundation for the first large-scale empirical investigation on NPD project risks in Saudi context and advances our understanding of the antecedents of NPD project risks.

The Uncertainty Importance Analysis for the Fault Tree and its Probability Density Evolution Algorithm
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In the conventional system reliability, the fault probability of the bottom event is assumed as the determinate value. However, the fault probability of the bottom event is usually uncertain which would result that the system fault probability is uncertain. In order to evaluate the effect of the uncertainties of the fault probability on the system fault probability, based on the structure function of the fault tree, the moment-independent importance measure (MIIM) model for the system reliability is developed. This IM model could not only measure the influence of the uncertainty of the fault probability on the entire system fault probability distribution, but also can provide the ranging of the fault probabilities. The probability density evolution model is developed to solve the IM efficiently. An electro-mechanical actuator system is employed to test the rationality and validity of the presented MIIM. The efficiency and accuracy of the developed algorithm also is tested.

Apply HFACS to Accident Investigation System Interface Design
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This study proposes a new methodology for conducting analyses using new user interfaces based on Human Factors Analysis and Classification System (HFACS). The objective of this research is to evaluate the performance of this new methodology for its use by people who are not ergonomic experts. We developed two accident investigation system interface alternatives which are based on the HFACS model. The participants were asked to conduct analysis with assistance of both alternatives in four cases. The results indicate both alternatives could be considered as good appliances to assist those who have no background knowledge about HFACS. The correct rates have significant difference between the two alternatives in one case, which is related to risky factors of supervisory and upper-level management. This finding has important implications that people who are not familiar with HFACS can regularly provide accurate analyses with the assistance of our investigation system in-interface.
IEEM17-P-0052
Network-Based Process Control and Improvements with Fuzzy Time Delay Modulator
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One of the major drawbacks behind using data networks is their induced network delay effect in the control loop. This effect not only degrades the performance, but can also destabilize the controlled process. This paper proposes a fuzzy logic based control modulation technique for network based process control. The technique is based on modulating the control signal provided to the network based controlled process under the objective of overcoming network delays besides maintaining the stability and controlling the performance as much as possible. The proposed technique, which can be used with any type of process controller, is illustrated via application on a Jacketed Reactor Control process.

IEEM17-P-0038
Modeling and Simulation of Cascading Failure on R&D Network Based on Different Node States Under Attack Strategies
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Northwestern Polytechnical University, China

Since cascading failure has negative and significant impact on R&D network, it is essential to research the characteristics of cascading failure for keeping R&D network safety. Firstly, the paper introduces the weighted scale-free network model to generate a R&D network. Then we develop overloaded function and restoration function to propose the cascading failure model of R&D network based on three states of nodes. Finally, the paper simulates the model. The results show that cascading failure can be stopped when the value of tolerance parameter exceeds the threshold value; the tolerance threshold value declines with the increase of tunable parameter, which indicates failure nodes with higher loads are easier to trigger cascading failure; the cascading failure size decreases with the increase of the value of restoration parameter; R&D network has strongest robustness under random attack, but is the most vulnerable to cascading failure under high-degree attack, which implies the importance of protecting high-degree nodes.

IEEM17-P-0663
A System Dynamics Case Study of Resilient Response to IP Theft from a Cyber-Attack
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Undesirable changes in supply chain physical operations derived from disruptions in the transmission or storage of digital information are reported daily despite the Information Technology (IT) protection available. Once a disruption materializes, the company loses will depend on the coherence and swiftness of the supply chain response (resilience). However, current resilience frameworks are qualitative, do not address evolution over time as a relevant aspect, and thus do not provide indications on how to design a resilient response. This paper contributes to closing this gap by developing a system dynamics model from an actual case of resilient response after a cyber-attack. Both case-specific and generic structures are extracted from the case data analysis, and a reaction mechanism is proposed that results in the observed behavior. The identification of these structures should eventually aid decision makers in the process of designing a resilient supply chain response.

IEEM17-P-0411
Throughput Analysis of Random Storage Systems Operated Under the Closest Eligible Location Rule
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Clausthal University of Technology, Germany

We study the performance of a storage and retrieval system executing single-command cycles under the closest eligible location rule to serve a random storage. For each arriving storage or retrieval request, the closest eligible location rule selects a storage location that incurs a minimum cycle time. The performance of the system is analyzed in terms of the expected maximum system throughput, which is obtained from the reciprocal expected cycle time. Assuming that the arrivals of storage and retrieval requests follow independent Poisson processes, we propose a mathematical model based on Gordon-Newell networks to develop closed-form expressions for the expected cycle time. In a numerical experiment, we investigate characteristic curves of the expected cycle time and the obsolescence of inventory for varying number of stock keeping units. Comparing our model to alternative approaches shows that the latter tend to significantly underestimate the expected maximum system throughput under the closest eligible location rule.

IEEM17-P-0384
An Optimization Model for Quality Improvement Investment Decisions Considering Learning and Forgetting Curve
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Continuous quality improvement is one of the keys to win the market competition. A product with high quality at competitive price will attract the customers to purchase. One way to maintain the quality improvement is by reducing product variance. In this paper, a quality improvement optimization model is developed to determine optimal investment allocation to certain component process by considering learning and forgetting curve. Maximum return on investment is the objective function of this model. Exponential learning investment function is used in this paper with taking into consideration the forgetting as the result of interruption. The model implementation will showed by numerical example and solved using Oracle Crystal Ball software.

IEEM17-P-0238
A Graphical Method for Multi-Signal Flow Graph Modeling and Testability Analysis Based on Visio Control Component
Jinsong YU, Yidong ZHENG, Diying TANG, Y. YANG
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This paper proposed a method for constructing the graphic modeling system on the basis of Visio drawing control through a lot of research about the technology of testable modeling and analysis. A regional growth algorithm based on the idea of image segmentation is put forward to obtain the fault-test dependency matrix and corresponding testability indicators such as fault detection rate(FDR) and fault isolation rate(FIR) are calculated according to the matrix. The optimal decision tree is also generated in this paper using AO* algorithm, which provides effective and reliable guidance for fault isolation. At last, the functions of the testability modeling and analyzing are verified taking a tape player as the research object. The experiment results show that the scheme is feasible and has important reference value for developing testability analysis tools.
IEEM17-P-0381

Performance Measurement of the Relationship Between Farmers-Cooperatives-Industrial Processing Milk in a Dairy Supply Chain: A Balanced Supply Chain Management Scorecard Approach
Aries SUSANTY, Arfan BAKHTIAR, Ratna PURWANINGSH, Dina Firma DEWANTI
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This research has several purposes. First, identify the metrics on each perspectives in the balanced supply chain management scorecard. Second, develop the scale of measurement of each metric. Third, utilize the analytical hierarchy process to measure the relative importance of each metric and perspective, and fourth, measure the current performance of each metric and give some feedback. As a pilot testing, the object of this research was represented by the relationship between the individual dairy farmers and two selected dairy cooperatives located in Semarang district and also by the relationship between two selected dairy cooperatives and the industrial milk processing which is where the cooperative sells its milk. There were 28 metrics used in this research and the result of measurement indicated that the performance of the relationship between farmers, dairy cooperatives, and industrial processing milk had total score 2.82. The total score was subject to improve since the highest total score could be achieved was 5. Then, among 22 metrics, 10 metrics should be improved since those metrics have high importance but low performance.

IEEM17-P-0491

Optimal Replenishment Policy for Inventory Systems with an Unreliable Supplier
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In this paper, a mathematical model is developed for an inventory system which orders replenishment from two external suppliers. One supplier is reliable which only delivers perfect quality items; the other supplier is unreliable which supplies some imperfect quality items. The inventory is capable of inspecting imperfect quality items. The average profit per unit time is formulated and a numerical method for obtaining the optimal replenishment policy is presented.

IEEM17-P-0372

Distribution Center Capacity Analysis in Stochastic Environment: An Application of Value Stream Analysis and Monte Carlo Simulation
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The main objective of this research is to develop a simulation based capacity analysis model. We applied value stream analysis and Monte Carlo simulation, in a stochastic Distribution Center (DC) operations environment, in order to analyze the capacity level and make informed staffing and operations decisions. A simulation model was developed to provide a baseline for management to understand workflow and DC available capacity. The results showed that the DC under study was capable of receiving and shipping 30% to 40% higher units per shift. In addition, the results showed that there was an imbalanced workflow caused by original flow design, and daily work scheduling and planning.

IEEM17-P-0524

A Comprehensive Model for Supply Chain Performance Measurement: Application in the Coal Beneficiation Plant of Steel Manufacturing Company
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3Marwari College, India

Companies are looking for a single solution or a set of metrics that they can apply to measure their supply chain performance but literature reveals that such a single solution does not exist. An important component in supply chain design and analysis is the establishment of an appropriate performance measurement and evaluation system. An effective supply chain performance measurement system must align with a company’s own supply chain processes. In this paper, a comprehensive supply chain performance measurement and evaluation (CSCPME) methodology based on the study of several established performance measurement models is developed. The critical performance measures reflect the five specific criteria, viz. effectiveness, efficiency, quality, productivity, and profitability. The proposed CSCPME is applied to a real case study for one of its performance measure (effectiveness) evaluation. The developed CSCPME methodology may provide a framework for companies to build their in-house supply chain performance measurement systems.

IEEM17-P-0913

Model Development of Rescue Assignment and Scheduling Problem Using Grasp Metaheuristic
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Natural disasters could not be avoided by humans. Indonesia is often facing natural disaster. Natural disasters can cause social, economic, and environmental impacts. This problem encourages researchers to take an active actions in disaster management issues. This research develops Rescue Team Assignment and Scheduling Problem by considering the required capability for the disaster incident locations and capability of rescue teams to handling time and applying fuzzy logic for travel times and severity of incident locations. This research also develops the solution method by applying GRASP Metaheuristics approach to solve this problem in a reasonable computation time.

IEEM17-P-0346

Last Mile Distribution in Humanitarian Logistics Under Stochastic and Dynamic Consideration
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Humanitarian Logistics has gained attention as it is expected to make a difference in disaster operations success. While managing pre-disaster decision is important, the ability to served victims as quickly after disaster stroke can help minimize the suffering. Last mile distribution is an inherent risk in humanitarian logistics due to its high uncertainty and dynamic nature. Thus, building responsive last mile distribution system is essential in the face of unpredictable demand and conditions. This study proposed last mile distribution model in considerations of the stochastic and dynamic situation. By incorporating flexible vehicle routing process, it is yearden to be able to minimize unmet demand while being responsive at the same time.

IEEM17-P-0844

Multi-Objective Optimization of the Competitive Supply Chain Network Design Based on a Huff Model
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The aim of a Huff location problem is to locate facilities on a competitive environment to maximize the market share. The customer behavior is formulated based on a Huff gravity model. This paper considers a social impact along with economic and environmental aspects in order to construct new facilities in a competitive supply chain. This problem is a multi-objective mixed integer non-linear programming (MINLP). To deal with the problem, two multi-objective meta-heuristics (i.e., non-dominated sorting genetic algorithm (NSGA-II) and multi-objective particle swarm optimization (MOPSO)) are proposed to cope with this problem. The results verify the superiority of the NSGA-II over MOPSO in terms of some comparison metrics. Additionally, a two-stage algorithm is developed to sort non-dominated solutions generated by the NSGA-II. In the first stage, Pareto-optimal solutions are obtained by the NSGA-II, then in second stage, a ranking method based on TOPSIS is performed to select the best solutions among Pareto-optimal one.
IEEM17-P-0556
Assessing Performance of Aging Air-Cooled Heat Exchangers Using Inspection and Performance Data
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This paper focused on one of the aging assets in gas processing plants which were the air-cooled heat exchangers. The heat exchangers have been operating for more than 20 years since the plant started and may have a greater risk of breakdowns. Thus, the main objective of the study was to assess the performance of the air-cooled heat exchangers and to determine the necessary actions for continued operation. Since there was no failure data, inspection data and performance data were used in this study. The performance analysis model used was based on the heat duty of the heat exchanger. The results from the analysis revealed that the critical level of percentage of tubes plugged before triggering the alarm at the compressor is 20.5%. Hence, it is proposed that the safe running level is to ensure that the percentage of tubes plugged is not more than 20%, else a planned replacement must be initiated. For the trip level, the results from the heat duty showed that 33% will trigger a trip at the compressor.

IEEM17-P-0244
Energy Balance of Waste Management Systems: A Case Study
Alberto BELLINI, Alessandra BONOLI
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Public policies for waste regulation can foster sustainable production systems in related fields. It is a common perception that waste to energy plants (WTE) are optimal solutions in terms of energy balance for dismissed materials, since they recover part of the energy as electricity and heat. A few researchers state that there is an optimal threshold beyond whom separated collection of waste is of no use, since it results in a reduction of total energy recovered. This paper investigates the effects of the reduction of unsorted waste in terms of climate factors and energy balance. It is shown that energy saving density from recycling is higher than energy recovery from incineration, hence, source segregated recycling is a better option for waste management. The paper proposes a benchmark to assess the net energy balance of different waste management systems. A case study is reported, based on data of Emilia-Romagna, Italy, where unsorted waste was recently reduced of about 30% thanks to a dedicated waste tax and policies to promote waste separation and re-use. The case study is used to validate the proposed benchmark, while the methods is general and can be used for different waste management systems and in different countries.

IEEM17-P-0506
Schools location through hybrid multi-criteria methodology to satisfy demand of extended school day program in Colombia
Jonathan CALIXTO, Nicolas TABARQUINO, Pablo MANYOMA
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This research develops a hybrid methodology of multi-criteria decision analysis, which allows taking into account different factors for location of educational establishments in Cali (Colombia), in order to implement a national strategy called extended school day. This strategy seeks to increase equity by offering better opportunities to students in public schools, through increasing stay hours in educational establishments. The national government wants to build new schools and adapt existing facilities for extended school day. With our methodology development, it is possible to analyze different sites to construct a new educational establishment, and based on this evaluation, to define priority vector to reduce school infrastructure deficit and increase service coverage.

IEEM17-P-0507
Effect of Socioeconomic Status on Lung Cancer Survival: A Mediation Analysis Based on Bayesian Network Approach
Kartika Nur ANISA, Shi-Woei LIN
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Identifying factors and mechanisms that influence survival time of cancer patients is critical for healthcare decision-makers. Besides the medical conditions, socioeconomic status (SES) of a patient may also significantly affect the prognosis of the disease. This study aims to investigate key determinants that affect lung cancer survival and to evaluate the direct and indirect effects (via other mediating variables) of SES on survival time. Bayesian Networks (BNs) were proposed and implemented to analyze a large database from The Surveillance, Epidemiology, and End Results (SEER) of the National Cancer Institute of the United States. Results show that the cancer stage at diagnosis is the most critical factor for determining survival time. Investigation of the underlying mechanism identifies both direct and indirect effects of SES on survival time, but the mediation analysis also indicates that the disparity on timely diagnosis (i.e., stage at diagnosis) caused by SES is only marginally significant.

IEEM17-P-0261
Development of Intelligent Building Management System Evaluation and Selection for Smart Factory: An Integrated MCDM Approach
Chih-Hao YANG
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Intelligent building management system (IBMS) has been recognized as a promising solution to growing issue of smart factory under industry 4.0 applications. Management systems play an important role in providing for operation optimization for the intelligent building. Considering IBMS evaluation and decision planning, this study present an integrated MCDM approach for evaluation and determination of management systems for the smart factory is analyzed, take into technological integration, government policy, product application and financial value, by using the Decision Making Trial and Evaluation Laboratory (DEMATEL), the Analytic Network Process (ANP) and ViseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR). This study contributes to the sustainable development - operation research (OR) literature, especially concerning the incorporation of the smart industry characteristic measurement into intelligent building management system, by utilizing MCDM decision model for intelligent building management system projects.

