

BOOK OF ABSTRACTS OF THE
PRODUCTION AND OPERATIONS MANAGEMENT SOCIETY (POMS)
INTERNATIONAL CONFERENCE SRI LANKA 