IEEM17-P-0601
OPBI: An Open Pipeline for Biomarker Identification
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Biomarker discovery is one particular pipeline utilized in shotgun proteomics, which is made up of series of phases starting from a set of mass spectrum files and ending with some significantly expressed proteins that are related to a particular disease condition. Different techniques and tools have been introduced to perform protein identification and biomarker identification, and they still consume days/hours to carry out the processes. Further, they ignore MS1 information and consider only the information included in MS2 spectra. In this paper, we present an open-source, R-based, accurate biomarker identification pipeline, which provides solutions to time consumption problem in current biomarker discovery pipelines and utilizes the information of MS1 spectra. The developed pipeline was validated using three raw datasets of PRIDE database. We observed around 2-4 times speed-up and FDR ranges from 0.0003 to 0.0009. The biomarker identification system is accurate and operates in a considerable speed than commonly used, open-source MaxQuant tool.
Specifically, it presents a framework for forecasting the obsolescence of robotic systems. As robots are now more cost-effective when compared to human labor and a lot easier to use, consequently, more people with little or no experience of line design are overseeing line automation. This paper proposes an easy-to-use tool with an application in a car-body shop - extension for application to other processes is feasible with minor modifications. In car-body shops, most of the operations are performed by robots that load and weld stamped steel parts. These robots are organized in cells separated by buffers. One of the main objectives of car-body shop designers is to keep cost as low as possible with no impact on the production rate and the quality of the parts produced. To do that, they have at their disposal two main levers: the size of buffers and the number of robots. Adding more buffers could reduce the impact of disruptions and, consequently, increase the production rate. On the other hand, adding robots will speed up the lines which would also increase the production rate. Both add significant but different costs. Also, additional robots mean additional failures, and this may reduce or reverse the increase in production rate. Given a target production rate, the goal of the method submitted in this paper is to help production line designers answer the following questions: What robot and buffer space allocation will meet the target at least cost? This paper proposes a judicious analytic solution based on simplifying yet realistic assumptions.

A Random Forest Method for Obsolescence Forecasting
Yoosra GRICHI, Yvan BEAUREGARD, Thien-My DAO
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Driven by the frequent technological changes and innovation, obsolescence has become a major challenge that cannot be ignored in which the life cycle of the components is often shorter than that of their systems. Basically, obsolescence problems are often sudden and not planned which causes delays and extra costs. On the other side forecasting appears to be one of the most efficient solutions to solve this problem. This paper aims to provide new light and help industries to generate different solutions to the problems of obsolescence. Specifically it presents a framework for forecasting the obsolescence based on random forest (RF) algorithm which has proven as the best predictor for forecasting obsolescence risk based on a previous comparative study with a high degree of accuracy.

Use of Additive Manufacturing for Polymer Tooling: Case Study from Reaction Injection Molding
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Manufacturing tooling for injection molding has traditionally been associated with high cost and long lead times, due to the complex geometry and demanding machining requirements. This has caused injection molding to be limited to large-volume production, as the tooling needs to amortize over large volumes to achieve a low unit cost. Additive Manufacturing (AM) technologies enables a high degree of complexity at a low cost, which enables cost-efficient manufacturing of the geometries required for injection molding tooling. Using AM tooling for thermoplastics injection molding presents a challenge, as it requires high pressures and temperatures, which destroy the tooling after only a few shots. Hence, this study focuses on investigating the use of softer polymer tooling with Reaction Injection Molding (RIM), which requires lower temperatures and pressures than those of thermoplastics injection molding. A case study has been performed to assess both the cost implications and how the use of AM tooling for RIM affects organizational agility.

A Hybrid Backtracking Search Algorithm for Permutation Flow-Shop Scheduling Problem Minimizing Makespan and Energy Consumption
Peng CHEN, Long WEN, Ran LI, Xinyu LI
Huazhong University of Science and Technology, China

With the advent of sustainable manufacturing, energy consumption becomes an essential consideration in the scheduling problem. However, traditional permutation flow-shop scheduling problem (PFSP) always only considers the production efficiency as its objective. In this paper, a hybrid backtracking search (HBSA) is proposed to minimize both the makespan and energy consumption for PFSP. In HBSA, the simulated annealing (SA) is hybrid with original backtracking search to update the population and then a local search algorithm is applied. Considering the effects of different operators on BSA, we analyze the effectiveness of initialization, crossover, and mutation and use the efficient strategy to improve its performance. Finally, the proposed HBSA is tested on the several benchmark problems to evaluate its performance, and the results are compared with genetic algorithm and branch and bound algorithm. The results validate its effectiveness.

Hybrid Simulation Method by Cooperating Between Manufacturing System Simulation and Computational Fluid Dynamics Simulation First Report: Optimization for Energy Consumption per Unit of Production Throughput Considering Compressed Air Feed
Hitoshi NAGASAWA, Hironori HIBINO, Motoonobu HASHIMOTO, Noritumi KASE
Tokyo University of Science, Japan

Considering compressed air feed for manufacturing systems, it is critical to optimize energy consumption including that in the utility systems, which supplies compressed air, and that in each production line. However, there has been no progress in the research of methods for optimization. Hence, in this research, a method, which is a hybrid of a manufacturing system simulation and computational fluid dynamics simulation, is proposed for evaluating the operation of both production lines and compressed air systems simultaneously. The proposed method is used to evaluate the deficiencies and excesses in the supply from a compressed air system and the reliability of the supply of a compressed air system in response to the daily production schedule. Moreover, the energy consumption per unit of production throughput is optimized for various compressed air feed.
In the advanced manufacturing, a lot of sensors are used to collect real-time process signals for statistical monitoring. Motivated by the complex correlation structures of these multi-channel profile signals, this paper proposes a monitoring scheme for their cross-correlations with the help of spectral network approaches. In particular, we first construct a network model for multi-channel profiles by extracting their features based on the multi-channel functional PCA. The topological structure of the network can represent the cross-correlations of multi-channel profiles. Then we propose to monitor the topological structure using its spectrum information. Numerical studies in a certain context. The results show that the technology obtained an average inference accuracy of 92.9%. As a result, it can be estimated that product quality can be enhanced by defect analysis such as root cause analysis.
### IEEEM17-P-0482
**An Overview of Sustainable Practices in Food Processing Supply Chain Environments**

Okumide OJO, Satya SHAH, Alec COUTROUBIS  
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Climate change has been a great challenge that the world is facing, it is a menace to the society and it is causing more damage than expected. The researchers are working tirelessly to reduce its impact on the planet in order to save the future. Mitigation of greenhouse gas emission and other sustainable practices is encouraged every day to make the world a better place to live. Sustainable practice has been identified as one of the major tools to control greenhouse gas emission especially in the emergent nations where industrialization is now growing rapidly. This paper discusses and analyzes the food security and food processing industry in the emergent nations. It also reviews literature on food processing, supply chain environments, sustainability and sustainable practices in relation to how these could help in promoting the sustainable development and environmental protection goals in the emergent nations.

### IEEEM17-P-0182
**How Do Employees Inspire Innovative Work Behavior?**

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In the rapidly changing 21st century, a new type of work methods and behavior is necessary and important. Research has unveiled the factors impacting innovative work behavior, but the underlying mechanisms for sustained inspiration remained far from fully understood. To fill that knowledge gap, this study investigated 50 good performance companies in Taiwan, and used the factors work motivation and transformational leadership to test the study's hypotheses: responses from 150 employees were used in the analysis. The findings suggest that both work motivation and transformational leadership are positively related to innovative work behavior, and that continuous transformational leadership and enhanced employee motivation can make employees produce results from innovative work behavior.

### IEEEM17-P-0366
**Design of an Evaluation Methodology for the Service Design and Development Process from Concurrent Engineering: The Case of the Advertising Sector**

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This paper presents the design and validation of a methodological proposal for the evaluation of the Advertising Design and Development Process (ADDP) from the perspective of Concurrent Engineering (CE). First, a model for the ADDP that allows the concurrence of activities was designed and then an evaluation methodology was established. As result of the methodology, a measurement instrument was developed integrating organizational, technological, human, information and market factors to detect failures during the PDCA cycle. Finally, this instrument was validated to make the necessary adjustments so that the measurement tools are correctly raised.

### IEEEM17-P-0477
**Sustainable Supply and Demand Chain Integration within Global Manufacturing Industries**

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Given the emerging industrial management strategies considering three pillars of sustainability in particular, there is a vital need to determine the differences of sustainability practices within both supply and demand distribution systems through global manufacturing environments providing with the successful global trade and logistics. This research paper aims to explore the interactions and advantages of sustainability applications within both supply and demand chain management. The research framework adopted consists of a survey questionnaire method which is conducted within a global tyre manufacturing company. The research results and analysis justify the need for the application of ethical codes, supply chain transformation and the effective association of industry executives, professional bodies and the government. The research study also identifies that the vital incentive factors for the organisation towards sustainable supply demand chain (SSDC) are mostly the financial benefits of doing so and therefore, a positive mind-set shift towards greening practices is required.

### IEEEM17-P-0878
**Product-Service System for Indonesian Industrial Estate Firms: A Conceptual Framework**

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Indonesian industrial estate firms give important contribution to industrial development towards national economic enhancement. Due to their significant roles, they need to be sustained. The initial problem faced by industrial estate firms is their limited resources, particularly in the availability of land and/or building. Thus, the industrial estate firm must gain profit from both products and services. To help industrial estate firms to sustain, this article proposed product-service system (PSS) concept that combine tangible products consumption and services. PSS categorized into three types, product-oriented, user-oriented, and result-oriented. Each type has its own characteristics and compositions of products and services. It will then be used to study Indonesian industrial estate firms in order to attain sustainability. It is discovered that 2015 Indonesian Industrial Estate Awards Winners (KIIC, Jababeka, Batamindo, and MM2100) have practiced all types of PSS, mainly for supporting services, although they still emphasize on selling products.

### IEEEM17-P-0649
**The Delivery of Service Quality to Increase Customer Repurchase Behaviour and Customer Satisfaction at Fast Food Outlets in Central Johannesburg, South Africa**

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*University of Johannesburg, South Africa*

The purpose of this paper is to determine the satisfaction level and repurchase behaviour of customers from fast food outlets (FFO) with regard to the five service quality dimensions. The focal point of the paper is to evaluate the fast food outlets (FFO), service quality through customer satisfaction. The higher the level of customer satisfaction, the greater the impact on customer retention and repurchasing behaviour. A questionnaire was established from SERVQUAL (Perceptions vs Expectations) and repurchasing behaviour concepts. The research required a convenient sampling method. Data obtained was analysed using description analysis to determine whether service quality perceived, leads to repeat purchases. After the composite analysis was conducted, it indicated a disparity between customers' perceptions and expectations. The overall service quality of the three combined fast food outlets using the SERVQUAL instrument resulted in negative gap average of (-0.6174) indicating that customers' expectations exceed perceptions. Consequently, customers are dissatisfied with service perceived.
This paper proposes an efficient algorithm to explore cycles in MSNs for a given demand level. Various examples are explored to illustrate the proposed method.

**Title:** A Simple Algorithm to Verify Cycles in MSNs for a Given Demand Level  
**Authors:** Shin-Guang CHEN  
**Institution:** Tungnan University, Taiwan  
**Abstract:** In applications of network theory, paths and cycles are important features to explore in a network. There are many methods to explore such features in graphs, namely binary-state networks. However, there are only limited methods to explore paths or cycles in multistate networks (MSNs). Nonetheless, in dynamic situation, the various flowpatterns make cycles changing in MSNs by given different demand levels. For example, the traveling salesmen problem, shortest path problem, or maximal flow problem under flowconstraints are this kind of problems. This study treated an optimal integrated maintenance under ecological constraint for a closed-loop system. The industrial scheme is composed by a manufacturing and remanufacturing units to meet a random demand with a given service rate and by respecting the retractation right. The production scheme subjected to random failures and a carbon emission. The goal of this study is to propose a new production strategy to find the economical plans of manufacture and carbon emission quantities as well as the optimum plan of maintenance actions with minimal repair for the production and remanufacturing machines.
### IEEEM17-P-0608
**Optimal Staff Assignment and Routing in Personalized Home Care**  
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The increasing demand for labor intensive medical services such as personalized home care has contributed considerably to the rising cost of health care systems throughout the world. An efficient deployment of medical personal has therefore become a priority for many medical service providers. In this paper, we address a real-world staff assignment and routing problem that was reported to us by a Swiss home care provider. The problem is to determine a multi-day visiting schedule that satisfies various constraints related to time windows, skill requirements, and the availability of personnel. Visiting schedules are evaluated based on service quality and deployment efficiency. We develop a novel mixed-binary linear programming formulation for this problem that is particularly efficient for long planning horizons. Our computational results demonstrate that the proposed formulation outperforms a recently-introduced formulation and is able to devise optimal or near-optimal solutions for real-world problem instances in short running times.

### IEEEM17-P-0290
**Iterated Exact and Heuristic Algorithms for the Minimum Cost Bipartite Perfect Matching Problem with Conflict Constraints**  
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2Boğaziçi University, Turkey*

In this study we address the Minimum Cost Bipartite Perfect Matching Problem with Conflict Pair Constraints (MCBPMPC) on bipartite graphs. Given a cost attached to each edge, the MCBPMPC is to find a minimum cost perfect matching on a bipartite graph such that at most one edge is chosen from a set of conflicting edge pairs. Two formulations, specially tailored iterated exact and heuristic algorithms are introduced. Computational experiments are performed on randomly generated instances. According to the extensive experiments, the iterated exact algorithm yields promising performance.

### IEEEM17-P-0231
**Green Vehicle Routing Problem with Path Flexibility**  
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In this paper, we consider the vehicle routing problem in the context that — multiple paths are optional between each customer pairs, while only one path is implied in traditional vehicle routing problems. We proposed the Green VRPTW-PF model, which takes the fuel consumption of acceleration and waiting on traffic lights into consideration. The model aims to determine the routes for a heterogeneous fleet of vehicles so that the sum of driver’s wage, fuel consumption cost and emission cost is minimized. We generated a set of instances and solved them by a commercial solver. Numerical experiments show that: 1) path flexibility has a significant influence on the optimal solution when considering green issues; 2) it's not always the best choice to travel on the shortest path between two customers; 3) acceleration and waiting fuel consumption have little impact on objective function.

### IEEEM17-P-0497
**Heuristic Approach of Exact Bin-Packing Model**  
**Amandus JOHANSSON, Manfred AXELSSON, Klas GUSTAVSSON**  
*Mid Sweden University, Sweden*

Bin packing problem has gained a wide interest in academia and in practice since the problems quickly becomes intractable as the problem grows. In this paper two models are compared: one model that generates exact solutions for bin packing problem and one that uses the same fundamental approach on the problem but extended with a heuristic combination of next-fit and a combinational best-fit. The results proves that the heuristic approach has competitive features of linearity as the problem grows, but still with satisfying optiumns in the evaluated instances.

### IEEEM17-P-0436
**Towards Extending Algorithmic Strategy Planning in System Dynamics Modeling**  
**Maximilian MOLL**  
*Bundeswehr University, Germany*

Acknowledging the importance of System Dynamics, this paper takes a first step towards extending the policy optimization capabilities, by allowing the controlled parameters to vary in time. To achieve this, for the first time a REINFORCE algorithm is being applied to a System Dynamics model. In order to improve performance, several instances are being made to compete against each other in several stages. A simple model is being used to compare this new approach to both the existing one and the optimal solution. It is shown that as expected the time varying parameters outperform the traditional constant parameter optimization and even almost reach optimality in some cases. Finally, a comparison is being drawn, when applying the same methodology to a system with noise.

### IEEEM17-P-0620
**Dynamic Lot Sizing with Time-Varying Demand and Return Rates for a Product Life Cycle**  
**Hong SUN, Weida CHEN, Zhiliang REN**  
*Southeast University, China*

In this paper, we propose dynamic lot sizing policies for a hybrid manufacturing and remanufacturing system in according with product life cycle. Demand rate and return rate are time-varying over the finite production horizon. Customer demand can be satisfied by new products or remanufactured products. The main objective is to minimize total cost of full product life cycle by optimizing the manufacturing and remanufacturing lot sizes. Optimal manufacturing and remanufacturing lot sizing policies in each phase are derived. Numerical results show that the remanufacturing activities replace manufacturing activities gradually with returns increases. The frequency of manufacturing in maturity phase is more than in introduction phase, whereas the frequency of remanufacturing in maturity phase is less than in decline phase. Therefore, the remanufacturing enterprise needs to determine its lot sizing policy based on the life stages of product.

### IEEEM17-P-0866
**Green Vehicle Routing and Scheduling Problem with Optimized Travel Speed**  
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Among all logistics activities, transportation is presented as a major source of air pollution and other environmental concerns worldwide. Road transportation significantly increases carbon dioxide, which is a known greenhouse gas emissions of vehicles. Therefore, environmental targets are added to economic targets in the vehicle routing decision making to find the right balance between these two dimensions. Research into quantifying emission rates based on travel speeds and for different vehicle sizes, showed that based on the vehicle type and using specific emission coefficients, optimum travel speeds that minimize carbon dioxide emissions can be obtained. In this paper we propose a mixed integer programming model for the green vehicle routing and scheduling problem with time dependent travel speeds and heterogeneous fleet, in which vehicles are characterized by different capacities, costs and emissions factors. The model aims at minimizing CO2 emissions by minimizing the deviation of travel speed from optimum travel speeds.
IEEM17-P-0879
Singapore's NEHR: Challenges on the Path to Connected Health
Lena Stephanie FELIX
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Singapore enjoys the rare distinction of being ranked among the healthiest countries in the world with one of the most efficient healthcare systems. However, what is needed in the present context is a transformation of the country's healthcare system in view of the looming ‘silver tsunami’ (a rapidly ageing population), which may render the country's predominantly hospital-centric healthcare model unsustainable in the mid to long run. The present study casts light on the key issues surrounding the design and implementation of the National Electronic Health Records (NEHR) in Singapore and suggests how these issues may be addressed.

IEEM17-P-0656
Achieving Strategic Growth in Microenterprises through Information Technology: UK Micro Enterprise Case Study
Satya SHAH, Matthew LONG, Elmira NAGHI GANJI
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Technology is a powerful tool that aims to assist efficient and effective use of resources within businesses. The paper examines to provide an understanding on the use of Information Technology tools and its influence on a UK microenterprise. It aims to explore further understanding on the strategic growth of any microenterprise firms. Through research findings and that of the analysis, it develops reasons and factors towards achieving greater time efficient practices with the use of information technology tools to achieve strategic growth for the business in the challenging economic markets. The paper presents the preliminary case study of UK microenterprise through observational findings examining general business processes, the challenges and drawbacks within the working environments and that of the use of technological tools. The findings of this case study will further enable the researchers to develop a novel framework to assist and enable any microenterprise in achieving overall strategic growth.

IEEM17-P-0633
Mechanisms for Effective Tacit Knowledge Transfer in University Laboratory: An Agent-Based Approach
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Source, recipient, and knowledge characteristic play an important role towards tacit knowledge transfer effectiveness. Moreover, to foster the transmission of tacit knowledge, it is required to define the mechanism, whether it is a formal or informal mechanism. Therefore, the effect of transfer mechanism together with the source, recipient, and knowledge characteristic towards tacit knowledge transfer effectiveness should be properly examined. Since knowledge transfer is considered as a complex system, the usage of agent-based approach is perfectly proper. The purpose of this study is to examine tacit knowledge transfer effectiveness by generating all possible scenarios based on source, recipient, and knowledge characteristic in formal and informal transfer mechanism using agent-based modeling and simulation approach. The result of this study found that the developed model has successfully generated the knowledge transfer effectiveness score by the error of 5%. The informal mechanism for some activities is a better strategy for transfer mechanism.

IEEM17-P-0905
Research on the Key Factors of Tacit Knowledge Diffusion in Customized Titanium Processing Enterprises Based on ISM Model
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In the context of knowledge-based economy, tacit knowledge is been highly valued and becomes the source of the core competitiveness of enterprises. Based on the literature reviews on tacit knowledge diffusion, ISM model is used in this paper to analyze and identify the key factors with a hierarchical structural model in customized titanium processing enterprises. It helps enterprises to improve knowledge innovation efficiency, enhance the knowledge application ability and strengthen technical capabilities and the talent storage capacity. After three steps of analysis of ISM model, the results showed that the influence factors on the tacit knowledge diffusion were prioritized. Employees and enterprises aspects had a direct impact on the tacit knowledge diffusion, whereas internal and external environment aspects were the basic influence factors that supported the other two aspects. Thus, managers may improve the tacit knowledge diffusion efficiency based on such advises.

IEEM17-P-0759
Design and Development of a Training Module for Data-Driven Product-Service Design
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Product-service design (PSD) is an integration of tangible product and intangible service. It comprises large number of design information aimed to offer better package design that satisfies customer requirements. The main challenge faced by designers is to ensure all the data and information is organized and readily accessible during design analysis e.g. product-service cost, configuration and quality etc. Previous literature studies are focused on data and knowledge management during design process. However, data analytics core skills such as data preparation, pre-processing and visualization with embedded programming skill are less emphasized. Thus, it is necessary for designers to have skills for managing data-driven design that helps in decision making. This study proposed design and development of a training module for data-driven PSD using ADDIE model. An expert assessment was conducted to measure the usability of our proposed training module. Our findings showed that the usability score of the module falls within the acceptable range and therefore it is suitable to be used for data-driven PSD training.

IEEM17-P-0330
Servitization and the Wider Services Communities: A Bibliometric Study
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For several years attention has been directed to the possible value for manufacturers shifting focus downstream in the value chain. As such the topic of servitization is emerging as a distinct and prominent research area. But even with this growing significance, there is only limited prior research analysing the citation patterns in service research, and none has focused on the emergence of servitization, associated terms, and its strong cross disciplinary nature. We use bibliometric analysis to uncover the literature development in service research and identify the changing dominant research themes. Specifically, we present the outputs of the co-citation networks for three periods: 1990s (early period), 2000s (middle), and 2010s (recent) and see a shift in orientation from a narrowly focused Operations Research tradition to a more managerial and strategic emphasis that places services, and specifically the emergence of servitization, at the centre stage of strategy and value creation.
IEEM17-P-0924
Environmental Analysis of Biomass Power Plants for Sustainability in Thailand
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The environmental impact of electricity generation is becoming more critical as electricity consumption continues to increase. This is because the world’s population is growing very fast and modern communities use large amounts of electric power. This paper presents the assessment and management of environmental risk of 7.5 and 9.9 MW biomass power plants in Thailand. Three environmental factors (air, sound, and water) have been examined in this research project. In the environmental analysis, comparisons of measured environmental data from the sites and environmental standards by USEPA (United States Environmental Protection Agency) and Thailand’s PCD (Pollution Control Department) are performed. This research project focuses on sustainability that impacts economic, social, and environment aspects by communities, companies, and individuals. The sustainable development of the research project can lead to a coherent and long-term balance between these three aspects. Recent findings from the environmental monitoring system revealed that quality levels of all three environmental factors are under the standards. It is implied that these two biomass power plants do not negatively affect the environment and satisfy the essential needs of humanity.

IEEM17-P-0377
High School Students’ Knowledge and Seismic Risk Perception: The Case of Mexico City
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A cross-sectional seismic risk perception study was conducted for the case of a high school students in Mexico City. The sample size of the population was N=302. Moreover, a nonprobability sampling was considered in the study. The working hypothesis was considered at a significant level of α=0.05. The relationship between the independent and dependent variables in relation to the psychological issues has been assessed by employing the non-parametric Mann-Whitney U and the Kolmogorov-Smirnov tests. Some of the preliminary results are: a) females are more knowledgeable than males on why an earthquake occurs; b) the Morning school students are more knowledgeable than Afternoon school students on the issue related to earthquake prediction and the time to get to safety once a ‘seismic early warning’ is activated; c) 73.8% of the students that participated in some sort of seismic risk educational programmes know the time to get to safety; d) 44% participants that discuss seismic risk issues at home have a defined meeting place after the occurrence of an earthquake; e) when participants do not discuss earthquake preparedness at home, 35.8 of them have a first aid kit; f) 19.6% of the participants experienced “a lot of fear” during the occurrence of an earthquake; and g) 7.28% feel scared when thinking or talk about earthquakes.

IEEM17-P-0907
Quantitative Risk Analysis of Components Under High Stress
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Lack of availability (reliability and maintainability) data is a key challenge during the design process of a new equipment or a production plant for a new location. Lack of data will also increase the uncertainty associated with design significantly. One solution is to use the collected historical data from similar equipment or results from high stress tests, such as Accelerated Life Test (ALT). However, the available studies mostly focused on the estimation of the probability of failure of the component. The main purpose of this paper is to propose a framework for quantitative risk estimation for a components under high stress. In this paper, the ALT concepts is used to estimate the probability of the failure and associated consequences.
Lean, Simulation and Optimization: A Maturity Model
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This article presents a maturity model that can be applied to support organizations in identifying their current state and guiding their further development with regard to lean, simulation and optimization. The paper identifies and describes different maturity levels and offers guidelines that explain how organizations can grow from lower to higher levels of maturity. In addition, it attempts to provide the starting point for organizations that have applied lean or are willing to implement it and which may also be considering taking decisions in a more efficient way via simulation and optimization.

Integrated Vendor-Buyer Inventory Model Considering Imperfect Quality and Inspection Errors with Controllable Lead Time
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Universitas Sebelas Maret, Indonesia
A joint production-inventory model of two-stages (vendor-buyer) for items by considering defective items and inspection errors with controllable lead time is developed in this paper. The assumption of the demand is assumed to be normal distribution. The production process is not perfect, which is produces a particular number of defective items. An inspection process of the shipment lot is hold by the buyer to sort out the item qualities. The human inspector may misclassify a defective item as a good one or misclassify a good item as defective one. The lead time of shipment can directly affects inventory investment in safety stock, the customer service level, and the competitive abilities of a business, so we decide to take lead time also as control object. An optimal solution for the expected integrated total annual cost is provided and for the illustrative purpose, numerical example is also presented. This paper gives complement to the current literatures that used in this study, so that this one model can cover all aspects that considered in the previous literatures.

Concurrent Scheduling of a Job Shop and Microgrid to Minimize Energy Cost Under Due Date Constraints
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Energy Conscious Production Scheduling is a developing field. This paper proposes a MILP formulation that allows for the concurrent scheduling of energy supply and job processes with the aim of minimizing energy cost while guaranteeing due dates. The energy system includes TOU grid pricing, dispatchable generators, an electrical storage system and a solar array. This was compared to a base case of makespan minimization and the potential cost savings are quantified.

Using Gradient Boosting Regressor to Predict Stress Intensity Factor of a Crack Propagating in Small Bore Piping
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Estimating the value of the stress intensity factor (SIF) for a crack propagating in small bore piping is essential for predicting the remnant fatigue life (RFL) of the aforementioned asset. Currently, the finite element method (FEM) is utilized to predict the SIF. The main shortcomings of SIF prediction using the FEM are high computational cost and considerable time-consumption. In this manuscript, the authors propose using gradient boosting regressor (GBR) as an alternative to FEM for predicting the SIF of a propagating crack. The GBR is firstly trained and then validated by using 70 and 30 SIF values, respectively, obtained by FEM. During the validation process, the coefficient of correlation ($R^2$) between the SIF values obtained by FEM and by GBR is 0.977, indicating good agreement between the two. The time required to predict the SIF of 30 data points is reduced from 30 mins (for FEM) to one second with the help of the proposed GBR. Good prediction accuracy and less time-consumption of GBR make it a suitable alternative to FEM for SIF prediction.

Mitigation Strategy Against Cascading Failures of the R&D Network
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As the cascading failures of the R&D network may lead to severe consequences, it is necessary to propose a mitigation strategy to keep it safe. According to the previous research, we develop a R&D network based on the BBV generation algorithm and propose the mitigation strategy on protecting some enterprises to avoid the cascading failures, then we explore the effects of mitigation strategy under different values of some critical parameters through numerical simulation. The simulation results show that the HP strategy is the best, followed by the KP strategy and RP strategy, parameter c and μ are two critical parameters related to the process of the cascading failures of the R&D network. This paper can provide a useful theoretical basis to protect the safety of the enterprises of the R&D network and improve the R&D efficiency.
The prosperity of diversified book market has significantly affected the management of book supply chain. In this paper, we construct a theoretical model to study the coexistence of printed book and electronic book in a book supply chain, which consists of one publisher, one printed book retail store, and one electronic book retail store. We derive the optimal wholesale price, retail price of printed book and retail price of electronic book to maximize the profits of the three parties in the supply chain. Besides, we find that the electronic book retail store should set a much lower price of electronic book than that of printed book set by the printed book retail store. Moreover, by further studying the effects of wholesale price, unit production cost of printed book and royalty rate of electronic book, some managerial insights are discussed in the paper.

The Choice of Buy-Back Contract in Logistics Service Supply Chain with Demand Updating and Mass Customization Service
Weihua LIU
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This paper explores the choice of buy-back contract in the service capacity purchasing of a logistics service integrator (LSI) in an environment of demand updating and mass customization service. Two optimal models are built: with or without a buy-back contract respectively. The conditions whereby an LSI benefits from using a buy-back contract are discussed, along with the analysis of the influences of various parameters upon the choice of buy-back contract. Many important results have been found. For example, the choice of whether to use a buy-back contract is closely related to the optimal customized degree and optimal service price, regardless of the level of demand updating.

The Joint Decisions of Modularity Level Design and Refund Price in a Two-Tier Supply Chain
Qingying LI, Weijian ZHOU
Donghua University, China

This paper investigates a two-tier supply chain for producing and selling modular products. The manufacturer may invest to increase the modularity level of the products, the retailer sources from the manufacturer at a modularity-level related wholesale price and then sells to the market. Customers may return the products to the retailer if unsatisfied. The retailer offers a refund price and returns the products to the manufacturer, where the products get salvaged. We investigate the joint decisions of the manufacturer’s modularity investment and the retailer’s refund pricing under both centralized and decentralized models. We derive the conditions under which the optimal decisions can be uniquely determined, and express the optimal decisions in closed forms. Sensitivity analysis of the optimal solutions regarding part of the cost parameters is also conducted.

Capacity Investments in Logistics Outsourcing
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Recently, various e-commerce businesses are investing in their in-house logistics fleet to implement a partial outsourcing strategy. Under this strategy, the business source their excess requirements through a delivery-as-a-service model using third party logistics (3PL) providers. Further, these 3PL also invest in the fleet capacity to cater to various sources of demand. Our aim in this paper is to study capacity investment decision of the 3PL providers as well as of the buyers who implements the partial outsourcing strategy. We investigate the impact of demand parameters and pricing parameters on the above decisions.

Towards an Approach to Assess Supply Chain Quality Management Maturity
Ana FERNANDEZ, Rui OLIVEIRA, Catarina CUBO, Paulo SAMPAIO, Maria do Sameiro CARVALHO, Paulo AFONSO, J. ROQUE, Marcio REBELLO, Joao BRANDAO
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Maturity models have been developed in order to help companies to improve organizational performance. Furthermore, due to the globalization and the growing competition, companies need to increase the competitiveness through operational efficiency, internally and in the entire supply chain. In this paper, an approach for the design and implementation of a Supply Chain Quality Management maturity model is presented. The concept of Supply Chain Quality Management has been developed in order to achieve a good integration between two approaches: Quality Management and Supply Chain Management, and how such integration can help and support the companies to become more effective and efficient. The proposed approach to assess Supply Chain Quality Management maturity incorporates both quantitative and qualitative information to define several levels corresponding to different integration maturity levels. A case study in a world class company of the automotive industry is being used to validate the approach.

Evaluation of Market Entry Strategies of Late Entrant in the Sustainable SCM
Tasuya INABA
Kanagawa Institute of Technology, Japan

This study evaluates market entry strategies of companies that execute sustainable supply chain management (SSCM). Those companies deal with environmentally and socially friendly goods and deliver the value to consumers. In this study, we assume a situation in which a pioneer company develops a market and another company enters the market as a late entrant, and evaluate strategies of the late entrant company. Four possible strategies are evaluated using agent-based simulation with a hypothetical scenario. From the simulation, findings such as each strategy works differently to market share increase and efficiency of the strategy are observed. These findings are useful for late entrants in deciding their market entry strategies.
IEEM17-P-0622
Weighted Point Matrix Based Supplier Evaluation Method for the Oil and Gas Industry
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2Schlumberger, Singapore

This paper proposes a weighted point matrix based supplier evaluation method for the oil and gas industry. The survey and interview are conducted to determine the weighted point matrix. The case study of an oil and gas company evidences the proposed method is feasible and efficient while it is applied to evaluating the suppliers in the company.

IEEM17-P-0602
Challenges in Implementing Cleaner Production: Barriers and Strategies in the Indonesian Seafood Processing Industry
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This paper investigates challenges in implementing cleaner production concept in Indonesian seafood processing industry. A number of obstacles and strategies related to cleaner production implementation is determined. A concept of Delphi method that involves some expert's opinion is adopted. A deep discussion and questionnaire is used to identify these barriers and strategies. These barriers and strategies will be structured into a hierarchy, and then an analytical hierarchy process will be used to investigate and prioritize underlying barriers and strategies to cleaner production implementation via Indonesian seafood processing industry. This research concludes on how rearranging public regulation or environmental rule and policy in order to help to alleviate the widespread and adoption of cleaner production in Indonesian seafood processing industry.

IEEM17-P-0817
Project Change Request: A Proposal for Managing Change in Industrialization Projects
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Most often, industrialization projects, such as New Product Development (NPD) projects, do not have the full scope of work well known beforehand; the degree of uncertainty is high. In this context, the development of the Project Management Plan (PMP) is postponed to later stages of the project, when the scope becomes better understood, having great consequences on the planning of activities and on the way work is performed. In order to overcome this problem, the common concept of Change Request is separated in the existing Engineering Change Request (technical) and the Project Change Request (management). The Project Change Request (PCR) is presented as a solution not only to allow the PMP to be defined earlier, according to Project Management (PM) good practices, but also to manage changes on project documents as the project evolves. The implementation of PCRs is expected to bring value to NPD practitioners when integrating NPD to PM practice.

IEEM17-P-0426
A New Method for Aggregating Experts’ Probability Judgments
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This paper proposes a new method to aggregate experts' probability judgments based on judgment evidence. The method uses a single causal Bayesian Network to express the judgment evidence of a single expert, and the final judgments are demonstrated through the integration of multiple causal Bayesian Networks into a single one, with the technology of reversal of arcs and the introduction of latent variables. This paper demonstrates the application of this method and raises some problems that occurs during its performance, by using a case of risk analysis for a large scale ground test of Air-to-Surface Missile.
Nanyang Technological University, Singapore offer a broad variety of products. Developing modular product families individualized products has increased the pressure on companies to

Marc WINDHEIM1, Erik GREVE2, Dieter KRAUSE2

Product Structure Alternatives: An Empirical Case Study

IEEM17-P-0503

Versatile, global markets as well as the increasing demand for more individualized products has increased the pressure on companies to offer a broad variety of products. Developing modular product families is an established approach to provide a suitable variety under economic conditions. However, balancing the demands for more external variety and less internal variety is a complex task for product development, affecting multiple domains in companies. In this paper, we conduct an empirical case study and investigate the correlating effects of external and internal variety on respective performance indicators (PI). Within two companies, we identify recurring chain reactions across ten decision scenarios and derive a subset of PIs affected by modular product structure alternatives (MPSA). In addition, the results highlight the major trade-offs between different target dimensions that occur while choosing dissimilar product structure alternatives.

IEEM17-P-0837

Feasibility of Implementing Energy Management System in Ports

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As a key element of the maritime industry that consumes considerable amounts of energy, ports have the potential to tap on higher energy efficiency and renewable energy production to reduce their environmental impact. Ports can also achieve financial benefits when they have better energy management. This study investigates the feasibility of implementing an energy management system (EnMS) in terms of cost and benefit for a port. Results from a discrete event simulation done on Singapore’s container terminal show that the implementation of EnMS is financially beneficial for terminal operators. There is also lower greenhouse gas emission.

IEEM17-P-0492

Financial Risk Measurement in Colombian System of Mining Royalties

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The objective of risk management is to mitigate the probability of financial losses due to different types of risk that could affect supply chain. This paper presents a methodological approach to estimate the financial risk of steam coal royalties received by Colombian government considering risk factors such as the commodity price, freight price and Exchange rate. These risk factors are considered in the model for estimating the Colombian steam coal royalties. We used robust risk indicators such as VaR (Value at Risk) and ES (Expected Shortfall). These measures were obtained through three approaches: parametric, semi-parametric and non-parametric. The coal royalties are an important income for Colombia. The royalties obtained of steam coal exports represented USD 894 million in 2014. In this framework, it is very important to estimate the volatility of tax incomes related to steam coal exports.

IEEM17-P-0329

Sustainable Building Policy Management in Kolkata, India

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In order to promote sustainability additional construction rights are provided to green buildings in Kolkata, India. The paper derived the green building costs from two cases presently under construction and determined that the existing policy is profitable to the builders only for high value properties in the city center. A life cycle analysis showed that there would be substantial financial and environmental benefits if properties in the outskirts are also converted to green. Concessions like tax reductions that are directed to the flat owners should be offered in addition to the present policy for promoting green buildings for all.

IEEM17-P-0566

Some Thoughts on the Kelly Criterion Associated with a Real Investment Perspective

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Since the inception of the Kelly criterion in 1956, most relevant theoretical and practical research has been done in the gambling and financial industries. However, the criterion is regarded to possess so high a potential that it may be applicable to real investment project analysis. From this perspective, this paper addresses some issues: i) a violation of a conventional stochastic dominance theorem, ii) a discounted Kelly criterion, iii) its optionality in terms of a binomial lattice option pricing model.

IEEM17-P-0883

Performance Evaluation of Logistics listed Companies Based on Grey Ideal Correlation Entropy

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Aiming at the logistics operation performance problems of logistics listed companies, the performance evaluation system is constructed by four aspects of the profitability, solvency, asset operation and growth ability. On the advantages of the inheritance of grey correlation method and TOPSIS (Technique for order preference by similarity to ideal solution) evaluation method, the performance evaluation model of weighted grey relational entropy is constructed. The model is applied to the performance study of Chinese logistics listed companies, and provides decision support to improve the management of the company, and to increase the reference basis for the logistics investors.

IEEM17-P-0470

Product Portfolio Optimization Based on Substitution

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The development of production capabilities has led to proliferation of the product variety offered to the customer. Yet this fact does not directly imply increase of manufacturers’ profitability, nor customers’ satisfaction. Consequently, recent research focuses on portfolio optimization through substitution and standardization techniques. However when re-defining the strategic market decisions are characterized by uncertainty due to several parameters. In this study, by using a GAMS optimization model we present a method for supporting strategic decisions on substitution, by quantifying the impact of those parameters. Empirical evidence supplements the research, where a case study from an industry company producing construction material demonstrates the results.
The aim of this study is to build an ecosystem through Small-Volume Production Through Industry-Academia procedure, including the prediction algorithm, help significantly to collected data. A resultant algorithm with 77.3% prediction capability was created by employing the Bayes classifier technique on the data of 332 projects of various Japanese IT vendors. The data of these projects, this study aims at project success rates. It is insisted that to raise success rates, support practitioners have been tried to develop solutions that will improve software development have resulted in failure, thereby researchers and engineers have tried to develop solutions that will improve project success rates. It is insisted that to raise success rates, support should be provided by the organization to which the projects belong. With the aid of predictions that incorporate project outcomes for various information technology (IT) vendors, this study aims at identifying project success factors, potentially supported by an organization. The data of 332 projects of various Japanese IT vendors were collected using an Internet survey, and a success/failure prediction algorithm is created by employing the Bayes classifier technique on the collected data. A resultant algorithm with 77.3% prediction capability was obtained. It is expected that the success/failure prediction procedure, including the prediction algorithm, help significantly to specify projects that an organization needs to participate in as priority.

An Empirical Study on Value Creation of Multi-Product Small-Volume Production Through Industry-Academia Collaboration
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The aim of this study is to build an ecosystem through industry-academia collaboration for company problem solving and the educational reform of universities. Focus is placed on the solution of problems in small-lot production of various small and medium-sized enterprises (SMEs) in the manufacturing industry in Japan. The manufacturing industry in Japan is supported by SMEs with multi-product small-volume production and subcontracted production. The manufacturing industry must be reformed; however, the reform methods for mass production such as the Internet of Things (IoT) are not suitable for SMEs. This study reports on the result of co-designing the information and communication technology (ICT) system to replicate the excellent craftsmanship of SMEs through industry-academia collaboration. This study will contribute to the dissemination of mutual learning between companies and universities through industry-academia collaboration.

Risk Evaluation in Project Management Implementation: The Case of Infrastructure Development Projects
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Risk plays an important role in the success of infrastructure projects. In managing risk, the identification of risk factors is critical. This paper evaluates the impact of human, organizational and technological risk factors on infrastructure projects. A survey on how well risk factors and risk management/mitigation predict project performance was carried out. The results of the survey were analyzed through statistical analysis techniques namely exploratory factor analysis, correlation and multiple regression. The correlation result showed a high positive correlation between risk management and risk mitigation. This correlation is likely to occur because if risk is better managed, positive results of risk mitigation will be higher. Hierarchical multiple regression explored the ability of the human, organizational and technology factors, risk management and risk mitigation to predict the project performance time factor. Risk mitigation appeared to be a strong predictor of performance. This result proves that risk mitigation does influence project performance.

Why CPM is Not Good Enough for Scheduling Projects
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Even with the widespread embrace of CPM and Gantt charts, projects miss deadlines, pay overtime and penalties, take low morale and fatigue and perhaps most critically, struggle with limited resources. This paper tutors gritty individuals on adopting Critical Chain Project Management (CCPM)-a 10-year old innovation now regularly used by NASA, ITT, BOSCH, Honeywell, Lucent Technologies, Tata Steel and many others. CCPM is easily effective in resolving resource conflicts and in meeting deadlines-without affecting the quality of deliverables. The lingo is different, yet CCPM easily deserves to fully displace CPM as the primary project instrument. Many fear that CCPM will add more confusion, uncertainty, and anxiety-“do we have a software for it?” To alleviate this MSProject® is used throughout this tutorial to reveal that even this common tool can enable one to add in the essentials of CCPM and reap material benefits.

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Producing companies are forced to a continuous development of new product innovations in shorter development cycles. The integration of mechatronic components with simultaneous high demands on quality and costs results in a significant increase of complexity. Therefore, the necessity to handle this rising product complexity requires a sustainable conceptual realignment of the current product development process. An approach to face this challenge is provided by the application of methods used for agile software development. These methods have helped the software industry for years to a measurable optimization of the success factors time, quality and costs. Referring to these successes, a method is developed which allows a systematic transmission of agile mechanisms of action towards development processes of technical products. In a first step, applied agile practices are identified and clustered to common so-called agile mechanisms of action. The second step considers their influence on the adjustment of deterministic process elements.

Using Fuzzy Front End Theory on the New Product Development and Innovation
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The Fuzzy Front End (FFE) theory, which focuses on the market decision making process and utilizes heuristic simulation methods to test the design ideas, is easy to understand, convenient to control, and fit to meet the rapidly changing market demands. The FFE theory is preferred for a timely and effective conceptual design of the new product development. Combination the Fuzzy Front End theory, a Flexible Four-Terminal (F4T) principle is derived from the metaphorical analogy to the four bar linkage mechanism. Using the F4T principle and the Fuzzy Front End theory, a new FFE frame model is established for the product innovation and design process.
IEEM17-P-0435

How Do Flexible Options Affect Customer Decision Making in an Online Configurator System?

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Product configurators are the prevailing toolkit used to enable online product customisation. Studies of consumer behaviour have acknowledged that consumers are usually indifferent to certain products or product attributes. Thus, they may have multiple satisfactory attribute choices when configuring products. However, existing configurators allow customers to choose only one attribute, which may make customers hard to make decisions. This paper proposes a new, flexible option-based configurator mechanism that allows customers to select multiple attribute choices. We investigate which factors significantly affect customers’ decisions to choose multiple options, and whether the flexible configurator increases customers’ satisfaction levels. The results of a series of experimental experiments show that the significant factors for utilitarian products and hedonic products are different. Customers gain no extra satisfaction from products customised by a flexible configurator, but enjoy a better configuration process.

IEEM17-P-0653

ETO Bid Solutions Definition and Selection Using Configuration Models and a Multi-Criteria Approach

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In a bidding process, bidders have to define and estimate potential bid solutions relevant to the customer’s requirements. Afterward, based on several criteria (e.g. cost, due date), they have to select the most interesting solution to be sent as an offer to the customer. However, the lack of complete and accurate information makes the estimation imprecise and uncertain. In this paper, an approach is proposed to support the definition and the estimation of the potential Engineering To Order (ETO) technical bid solutions and the selection of the most interesting ones. The definition and the estimation of the potential bid solutions is supported by a new knowledge-based configuration model whereas the selection of the most interesting solutions is supported by a new multi-criteria decision making approach that takes into account uncertainties and imprecisions.

IEEM17-P-0293

Assessing the Profitable Conditions of Online Grocery Using Simulation

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In the era of information revolution, the retailing industry has a significant opportunity to reach every single individual through Internet. Online Grocery Shopping is the new promising business. One of the major challenges facing this industry is the high cost and uncertainty associated with operations. This paper attempts to assess the profitable conditions for an E-grocery to a major retailer in Jeddah, Saudi Arabia. We will develop simulation models for E-Grocery order picking and home delivery operations in order to generate several strategies and evaluate them. This study has shown that simulation is a powerful decision support tool that can assist in predicting and mimicking Online Grocery Shopping operations before implementation. A brief operational strategy is proposed based on the case study for an entrepreneurship project that is based on the principles of courage and caution to exploit the opportunities and overcome the challenges.
IEEM17-P-0075

Jointly Optimal Design of Perfect Maintenance Policy and CUSUM Control Chart

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For quality control and maintenance management of small process shift, jointly optimal design of perfect maintenance policy and CUSUM control chart is put forward, in which four scenarios of production process are considered, quality loss cost is introduced into total cost and quality loss functions are defined based on the parameters of CUSUM chart. The cost caused by the downtime for detection and/or maintenance is also proposed. By minimizing the expected total cost per unit time, a model is established to search the optimal combination of decision variables to realize the joint economic design of CUSUM control chart and maintenance policy. Pattern-search algorithm is used to find the solution. Finally, a numerical case is shown to illustrate the proposed methodology and sensitivity analysis is conducted.

IEEM17-P-0076

Development of a Low-Cost Tool for Semi-Automatic Classification and Counting of Particles in Industrial Oils

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Particle counting is a well-established method for detecting contaminations in industrial oil aiming at extending machinery shelf life. Although being standardized procedures for oil analysis vast, they are also very time-consuming and complex to be performed by most companies. This results in an often used standard-less analysis called potential tool to replace the manual feature extraction in big data era.

The potential of the tool to quickly and effectively count particles, providing the specialist with relevant information concerning the characteristics of the particles, availing one a more accurate decision making.

IEEM17-P-0243

Intelligent Fault Diagnosis of Rotating Machinery Using Locally Connected Restricted Boltzmann Machine in Big Data Era

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In intelligent fault diagnosis, unsupervised feature learning is a potential tool to replace the manual feature extraction in big data era. Therefore, we first develop a locally connected restricted Boltzmann machine (LCRBM) from the traditional RBM in order to handle the periodic appearance of fault characteristics in the raw signals of rotating machinery. Then, using LCRBM, we propose a method for intelligent fault diagnosis of rotating machinery. In the method, LCRBM is used to obtain features directly from raw signals. Based on the features learned by LCRBM, the method uses softmax regression to recognize faults. The proposed method is verified by the dataset of locomotive bearings and its superiority is demonstrated by the comparison with methods using the traditional RBM and eighteen widely used manual features. Results indicate that the proposed method is able to automatically learn fine features from raw signals of rotating machinery and achieves higher diagnosis accuracies.

IEEM17-P-0540

Memetic Algorithm to Optimize Level of Repair and Spare Part Decisions for Fleet Systems

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The Level of Repair Analysis (LORA) and Spare Parts Provisioning (SPP) are the major maintenance planning decisions which have a direct impact on the Life Cycle Cost (LCC) of a capital intensive system. Such capital intensive systems are comprised of a considerable number of assembles/sub- assemblies, which need to undergo optimized maintenance actions, proving to be beneficial for them. Employing heuristic methods can yield faster results which can converge to the global optimum. This research consists of an integrated approach which simultaneously optimizes the level of repair and spare parts decisions for fleet systems. This study uses the memetic algorithm to yield appropriate results for this complex combinatorial problem. It also draws a comparison of the results obtained by the memetic algorithm with those obtained by genetic algorithm.

IEEM17-P-0217

Optimal Scheduling of Imperfect and Perfect Inspections for Systems Subject to Continuous Degradation

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Inspection and Maintenance policies are important in detecting system failures and restoring the system. Most existing researches assume that inspections are perfect. A more realistic situation is that inspections influence the environment or technical conditions are imperfect. In this paper, we consider a system subject to continuous degradation with both imperfect and perfect inspections. The system is modeled by a renewal process and expected cost and length of a renewal cycle is derived. A numerical example is presented in the end, which derives the optimal number of imperfect inspection within a cycle by minimizing the long-run cost rate.

IEEM17-P-0259

Reliability Assessment of NAND SSD Based on Acceleration Degradation Test

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Characterizing life of cheap, highly reliable products is a challenge due to cost and time restriction. Accelerated degradation testing (ADT) provides a way to predict life or reliability cost- and time-effectively. To evaluate the lifetime of solid state disk (SSD) rapidly, this paper carried out research on modeling and statistical analysis method of constant stress accelerated degradation testing (CSADT). Take a certain type of commercial off-the-shelf NAND SSD as the object, the write current is chosen as the degradation index, and CSADT is conducted under 80oC, 90oC and 104oC. A time-to-degradation model is constructed based on the physics of failure and test observations. Besides, a preliminary test is conducted to determine the relationship between current drift and temperature, aiming at modifying the degradation data. Then reliability and lifetime information of SSD can be predicted through the obtained degradation model. The application shows the proposed method not only can save time and money, but also provides reference for other space electronic products.

IEEM17-P-0386

Reliability Analysis for Single-Unit System of Warship Equipment with One Repairman Having Vacations Based on Phase-Type Distribution

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As maintenance resources must be dispatched and assigned between warship equipment system, the policy is introduced to a common single-unit system, which is a repairman taking single vacation and multiple vacations, respectively. This paper assumes that single unit lifetime, the time spent on vacation by the repairman, idle time and repairing time all follow different Phase-type distribution, the more applicable interpretable models for system reliability with a repairman taking vacations are built respectively. The reliability features, such as steady-state failure frequency and system mean time between failures, are introduced by these models. Finally, these models are applied by a numerical application and how difference policy affects the system reliability laws will be introduced.
IEEM17-P-0047
On Economizing Local Foods Networks in Developing Countries
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Economizing is associated with efficient resource use in networks. Based on preceding studies that have revealed particularities of local food production, that they resemble more services than modernistic food production, this entails a need to enhance networking supported by cheap and easy to use information technology. Conceptual understandings from preceding studies on local food networks in developed countries are applied to discuss adaptation regarding networking in local food production in developing economies. The discussion suggests that in these economies local foods need to focus on enhancing interaction and gradually on automating the supply chain. In addition, developing economies should consider hybrid supply chain solutions, where only the upstream food production is considered "local".

IEEM17-P-0197
Tax Policy and Sourcing Strategy – A Social Welfare Perspective
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For recent decades, China has been the clear choice for global companies to build manufacturing plants to supply the world due to its seemingly unlimited supply of low-cost labor, lower currency, and attractive government incentives. However, recent trends have showed that the U.S., with a resilient corporate sector, flexible skilled workforce, and potential stricter tax policies, is becoming more attractive as a place to manufacture many goods to consume on its own soil. This research studies the incentives, possibilities and benefits of reshoring from the perspective of the social welfare. First, our analysis indicates that firms may remain offshoring even if the government provides tax incentives. Secondly, reshoring may increase the employment in the home country, but it also has a negative effect on the domestic consumer surplus, and then impair the overall social welfare given the tax policy implemented by the government.

IEEM17-P-0461
On the Circular Supply Chain’s Impact on Revenue Growth for Manufacturers of Assembled Industrial Products – A Conceptual Development Approach
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Materials scarcity, legislative compliance, and cost savings opportunities drive firms to take back used products from their customers for reuse, recovery, and recycling. For this purpose, firms implement circular supply chains. Although academia has given circular supply chain related topics considerable attention since the 1990s, the relationship between the circular supply chain and the firm's revenue growth remains under-researched. Using revenue growth theory, this study examines how the use of circular supply chains can grow the revenue of manufacturers of assembled industrial products (e.g. process equipment and engines). Findings show that the circular supply chain can increase revenue streams from the firm’s existing markets, create market opportunities in new geographies, and provide access to market segments un-addressable with the firm's new products. The paper adds to understanding of the circular supply chain and provides research suggestions into the revenue potential inherent in circular supply chains.


IEEM17-P-0862

Multi-Objective Optimization of Costs and Pollutants in Order to Make Sustainable Supply Chain of Bio-Fuels
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Considering the importance of supply chain performance, the investigation of the relationship between supply chain performance and supply chain sustainability is substantial too. On the other hand, energy is considered in the center of environmental, social and economic analysis, and effects on the elements of sustainability. In this paper, a sustainable model is represented to optimize the supply chain of biofuels through a two-objective mathematical model by taking into account both economic and environmental objectives. The presented model is consists of three levels that are biomass fields, bio-refineries and distribution centers. The model also consider uncertainty, limited availability of transportation facilities, nitrous oxide and carbon monoxide emissions. In order to solve the model, the weighted sum method in GAMS software has been applied based on different weights according to the importance of each objective. Finally, the analytical results demonstrate the validity of the presented model.

IEEM17-P-0289

Excess Inventories Redeployment Strategy for Spare Parts Service Logistics Management
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Many leading companies are now offering global customers better spare parts services for system maintenance through a more complex service logistics network, extending beyond the traditional on-site stocking management, to boost profit margin. One challenge these spare parts service providers face is how to achieve desired service levels at a low cost through minimization of excess inventories in the global spare parts supply chain. To address this issue, we demonstrate an inventory redeployment strategy to transform a conventional spare parts supply chain (with forward stocking facilities only) into a closed-loop, multi-echelon service network with the capability of redeploying inventories from overstocking to understocking facilities, reducing purchase of high-value spare parts. To assess the quality of our novel solution approach, we used a network flow optimization model to analyze the proposed excess inventories redeployment strategy of an international company’s service parts operations, and found significant inventory cost savings.

IEEM17-P-0508

Status and Future of Manufacturing Execution Systems
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3Kennedy Maritime AS, Norway

This paper proposes a taxonomy for characterizing manufacturing execution systems and discusses how they can benefit from the recent developments of Industry 4.0. The study is based on a literature review. The taxonomy contributes to theory and practice by providing a framework for benchmarking of manufacturing execution systems. The taxonomy can be utilized in the selection or design process of the manufacturing execution systems. Outlining the further opportunities provided by Industry 4.0 technologies, the paper also provides directions for future improvements of manufacturing execution systems.

IEEM17-P-0632

A GA-Based Method for Sales Order Allocation in a MTS/ MTO Supply Chain
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Today’s manufacturing environment has shifted from mass production to mass customization where products are specially catered to customers’ varying preferences. To avoid having high inventory levels in this high mix low volume environment, supply chains are adopting the Make-To-Order (MTO) production strategy. This allows companies to have intermediate inventory for generic parts and the remaining production processes only resume when demand is known. However, with this strategy, the new challenge is to ensure fulfillment of orders before their respective due dates. To address such challenge, this paper proposes a Genetic Algorithm (GA)-based method for the allocation of customized orders to different MTO production sites. The proposed method generates an allocation plan that minimizes the transportation and backorder cost. Efforts have been made to improve solution accuracy by incorporating in the GA’s fitness function estimates of each allocated order’s completion date based on actual conditions in a job shop manufacturing environment.

IEEM17-P-0016

Using DEA Model Without Input and with Negative Input to Develop Composite Indicators
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We propose a kind of DEA model to develop composite indicators. In particular, this DEA model has no input and has negative outputs, which can be considered as a generalization of the Farrell proportional distance function. This DEA model was used to develop a composite indicator for rating the economic conditions of the countries along China’s Belt and Road initiative.

IEEM17-P-0077

Feasibility Analysis of Grid Tied PV System Based on Net-Metering Incentive for a Developing Country: A Case Study of Pakistan
Ayeesha ZAHIR, Shoab Ahmed KHAN, Afshan NASEEM
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This paper investigates the techno-economic viability of grid tied PV system that can be massively deployed in the residential areas of a developing country. Pakistan has been chosen as the area of study for this research. Furthermore, it takes net-metering incentive into account to propose a technologically viable and cost effective grid tied photovoltaic (PV) setup to mitigate the energy crisis prevalent over Pakistan. A detailed market research has been carried out for appropriate technology selection and optimal design of the PV system. Cost and payback analysis for the proposed system has been carried out to find the economic feasibility of the system. The results of the analysis showed that the proposed system can recover its cost with the net-metering incentive within 12 years and the consumer can benefit from the free electricity produced by the system for the remaining of its life time i.e. 13 years.

IEEM17-P-0249

Assessing the Possible Potential in the Global Energy Consumption: Integrated Artificial Neural Network and Data Envelopment Analysis
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Energy is fundamental to attaining various objectives globally. Its conservation and optimal use will help achieve the numerous objectives. Energy use has been well analyzed and assessed for different purposes using Artificial Neural Network (ANN) and Data Envelopment Analysis (DEA). This study has looked at the various benefits that can be acquired using these methods leading to the significance of developing an integrated model. To determine how much energy could be conserved globally, the integrated model was developed. The model applied to the global energy consumption from 1995 to 2009 discovered a possible saving of 1.62% that could have been conserved.

IEEM17-P-0250

The Selection of Enterprise Technology Innovation Mode (TIM) Based on Grey-AHP Method
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The choice of enterprise technology innovation mode (TIM) is a critical part of the enterprise strategy, which has important influence on the development of enterprises. This paper proposes a four quadrant model of TIMs, drawing upon relevant literature on technology innovation. Then, the evaluation index system was structured by Delphi method and literature analysis, and AHP method was used to determine the weights of indexes. Grey comprehensive evaluation method is a scientific and reasonable method, it comprehensively analyzes qualitative and quantitative data. According to the evaluation results of two dimensions, determine the choice of TIM, and the selection model of TIM was established. Finally, the effectiveness and applicability of the TIM selection model is verified by a case study of ZX Company.
Nestled Bilevel Genetic Algorithms for Game-Theoretic Optimization of Product Line Design Considering Competition
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Product line design considering competition (CPLD) can be formulated as a discrete bilevel optimization model based on the Stackelberg-Nash game, which is proved to be NP-hard in nature. This paper develops a nested bilevel genetic algorithm (NBGA) for solving the CPLD problem, in which the lower-level optimization problems are solved in a nested and sequential way for given upper-level decision variables. To compute the Nash equilibrium, the sequential tatonnement procedure is adopted in the lower-level optimization. A generic integer encoding scheme is introduced to represent the upper- and lower-level product line generation and selection, respectively. The design and implementation of the NBGA is discussed in detail. Finally, an application to CPLD of mobile phones is reported to illustrate the feasibility and potential of the proposed NBGA.

A Two-Staged Task Assignment Algorithm for Worker Recommendation in a Crowdsourcing Environment
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2Sichuan University, China
Crowdsourcing markets have provided a means to complete tasks cheaply by global netizens. However, having less control of their workers may adversely affect the quality of work, even worse when assigning tasks without considering workers’ skills, abilities and commitments. We extend the Dual Task Assigner (DTA) algorithm with the Artificial Bee Colony (ABC) algorithm, which figures out the optimal task baseline level for each task to guide the task assignment to workers with appropriate skills. We empirically evaluate the proposed algorithm using data collected from several crowdsourcing practices by freshmen in computer classes. The results show that our algorithm guarantees task results, and statistically performs better than the existing DTA and random assignment algorithms.

Simulation-Driven Manufacturing Planning for Product-Production Variety Coordination
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2Chalmers University of Technology, Sweden
Ambitious manufacturers are challenged to satisfy a broad range of customers while ensuring that the emerging product variety can be produced. Current practice suggests that products and production systems are modeled separately until the late stages of development, when the designs are fixed and modifications are costly. In this paper, both product and production varieties are modeled, assessed, and evaluated using discrete-event simulation during preliminary stages. An illustrative example from the aerospace industry is used to demonstrate the approach. The simulation software Simio is used to model a sequence of operations and a set of input data related to a variety of aerospace sub-systems and a variety of welding resources. Through the simulations, the average utilization rate, the average throughput time, and the average work in process are generated. These outputs are used to evaluate the sets of product-production alternatives during the early stages of platform development when the cost to adjust the design of the products, production resources and operations are trifling.

Statistical Analysis of Oil Insulation Breakdown Voltage
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Liquid or oil insulation are widely used in electrical power apparatus. The breakdown characteristic of oil insulation is statistically analysed. In order to obtain adequate information, suitable statistical distribution functions needs to be selected to model the breakdown voltage data set. In this work, breakdown test of oil insulation is carried out with certain ramp rate, i.e. rate of rise of voltage. The experimentally obtained breakdown voltage data was mapped with normal and weibull distribution. The statistical distribution of data is adopted to obtain information about the breakdown characteristics of oil insulation. The normal distribution is used to estimate mean value, standard deviation, whereas scale parameter, shape parameter are estimated using weibull distribution. Skewness factor is estimated for normal distribution and is seen to be of non-zero value. This non-zero skewness represents asymmetric distribution of experimental data. Weibull distribution being asymmetric in nature fits well with the experimental data. The weibull distribution provides significant information about the breakdown mechanism as well as characteristic breakdown voltage magnitude.
IEEM17-P-0489
Integrated Value Stream Mapping and Simulation for Cash-to-Cash Cycle Time Improvement of a Machining Facility
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2Temasek Polytechnic, Singapore
3CKE Manufacturing Pte Ltd, Singapore
This paper aims to improve the cash to cash (C2C) cycle time in a machining facility using integrated values stream mapping (VSM) and discrete event simulation (DES) techniques. C2C has been used as a metric to measure the effectiveness of working capital especially the cash management. This paper illustrated that the integrated VSM and discrete event simulation methodology can be an effective tool for C2C cycle time improvement. The methodology is described through a case study of a machining facility. The results show that through the integrated VSM and discrete event simulation methodology the C2C cycle time could be improved significantly.

IEEM17-P-0667
Manufacturing Industry in Cloud Computing Era: Case Study
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Cloud computing is a popular term to companies because of its characteristics of cost efficiency and flexibility. Cloud computing impacts the industries from both technical perspective and business perspective. Many companies adopt cloud to support their business activities. They can provide their internal resources/capabilities as services to other stakeholders in their collaborative relationship. It’s critical to realize the importance and usefulness of cloud solutions for companies. Therefore, the current status of cloud-based solutions development and the innovation are discussed in this research paper, particularly in the manufacturing industry. A multiple cases analysis will be performed to understand how companies are using cloud as an enabler of their business. Various cloud-based solutions were implemented in the case companies to help researchers to understand the implementation and application. In the end, some advice and suggestions on their cloud implementation strategies will be provided for companies from different aspects.

IEEM17-P-0300
A Fuzzy Approach for Fatigue and Creep Analysis in a Fire and Tube Boiler
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A fuzzy approach for fatigue and creep analysis is proposed for a fire and tube boiler. Pressure and temperature induce cyclic stresses in boiler components, thus rendering them very susceptible to fatigue failure. Elevated temperatures in the creep regime in boiler tubes increase the probability of failure. Thus, the need has risen for an integrated Programmable Logic Controllers and fuzzy approach to come up with an adaptive controller capable of monitoring fatigue and creep. Finite Element Analysis (FEA) is performed on the boiler model using SolidWorks and the results obtained help to determine the overall integrity of the boiler. Temperature, pressure and the boiler materials are then taken as inputs to the Fuzzy Inference System (FIS) which then determines the extent of fatigue and creep damage aggregation through the rules generated in the fuzzy logic toolbox simulations in Matlab.

IEEM17-P-0304
The Advantage of the Arduino Sensing System on Parking Guidance Information Systems
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2Chuang University of Technology, Taiwan
Parking is a big problem in metropolis. When people go to mall, department stores or hospitals, they often waste much time to find an unoccupied parking space. The study aims to provide people with real-time information about the parking spaces using an app which is transmitted through Arduino systems, WiFi communication modules, and the parking route planning mechanism. In this way, people can have a good command of parking information when they get into the parking lot.

IEEM17-P-0681
An Intelligent Optimization Approach for Waste Collection with Dynamic Disposal Trips
Qi WEI, Qi LIU, Zhaoxia GUO
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This paper investigates a waste collection problem with the consideration of dynamic disposal trips. A hybrid artificial bee colony (ABC)-based approach is developed to handle this problem. We hybrid the ABC algorithm with the variable neighborhood descent algorithm to generate the better optimum-seeking performance, and propose heuristic procedures to choose disposal trip dynamically and calculate the carbon emission in waste collection process. The effectiveness of the proposed algorithm is validated by numerical experiments. The experimental results show that (1) the proposed hybrid ABC algorithm can solve the investigated problem effectively; (2) the algorithm exhibits better optimum-seeking performance than several traditional metaheuristics; (3) dynamic disposal trips should be considered in practice because it reduces the carbon emission at most 7.29% for investigated instances.

IEEM17-P-0191
A Sequential Multi-Objective Robust Optimization Approach Under Interval Uncertainty Based on Support Vector Machines
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Interval uncertainty can cause uncontrollable variations in the objective and constraint values, which could seriously deteriorate the performance or even change the feasibility of the optimal solutions. Robust optimization is to obtain solutions that are optimal and minimally sensitive to uncertainty. In this paper, a sequential multi-objective robust optimization (MORO) approach based on support vector machines (SVM) is proposed. Firstly, a sequential optimization structure is adopted to ease the computational burden. Secondly, SVM is used to construct a classification model to classify design alternatives into feasible or infeasible. The proposed approach is tested on a numerical example and an engineering case. Results illustrate that the proposed approach can reasonably approximate solutions obtained from the existing sequential MORO approach (SMORO), while the computational costs are significantly reduced compared with those of SMORO.

IEEM17-P-0240
Reliability-Oriented Quality Risk Modeling and Monitoring Approach in Manufacturing Process
Jiaming CUI, Yihai HE, Chunling ZHU, Fengdi LIU
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As a critical stage to form the final product reliability, the manufacturing process is always a focus of quality control activities. However, the reliability oriented quality control in manufacturing stage has not obtained enough attention. In this paper, based on the risk-based thinking advocated by the ISO 9001:2015 standard, a reliability-oriented quality risk monitoring approach is proposed to promote the fitness of the process quality control. First, the formation mechanism of quality risk in manufacturing process is examined considering the product reliability degradation. Then, quality negative event is defined to metric the quality risk, and its risk computation model is established based on the potential quality failure cost. Further, the Poisson moving average chart is adopted to achieve workstation-level and product-level quality risk monitoring. Finally, a case study is carried out to verify the proposed method.

IEEM17-P-0340
Test Stand for the Investigation of Driven Rollers
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Energy requirements of modular conveyor systems are essentially determined by the necessary drive power, which is composed of the main drive and intermediate drives. The use of driven support rollers reduces the load on the conventional drive at the head of conveyor systems. Thus, the drive can be build smaller, which can lead to energy and cost savings in contrast to conventional systems. Driven rollers enable the implementation of modular conveyor systems. The theoretical possibilities and consequences of driven rollers are promising. Due to a lack of knowledge regarding the economic efficiency and behavior under certain conditions, driven rollers have not yet been integrated into industrial operation. In order to investigate the behavior of driven rollers and to ensure the introduction into practice, test stands are indispensable. This paper presents the concept of driven rollers and, on this basis, the development of a test stand for investigating these rollers.
Preventive maintenance scheduling is a complex maintenance management activity that involves the consideration of several factors: maintenance technicians' availability, available machine periods, maintenance skills required and, task duration and its set date of achievement. When resources are scarce and time to perform maintenance is limited due to high utilization of equipment, tasks are delayed in relation to the date set for achievement. In this context, maintenance tasks must be prioritized to minimize the delays of critical tasks and, consequently, the overall negative impact. Thus, tasks classification is considered the first step of maintenance scheduling. This paper presents a multi-criteria classification using a risk-based approach to prioritize preventive maintenance tasks. The developed method can be easily integrated in a computerized maintenance management system to support maintenance scheduling.

**IEEM17-P-0374**
A Method for Function Modules Clustering Based on the Function Analysis and the Law of System Completeness
Yujuan DU, Ping JIANG, Shenghui SUN, Runhua TAN
Hebei University of Technology, China

In the modern TRIZ, the function analysis is often used to analyze complex system whose principles are difficult to understand or confuse problems are needed to identify. In this paper, the function analysis is used to build the Numeric Design Structure Matrix (NDSM) of the system, and then we cluster the system components into four modules according to the Genetic algorithm. Finally, the law of system completeness is introduced to identify the type of the module and judge the degree of idealization of each module. As a result, the problem scope of system is ascertained.

**IEEM17-P-0382**
Analysis of Multi-State Warm Standby System Reliability Model with Repair Priority
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A single repair facility can provide the services of corrective maintenance and protective maintenance. For a multi-state warm standby system with repair priority, a model is built to describe the system reliability satisfactorily based on the PH distribution, which can fit any distribution approximately. A series of reliability features including system stability availability, system failure rate and mean time between failures (MTBF) are obtained. The applicability of PH distribution is verified in the numerical application to demonstrate the fluctuation of system reliability function as time goes by.

**IEEM17-P-0408**
Reliability Model Analysis on Parallel System Having Multiple Vacations of One Repairman
Wei WANG, Dongliang YIN, Bingqing WANG
Huazhong University of Science and Technology, China

As large complex equipment cannot be repaired in a timely manner in practice, the policy that a repairman takes multiple vacations is introduced to the parallel system containing identical components. Considering too stringent constraints of model due to exponential distribution and other special types of distributions in past studies, this paper proposes a mean life evaluation method for complex multi-function systems on GO method and formulating the evaluation process of the proposed method. Then, the Power Shift Steering Transmission (PSST) of a heavy vehicle is taken as an example, its mean life is evaluated by this paper’s method. Finally, in order to illustrate the advantages and rationality of the proposed method, the evaluation results and operation efficiency are compared with those by Monte Carlo method. All in all, this study not only widens the application of GO method; but also provides a new MTTR evaluation approach for complex multi-function systems with standby structure.
Research on Basic Maintenance Unit Model Under Two-Level Maintenance System
Di ZHOU, Zhiyu JIA, Chenhui ZENG
CHINA Aero-Polytechnology Establishment, China
In two-level maintenance, the intermediate-level sites are replaced by other sites. How to allocate tasks of testing and replacing shop-replaced units is the key to balance material reliability and expenses. This paper presents basic maintenance unit model to divide support tasks and resource among organizational-level sites of a basic maintenance unit with lateral support. The process of level of repair analysis is also improved. Finally, the feasibility of the model is verified with a numerical example by Monte Carlo simulation on comparing with other models.

Tool Condition Monitoring in Deep Hole Gun Drilling: A Data-Driven Approach
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1Singapore Institute of Manufacturing Technology (SIMTech), Singapore
2Singapore Institute of Manufacturing Technology, Singapore
Data-driven tool condition monitoring techniques have received attention in manufacturing industry due to their ability to improve effective and efficient decision-making. In this paper, we present a novel data-driven tool condition monitoring method for tool wear monitoring in deep hole gun drilling. The proposed method uses the Gaussian process regression (GPR) based on a combination of force, torque, and vibration signal features, which are extracted within a pre-defined segment. The segmentation method is based on the sliding time window approach, to improve the estimation accuracy of the GPR. We also leverage a smoothing method to refine the estimation outputs to reduce noise and outliers. We show the performance of the proposed method using gun drilling experimental data. The results showed that the tool wear estimation accuracy can be enhanced by the proposed method, which considerably outperforms the other methods such as linear regression, ensemble, and support vector regression.

Modelling Electricity Spot Prices with a Three-Regime Markov Model
Vajira MAHARAJ, Venkata Seshachala Sarma YADAVALI
University of Pretoria, South Africa
Price formations in the spot market have received significant attention due to their great impact on delivered profits for the retailer and in turn, the pricing signal received by the consumer. The increased availability of supply and demand data since the shift towards deregulated industries has enabled the relationships between prices and their underlying drivers to be better understood and analyzed. In order to appropriately capture these stylised features, particularly mean-reversion, seasonality, volatility and short-lived spikes, a three-regime Markov switching model is used. The model is superior in comparison to similar works found in literature can be investigated self-organizing network control problem.
Impact of performance feedback on work engagement was mediated by identity increase along with the increasing of organizational identity. Identify, referring that the impact of calling orientation on professional identity has a significant positive effect on the intermediary role of professional orientation and work engagement; (3) Organizational identity has a quantified, and we can evaluate the quality of butyl rubber stopper demolding. For the problem how to decide silicide optimization.

Research of Silicone Oil Uniformity for Butyl Rubber Stopper and Simulation Verification
Yanrun ZHU1, Caiyun CHEN1, Pengchong DONG2, Jingpeng LU1, Shijian JIANG2
1Beijing Institute of Technology, China
2Yanshan University, China
Silicone oil has been recognized as an effective factor for dealing with the butyl rubber stopper demolding. For the problem how to decide reliable injection for butyl rubber stopper, we take on some research on the uniformity of silicone oil, and verify the test according to the finite element simulation. At first, a 3D model of mold is constructed, while the economic cost and reconfigurability are used as the indexes. Then, computational fluid dynamics (CFD) simulation is used to establish the function model, which is a powerful and often indispensable tool for modeling airflow and aerosol transport in realistic and complicated airway geometry. After we mesh the model and set the appropriate boundary conditions, better entrance speed of injection is achieved. From this result, it could be suggested that silicone oil could be quantified, and we can evaluate the quality of butyl rubber stopper silicide optimization.

The Effect of Tightness-Looseness on Well-Being: Residential Mobility as a Moderator
Bing HUANG1, Xiaopeng REN2
1University of Chinese Academy of Sciences, China
2Institute of Psychology, China
This study examines how tightness-looseness influence well-being at individual level and residential mobility as moderator. The sample comprised of 344 Chinese participants (aged 13 to 66), and the data were collected from the internet. Two important results were found. First, tightness-looseness was positively associated with the life satisfaction, job satisfaction and efficacy, but it was negatively associated with exhaustion. Tightness-looseness can predict job satisfaction, life satisfaction, exhaustion and efficacy. Second, Residential mobility partly moderated the relationship between tightness-looseness and well-being. Residential mobility had a moderating effect on the relationship between tightness-looseness and job satisfaction, tightness-looseness and exhaustion.

The Effect of Calling Orientations on Work Engagement of Employees in Securities Company: An Intermediary Model of Mediation
Jie ZHU, Yong WANG, Li-qi YI
Institute of Psychology/ University of Chinese Academy of Sciences, China
This study focuses on the impact of calling orientation on employees’ work engagement in securities industry, through the investigation of 291 securities employees, and also discusses the mediating role of professional identity and the moderating role of organizational identity in this mechanism. The results show: (1) Securities employees’ calling orientation can significantly predict work engagement; (2) Professional identity serves as a partial mediator in the relationship between calling orientation and work engagement; (3) Organizational identity has a significant effect on the intermediary role of professional identity increase along with the increasing of organizational identity.

The Impact of Performance Feedback on Work Engagement ---- The Mediating Effect of Psychological Empowerment
Jie XIAO, Tong LIU, Yi-Wen CHEN
Institute of Psychology/ University of Chinese Academy of Sciences, China
In order to investigate the impact of performance feedback on work engagement and the impact mechanism between the two constructs, a questionnaire survey was conducted among 155 employees from 5 enterprises in Shandong Province by three scales, psychological empowerment, work engagement and performance feedback. The results showed that: First, performance feedback had a positive impact on work engagement and psychological empowerment. Second, the impact of performance feedback on work engagement was mediated by two dimensions of psychological empowerment, meaning of work and autonomy. Performance feedback helps employees get a sense of meaning, enhanced their sense of autonomy and thus increased work engagement.
IEEM17-P-0202
Predictive Modeling of Potential Customers Based on the Customers Clickstream Data: A Field Study
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2Tongji University, China
With the development of e-commerce business and techniques, customer behaviors have been digitalized. In this research, we target on solving the challenge for most of the companies: finding the next group of paying customers. We conduct field studies at the telemarketing team of an online advertising classifieds website company. Dynamic models are developed to predict the probability of making purchases after each telemarketing contact. The real life data is collected from more than 1.2 million of the historical telemarketing campaign contacts. The model utilizing clickstream data successfully integrates the early indicators of purchase behaviors, and deliver comparable results (best AUC 0.867) with models on paid customers. We have also designed a practical decision support system which could generate and distribute candidate customers for the sales representatives of the telemarketing team. The decision support system has been launched and the effectiveness of the system has been tested in real life practices.

IEEM17-P-0645
Service Strategy Under Online B2C Dual-Channel Competition
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This paper studies the online B2C dual-channel's service strategy under two service-delivery models: e-tail channel and direct channel separately provide the service. We combine service, channel preference and pricing into the model and get the supply chain members' optimal profits. It is found the manufacturer and the whole supply chain prefer e-tail channel to be the service provider. However, the e-tailer is not always willing to provide service. Therefore, the manufacturer may have to compensate for e-tailer or provide service itself.

IEEM17-P-0709
The Effects of Relationship Norms on On-Line New Product Development Value Co-Creation Engagement
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In today’s market, new product innovation is very important to the company, especially to the Fast Moving Consumer Goods (FMCG) company. This paper focuses on the motivations of individual’s participation in the new product development (NPD) co-creation which is hold by FMCG company. At the same time, the concept of relationship norms (communal relationship, exchange relationship) is quoted in this paper to study what are the different motivations of the two relationship groups to participate in the co-creation activity. Data analysis show that, in exchange relationships, the high lever financial rewards can positively influence the willingness of participation significantly. But it's not significant to the communal relationship respondents. The moderating effect of relationship norms is significant. And the motivations of helping the enterprise and gaining hedonic benefits can enhance the willingness of participation significantly. It's very meaningful to the FMCG companies when they want to hold a NPD value co-creation activity on internet. They can have a test first to estimate the relationship norm between the brand and the consumers. Then make decision to give what kind of rewards to the consumers to encourage them.

IEEM17-P-0730
Effect of Service Recovery on Recovery Satisfaction and Behavior Intention: An Empirical Study on Clothing Product Online Shopping
Yun LI, Tong LIU, Yi-Wen CHEN
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In the background of clothing products online shopping, data of 276 service failure experienced consumers had been collected through online survey. The aim of this study was to investigate the influence mechanism of service recovery strategies (compensation, recovery speed, apology and recovery initiation) on recovery satisfaction (RS) and behavior intentions (BI) (Word-of-Mouth (WOM) and Repurchase Intention (RI)). Hierarchical regression and bootstrapping had been used to examine the mediation effect of WOM and RS. The findings indicated that all of the four strategies had positive effects on RS; Positive WOM had the mediation effect between RS and RI; RS had the mediation effects between recovery strategies and BI. Also, theoretical and practical contributions had been discussed to give some new perspectives or advices. Limitations and suggestions for future research had been mentioned in the end.

IEEM17-P-0765
Keyword Extraction from Online Product Reviews Based on Bi-Directional LSTM Recurrent Neural Network
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2Dongguan University of Technology, China
Online reviews are acknowledged as an important source of product information when customers make purchase decisions. However, the era of information overload, product review data on the Internet are too abundant and contain much irrelevant information. This makes it difficult for customers to find useful reviews. To solve this issue, some e-commerce websites provide keywords for product reviews, but these are generated beforehand and have the potential to distort customers' opinions of products. This paper presents an automatic keyword extraction method based on a bi-directional long short-memory (LSTM) recurrent neural network (RNN). The results of experiments conducted on product reviews obtain by data-crawling jd.com show that the proposed approach has a very high accuracy of keyword extraction. This can help reduce human annotation efforts in e-commerce.

IEEM17-P-0793
Empirical Study of the Relationship Between Flow Experience, Perceived Transaction Value and Impulse Buying Behavior
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As a pleasant experience of being immersed in the current activity, flow experience is an important factor that facilitates impulse buying behavior. In addition, consumers' perceived value in the virtual environment has a significant impact on the purchase decision making. This research employ questionnaires to investigate the consumers' psychological experience of online shopping, thereby study the relationship between flow experience, perceived transaction value, positive affect, shopping motivation, and impulse buying behavior. The results indicate that (1) flow experience and perceived transaction value, which mediated by positive affect, have positive impact on impulse buying behavior; (2) the positive relationship between positive affect and impulse buying behavior is moderated by hedonic shopping motivation.

IEEM17-P-0368
Solution to Excess Capacity in View of Stakeholders
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1Hebei University of Technology, China
2Tianjin Environmental Protection Bureau, China
Excess capacity is one major problem in the process of China’s economic development. The reason is that capacity goes far beyond the market demand. It's different from excess capacity in the West, which is caused by insufficient demand of consumers. In addition, various stakeholders who have different needs are involved in the processes of formation and governance of excess capacity. Excess capacity is formed and finally upgraded by game among central (WOM) and Repurchase Intention (RI)). Hierarchical regression and bootstrapping had been used to examine the mediation effect of WOM and RS. The findings indicated that all of the four strategies had positive effects on RS; Positive WOM had the mediation effect between RS and RI; RS had the mediation effects between recovery strategies and BI. Also, theoretical and practical contributions had been discussed to give some new perspectives or advices. Limitations and suggestions for future research had been mentioned in the end.

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IEEM17-P-0005
Understanding the Service Desk: Applied Forecasting and Analytics Approach
Jun Jie NG
Defence Science & Technology Agency, Singapore
In this paper, the study aimed to identify the best forecasting model to represent the Service Desk, service desk of an Information Technology (IT) project under the Singapore’s Ministry of Defence (MINDEF), in the aspect of Service Requests management. Defence Science and Technology Agency (DSTA) support MINDEF users in the area of technical consultancy and project management areas such as resource allocation management for IT service delivery and excellence. To achieve an overall aim of better service delivery for their system users, we intend to answer questions such as: How should we plan the helpdesk staffing for the next week/month?

IEEM17-P-0392
Multimode Resource-Constrained Multi-Project Scheduling with Ad Hoc Activity Splitting
Byuang JUN, Fong Chong CHUA
Singapore Institute of Manufacturing Technology, Singapore
This paper focuses on a multimode resource-constrained multi-project scheduling problem in an engineer-to-order company. During the execution of multiple projects, some activities should be split into sub-activities in an ad hoc manner according to the readiness of customers. Moreover, there is no prior information on when and how the activities need to be split. To deal with the problem which has not been addressed in previous research, an ad hoc activity splitting method and a simulated annealing algorithm is developed. A prototype scheduling system is developed and a case study for scheduling with ad hoc activity splitting is reported.

IEEM17-P-0451
Resource-Constrained Project Scheduling in Hazardous Environment
Shuai LI, Zhicong ZHANG, Kaishun HU, Shaoyong ZHAO, Xiaohui YAN
Dongguan University of Technology, China
This paper studies a resource-constrained project scheduling problem (RCPSP) in hazardous environment. Due to the special working environment, this problem is not only constrained by the resources quantity, but also influenced by the cumulative damage suffered by workers. As this extremely increases complexity of the problem. We use particle swarm optimization (PSO) algorithm to solve the investigated problem and design a specific discrete mechanism. Computation results shows the adaptability of our algorithm.

IEEM17-P-0083
Wiki as a Research Support System – A Trial in Information Systems Research
Cheruk Hang AU
The Chinese University of Hong Kong, China
This paper shows the preliminary results of a study on exploring how to use Wiki as a research support system, with a focus on literature reviews management and research project management. A wiki was established by an Information Systems research student, who focused on e-Commerce. The Wiki included literature reviews and other related information, such as conferences and journal information. The technical issues and user experience are covered in this paper, and analysis on some wiki pages are made. The paper also addresses the issues and difficulties of writing literature reviews as suggested by some previous scholars. Based on the preliminary outcome, further research directions are suggested, and recommendations are made to researchers and wiki software developers. In the long term, the study would contribute to a clearer image of Research Support System development.

IEEM17-P-0226
Outsourcing in Business and Management Studies: A Co-Citation Analysis
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2Ming Chuan University, Taiwan
3National Taipei University of Business, Taiwan
4National Chiao Tung University, Taiwan
Outsourcing is a critical issue for an enterprise in the past two decades. It extended from the local operation service to the global service and influenced enterprise decision making process. Companies need to create competitive advantage from cost reduction, especially via outsourcing their operational activities. The purpose of this article is to bring up a visual mapping of two-dimensional intellectual structure and to recognize the subfields of the outsourcing through co-citation analysis. In this study, we collected some papers from ISI Web of Knowledge (WoS) database in the outsourcing area. We rank the outsourcing documents by times cited and collect the top 60 articles. Also, we use multidimensional scaling (MDS) and clustering techniques (CT) to create the two-dimensional maps to show the intellectual structure of outsourcing dynamically. The conclusion would provide for the researchers’ reference.

IEEM17-P-0916
Applicability of Lean Product Development to a Company in the Marine Sector
Elisabeth SYNNES, Torger WELO
Norwegian University of Science and Technology, Norway
How can a marine company best combine people, process, and technology to optimize its Product Innovation system for advanced, complex products produced at low volumes? This paper discusses the possibility of using the Lean concept to improve the company’s product development system. The operational context of the case company is analyzed up against the framework of Morgan and Liker’s 13 Lean Product Development (LPD) principles. Our hypothesis is that although the business context of the case company is radically different from Toyota, several principles and practices will still be applicable once ‘contextualized’. A workshop was held with a multidisciplinary product team to assess the practices of the company relative to LPD. The team evaluated current company practices and desired future practices. The results are summarized and discussed herein. It is concluded that the original LPD principles have a varying degree of applicability to the context of the case company.

IEEM17-P-0021
The Effect of Service Quality Among Customer Satisfaction, Brand Loyalty and Brand Image
Kai-Fu YANG, Hao-Wei YANG, Wen-Yu CHANG, Huan-Kuang CHEN
Changyang University of Technology, Taiwan
The objective of this study was to assess the psychological and physiological dimensions of service quality, customer satisfaction, and brand loyalty of Taiwan’s Superdry, and to find out whether brand image has a positive moderating effect between service quality and brand loyalty. The findings from the study confirmed that service quality has a positive direct effect on customer satisfaction, as well as a customer satisfaction to brand loyalty and service quality to brand loyalty no matter in both psychological and physiological dimension. Moreover, brand image has a positively moderating effect between service quality and brand loyalty.

IEEM17-P-0167
Exploring the Role of Professional Development Motivation Between Work Values and Job Satisfaction
Jen-Chia CHANG, Kuei-Miao LIN
National Taipei University of Technology, Taiwan
This research probes the role of professional development motivation between work values and job satisfaction. Convenient sampling is employed to conduct questionnaire survey to the administrative staff of four private technological universities in northern Taiwan. The valid 242 data are analyzed using SEM (structural equation modeling) and the results reveal that work values significantly affect professional development motivation and job satisfaction respectively. The mediating effect of job development motivation between work values and job satisfaction shows a statistical trend toward significance. In addition, the strongest motivator of administrative staff professional development is “cognitive interest” orientation and “social relations” orientation takes second place. Implications for educational institutions, the university staff and future researches are discussed.
IEEM17-P-0400
A Game-Based Learning System to Disseminate Kanban Concept in Engineering Context: A Case Study from Risk-Based Inspection Project
Andika RACHMAN, R.M. Chandima RATNAYAKE
University of Stavanger, Norway
Engineering activities (e.g. design, analysis, and assessment) are characterized as knowledge works, which have intangible output/input and processes, as well as invisible work-in-process (WIP). Due to its invisibility, WIP in engineering projects has not received adequate attention, which hinders engineering companies from capturing the challenges associated with WIP management and optimization. The kanban concept has been proven to enable the management and optimization of WIP in the manufacturing industry. This concept has not been prominent in engineering type of activities and projects, due to the belief that it is applicable only to repetitive and physical production. This manuscript proposes the utilization of game-based learning to disseminate the importance of managing and optimizing WIP by applying the kanban concept in engineering projects. A game is developed to serve this purpose. A project related to risk-based inspection ( RBI) is selected as the case study for developing the game.

IEEM17-P-0644
Analysis of the A3 Report Template and Suggestions for Improvement
Swatisati TA, Laura Xiao Xia XU
Singapore Institute of Manufacturing Technology, Singapore
This paper studies the current difficulties lean team members face when creating and using the A3 report as a lean implementation tool. A study was conducted in a Singaporean manufacturing firm to observe problems faced when participants create, review and edit the A3 report. Problems observed include participants not creating action tasks, not recording identified problems, lack of collaborative root cause analysis, excess time spent on consolidating the Kaizen Newspaper, and excess time required to inform persons-in-charge of action tasks. Probable causes of difficulties observed are highlighted and case studies are referenced to propose possible features to mitigate these difficulties, such as sending tasks for review automatically, recording problems when identified, encouraging sharing of A3 reports, automatic updating of the Kaizen Newspaper, and automatic notifications for persons-in-charge of action tasks. A mobile application was suggested as the medium of the improved A3 report and developed. Preliminary testing of two features indicate that it can reduce time required to manage the A3 report by approximately 90%. Additional trials were suggested to support the proposed features in the improved A3 report.

IEEM17-P-0402
Influence of Parental Rearing Patterns on Academic Burnout: The Mediating Role of Psychological Capital and Self-Control
Yu-Mei HE, Tong LIU, Yi-Wen CHEN
Institute of Psychological University of Chinese Academy of Sciences, China
On the basis of resource conservation theory and self control resource model theory, the influence of parental rearing patterns on academic burnout of junior high school students is investigated to explore the mediating role of psychological capital and self-control, providing theoretical and practical basis for reducing academic burnout of junior high school students. Questionnaire method is adopted to test 197 students in certain junior high school of Beijing City. The data were analyzed by descriptive statistics, hierarchical regression analysis, AMOS data analysis, bootstrap and so on. The results show that:Parental refusal has positive correlation with academic burnout and negative correlation with psychological capital and self-control; parental emotional warmth has negative correlation with academic burnout and positive correlation with psychological capital and self-control; different dimensions of parental rearing patterns can influence students' academic burnout through the mediating role of psychological capital and self-control.

IEEM17-P-0082
Safety, Sustainability, and Consumers’ Perceived Value in Affecting Purchase Intentions Toward Organic Food
Shu-Yen HSU, Chiao-Chen CHANG, Tyorne F. LIN
National Dong Hwa University, Taiwan
This study aims to investigate the influence of the corporate social responsibility for environmental protection, consumers’ attitudes and purchase intentions toward organic food under the circumstances of global warming and frequent food safety problems. Samples are collected by questionnaires with a total of 177 valid questionnaires. The data are analyzed by Structural Equation Modeling (SEM) and the result shows that corporate social responsibility has a significant influence on consumers’ perceived value. Moreover, consumers’ perceived value and corporate social responsibility are the important factors of affecting consumers’ attitudes and purchase intentions. And consumers’ attitudes also has an indirect effect on food safety concern and purchase intentions. The results of the study would serve as reference for corporations to pursue economic benefit as well as to fulfill corporate social responsibility for the goal of sustainable management.

IEEM17-P-0089
Appraisal of Mask Manufacturing Information Security Based on ISO27001 and Common Criteria
Cynthia WANG, Eric GUO, Sammy CHEN, Sherry ZHU, Jason WU
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Information security management has become one of the key areas of organization management and customer audit, also has been concerned by more and more clients and third-part audit organizations. How to establish, implement, maintain and continually improve information security management system has become a big concern for enterprises to improve strategic management level.ISO27001 standards is an evaluation scheme of information security operational system. But ISO27001 is neither necessary nor sufficient to pass Common Criteria evaluation. This paper presents the difference and the relationship between ISO27001 Information Security Management System (IAMS) and Common Criteria which are popular in many semiconductor companies, and will find more benefits in information system management with these two types of certifications for semiconductor production process.

IEEM17-P-0143
Study on Hazard Identification Method for Life Cycle of Patch Board
Xia LIU, Bisong LIU, Wanjin TANG, Wu QIAN, Fei FEI
China National Institution of Standardization, China
For patch boards are widely-used, the consumer’s demands on safety of them become more and more strict. Therefore identifying hazards during the life cycle of patch boards with formal methods has played an important role on improving the products' safety level. In the paper, hazard identification during the design stage can adopt the comprehensive list of hazard. During the logistics stage, the hazard and operability study method were adopted. Hazard identification during the usage stage, adopted the method of failure mode and effect analysis based on analytic hierarchy process and the fault tree analysis method to find the primary causes and triggering conditions of the accidents. Hazard identification during the recovery stage adopted the fault hypothesis analysis method to analyze environmental harm caused by improper handling.

IEEM17-P-0215
An Improved Aircraft Landing Distance Prediction Model Based on Particle Swarm Optimization - Extreme Learning Machine Method
Silin QIAN, Shengyan ZHOU, Wenbing CHANG, Fajie WEI
Beihang University, China
Aiming at the problem that aircraft landing runway overrun, this paper proposed a landing distance prediction model based on improved extreme learning machine (ELM) with flight data. Particle swarm optimization (PSO) was used to optimize the input layer weights and the hidden element bias of a single hidden layer feedforward network. And then the optimal input weights and the implicit bias were applied to the ELM prediction model. Firstly, flight data is preprocessed with data slicing method based on flight height, and determine model input variables. Secondly, select the appropriate activation function. Subsequently, establish the PSO-ELM model of landing distance prediction. In the end, compare with traditional BP neural network and ELM under different evaluation indexes. The results show that the prediction of landing distance conforms to the actual measured data. The maximum absolute error is 45 meters, and the maximum relative error is 6%.
Light SIEM for Semiconductor Industry
Wu QINGRONG, Sherry ZHU, Eric GUO, Max LU
Semiconductor Manufacturing International Corporation, China
Information security is the foundation of enterprise information framework, and a strong enterprise information framework benefits business growth. Information security management system combined with business data can provide more effective service for enterprise. When IC production enters into the nanometer generation, more and more semiconductor manufacture companies have taken a lot of effort in information security area to prevent company information security. Lots of traditional security approaches are deployed, such as firewall, IDS, HIPS, anti-virus, DLP. But these products and applications like information islands, to protect sensitive data independently. This paper attempts to analyze semiconductor industry security requirements and to describe our practice on building up a high-performance Light SIEM. The Light SIEM system links with different security products and applications, correlates business data with information security management, and an effective approach to support enterprise information security management, including threat detection and security incident response and reports for compliance purposes.

An Efficient Intranet Architecture Scheme Based on Regional Function and Security Requirement in Semiconductor Manufacturing Enterprises
Fan SHUAIHE, Sherry ZHU, Eric GUO, Max LU, Wu QINGRONG
Semiconductor Manufacturing International Corporation, China
The use of information and communication technologies is growing rapidly [1], and information security requirements have risen to a new stage. When IC production enters into the nanometer generation, more and more semiconductor manufacture companies have taken a lot of effort in information security area to prevent company information security, especially at the network level. The network structure of the semiconductor manufacturing enterprise is complicated due to huge organizational structure, and there are easily potential risks come from threat or attack to network. In this paper, and a good practice of internal area network solution is presented. In order to guarantee the security of customer IC design data and foundry process knowledge, an effective functional security zones scheme is designed to enhance the security level of intranet and at the same time not to affect operation convenience and efficiency.

Big Data Analytics to Improve Photomask Manufacturing Productivity
Xiaoming FAN, Xuan ZHUI, Kuei Chi KUO, Cong LU, Jason WU
Semiconductor Manufacturing International Corporation, China
Driven by Moore’s law, the number of transistors fabricated on a wafer will be doubled every 12 or 24 months with a lower average selling price [1]. When IC production enters into the nanometer generation, many factors including recipe, process, tool, and chamber with the multi-colinearity affect the yield that are hard to detect and interpret. This paper describes both our practice on big data analytics to a real-time remote monitor mask production line, and how to monitor critical production machines’ parameters, and then setup an alert mechanism, all of which are helpful in improving production machine usage and production line productivity, and decreasing mask scrap.

Failure Mode Classification for Control Valves for Supporting Data-Driven Fault Detection
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Significant losses of production due to unplanned downtimes are a major problem caused by technical failures of equipment. Existing approaches like failure mode and effect analysis try to identify possible equipment breakdowns, their causes and effects in order to quantify the reliability of the system. Yet, they are not used for the detection of faults. On the other hand, Industry 4.0 and data mining aim to improve the total operating time of automated production systems. However, due to the complexity of automated production systems and the underlying physical phenomena, it is essential to formalize expert knowledge for usage during data analysis. In this contribution a classification table is proposed, in which the expert knowledge on failure modes, underlying parameters and detection features are summarized and presented. This knowledge is used to formulate appropriate detection models. The evaluation for detection of failure modes for control valves showed the usefulness of combination of expert knowledge and data-driven data analysis.

Development of an Entropy-Based Feature Selection Method and Analysis of Online Reviews on Real Estate
Hirotaka HORINO1, Hirofumi NONAKA1, Elisa Claire ALEMÁN CARREÓN2, Toru HIROAKA2
1Nagoya University of Technology, Japan
2University of Nagasaki, Japan
In recent years, data posted about real estate on the Internet is currently increasing. In this study, in order to analyze user needs for real estate, we focus on “Mansion Community” which is a Japanese bulletin board system about Japanese real estate. In our study, extraction of keywords is performed based on calculation of the entropy value of each word, and we used them as features in a machine learning classifier to analyze 6 million posts at “Mansion Community”. As a result, we achieved a 0.69 F-measure and found that the customers are particularly concerned about the facility of apartment, access, and price of an apartment.

Implementing the Balanced Scorecard in Excel for Small and Medium Enterprises
Antonio VIEIRA, Nuno SOARES, Sergio D. SOUSA
University of Minho, Portugal
Performance measurement is a way for organizations to be able to assess processes’ performance. The Balanced Scorecard (BSC) is one of the best-known performance measurement systems. However, many small and medium enterprises (SME) face problems when trying to implement these frameworks, due to software associated costs. In this context, this paper documents the work conducted to develop a low cost solution for SME. The solution consisted on implementing the BSC in an excel workbook. The created tool allows users to have a chromatic view over data and assess its quality, by introducing risk analysis, through the utilization of trails with different intensities, depending on the associated risk. Moreover, data is automatically recorded to allow traceability and dynamic charts were introduced to allow the analysis of different performance attributes.
Determining Golden Process Routes in Semiconductor Manufacturing Processes for Yield Management
Chang-Ho LEE1, Dong-Hee LEE2, Young-Mok BAE1, Kwang-Jae KIM3
1Pohang University of Science and Technology, South Korea
2Hanyang University, South Korea
Managing the yield of wafer is one of the most important tasks to the semiconductor manufacturers. A lot of efforts for enhancing the yield of wafer have been conducted in both industries and academia. Thanks to the advance of IoT and data analytics techniques, huge amount of process operational data, such as indices of process parameters, equipment condition data, or historical data of manufacturing process is collected and analyzed in real-time. Though the amount and availability of process operational data have been increased, existing yield management approaches on semiconductor manufacturing process have only considered a single process or few processes among the overall processes. This study proposes a way to find process routes which maximize the yield of wafer (i.e., golden process routes) in view of multiple process steps. This work is expected to complement the existing efforts for managing the yield of wafer by adding results of process-oriented analysis.

Nonparametric Variance Control Charts Based on Siegel-Tukey Test
Suyi LI
Beijing Institute of Technology, China
To monitor the process variance in a distribution-free way is important, but relative research is still in the literature. We propose some new nonparametric control charts based on Siegel-Tukey test. The proposed charts can detect shifts in process variance, and the in-control performance will not be affected by the underlying process distribution. We compare the out-of-control performance to the parametric control charts and the results are convincing. We also give a numerical example to show how the charts work.

Optimization of Machining Parameters for Ultrasonic Assisted Vibration-Grinding (UAVG) of Ultra-Low Expansion (ULE) Optical Glass Using Taguchi Method
Katwe MULENGA1, Bin GUO2, Xinyu FU3, Qingliang ZHAO4
1City University of Hong Kong, Hong Kong SAR
2Harbin Institute of Technology, China
Glass materials possess properties that are highly needed in various areas of today’s and future innovation applications. In this study, we concentrated on optimization of Ultrasonic Assisted Vibration Grinding parameters for Ultra-Low Expansion (ULE) optical glass using the Taguchi method. This material is of interest as it finds its applications in the space industry such as Hubble telescope. A hybrid process of grinding; Ultrasonic Assisted Vibration Grinding (UAVG) has been used in this work, an alternative to solve some problems with machining glass materials. We investigated the effects of control parameters; Feedrate, Depth of cut, Spindle speed, and Diamond grit size, on response variables; surface roughness and cutting force. Using Signal to Noise ratios (S/N) and Analysis of Variance (ANOVA), the machining parameters were optimized revealing that for Surface roughness had was more influenced by the spindle speed while diamond grit size influenced the cutting force.

The Panel Data Predictive Model for Recurrence of Cerebral Infarction with Health Care Data Analysis
Xiaohan LI, Wenxing CHANG, Shengan ZHOU, Fajie WEI
Beihang University, China
The paper has developed a predictive model for recurrence of cerebral infarction by analyzing the diagnostic data of cerebral infarction inpatient from health care system with the panel data regression method. The cerebral infarction has high morbidity, high disability and high mortality rate. It also has high relapse rates. The mortality rate of recurrent patients is much higher than its first onset. Which means the implementation of targeted prevention measures based on the prediction result may effectively reduce the mortality and invalidity. Finally, the paper analyzes the possible factors of the cerebral infarction recurrence. Then the study builds the initial predictive model with the panel-regression method. Finally, the proposed model is validated by empirical research to show the prediction effect. The accuracy of prediction result suggests the proposed model is feasible.
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Prime Taxi +65 6778 0808
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MRT Information Centre 1800 336 8900

Emergency Services
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Police Hotline 1800 225 0000
Fire & Ambulance Services 995
Ambulance Service 1777
(Non-emergency)
Emergency Road Service 6748 9911
(24h)
SUNTEC Singapore
Address: 1 Raffles Boulevard, Suntec City, Singapore 039593
Tel: +65 6337 2888

By Buses:
Bus Services: 36, 97, 106, 111, 133, 501, 502, 518, 857, 700

By MRT:
MRT stands for “Mass Rapid Transit”, and is Singapore’s train and subway system. Suntec Singapore is connected to the MRT network through several MRT stations.

The nearest MRT Stations are Esplanade Station (CC3) and Promenade Station (CC4/DT15) via the Circle Line which will bring you directly to Suntec Singapore.

Alternatively, take the MRT to City Hall Station (NS25/EW13), followed by a five to ten minutes walk via an underpass to Suntec Singapore.

Walking from MRT station
• 1 min from Promenade and Esplanade MRT
• 5 - 10 mins from City Hall MRT
TRANSPORTATION IN SINGAPORE

Singapore has one of the most extensive & efficient public transportation systems in the world. With the Mass Rapid Transit (MRT) trains, buses & taxis, travelling in the city and suburbs can be a quick and affordable affair. For a comprehensive guide that includes offline maps, estimated prices & time, download free smartphone app Singapore Map by Street Directory Pte Ltd from Google Play or Apple App Store. If you are using a Blackberry, you can still visit www.streetdirectory.com for the same services.

Train (MRT)
The MRT is a fast and cost-effective way of getting around Singapore. You can take the MRT from Changi Airport Terminal 3 to the city for a just couple of dollars. (If you are arriving at Terminal 1, 2 or 4, you can take the Skytrain to Terminal 3.) If your hotel is not walking distance from any MRT station & you wish to save some dollars on transport, you can consider taking the MRT to the nearest MRT station before taking a taxi. Services operate from about 5:30am and usually end before 1 a.m. daily.

Bus
There are currently more than 300 bus services which run daily from 5.30 to midnight. The suggested app above will direct you to the exact bus-stop and the number to take.

Taxi
Taxis ply the island round the clock, bringing you wherever you want, anytime you want. However, do note that airport, peak-hour, city area & Electronic Road Pricing (ERP) gantry surcharges apply.

The hotlines for various taxi services in Singapore, are also listed below.

Comfort and City Cab    +65 6552 1111
Premier Taxis           +65 6363 6888
Prime Taxi              +65 6778 0808
SMRT Taxis              +65 6555 8888
TransCab                +65 6555 3333
MRT Information Centre  1800 336 8900

Uber and Grab services are also available in Singapore.
Singapore, the tiny sunny island, named after a legendary lion that could have been a Malayan tiger instead, is an exciting little cultural potpourri of mainly Chinese, Malays & Indians, not to mention the influx of new immigrants from the rest of the world in the recent years. Smaller than a full-stop on the world map, only 761.1km² in size, Singapore has a bewitching concoction of activities & attractions to fill up your time after your conference.

**Merlion Park**
A picture with Singapore’s most iconic national mascot, the Merlion (a half-lion, half-fish), is the best proof of “You’ve Been Here” & best of all, it is free to visit! Pose with the Merlion before taking a walk into the restored colonial architecture Fullerton Hotel which used to be Singapore’s General Post Office, built in 1928. Another interesting restoration nearby is the Fullerton Bay Hotel which incorporated buildings that used to be part of the bustling Collyer Quay. Do make sure you also take a shot of the Esplanade, the durian shaped architecture unique to Singapore.

**Marina Bay Sands**
Another icon of Singapore’s skyline would be the most expensive to build integrated resort in the world – the Marina Bay Sands. Other than taking a photo of the iconic resort, there are various attractions worth visiting in Marina Bay Sands including the Shoppes at Marina Bay Sands mall, a museum, two large theatres, seven “celebrity chef” restaurants, two floating Crystal Pavilions, an ice skating rink, and the world’s largest atrium casino with 500 tables and 1,600 slot machines.

**Gardens by the Bay**
Spanning 101 hectares, Gardens by the Bay comprises three waterfront gardens – Bay South, Bay East and Bay Central. An exemplary showcase of horticulture and garden artistry, the Gardens will bring the world of plants to Singapore and present Singapore to the world. Get up close with a wide variety of plant species from around the world in the iconic cooled conservatories, marvel at the Supertrees vertical garden, or discover the intricacies of plant life at the themed gardens. In this horticultural oasis nestled in the heart of the city, there’s so much to explore!

**Geylang**
If you want to taste some good food while experiencing the seedy side of the clean & safe Singapore, just head down to the red-light district – Geylang. With neon lights marketing China Chinese cuisine, sleazy nightclubs & adult shops lighting up the main street, Geylang is the place where you can find cheap & exotic foods like frog legs in congee or a very expensive crab bee hoon (rice vermicelli) in a grimy restaurant listed by celebrity chef Anthony Bourdain as one of the 13 places to eat before you die.

**Clarke Quay**
Clarke Quay exudes a charming mix of modern and traditional. From a humble fishing village, it developed into a busy seaport and is now a popular spot for dining and nightlife. Five blocks of restored warehouses house various restaurants and nightclubs. Notable restaurants and nightclubs include Hooters and Indochine. To get a dose of adrenaline rush, hope onto the G-Max Reverse Bungy. For a calming cruise along Singapore River, hop onto the River Taxi.

**Chinatown**
Chinatown is Singapore’s oldest ethnic district rich in culture and history. Chinatown Street Market is a one-stop shopping dining and entertainment hub in Chinatown where visitors will come across numerous Chinese Medical halls, teahouses, eateries and also handicrafts. To learn more about the history of Chinatown, be sure to visit the Chinatown Heritage Centre.
Master of Science in Engineering Management (MSEM)
理學碩士 (工程管理學)
Full-time (1 Year)/Part-time (2 Years)
Programme Code: P56

Master of Science in Statistical Engineering and Data Analytics (MSSEDA)
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Programme Code: P70
Industrial engineers have traditionally focused on improving performance of an entire system while keeping in mind productivity, quality, cost, safety, sustainability, and product or service enhancement.

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That is why SMU Curricula are constantly refreshed with innovative and pragmatic initiatives across all levels of undergraduate, postgraduate, doctoral programmes and lifelong learning.

Our research-friendly culture also creates a rich environment that supports multi-disciplinary initiatives. One example is the Centre for Research on the Economics of Ageing, established to enhance retirement readiness, understand the needs of an ageing population and to shape policies that make a difference.

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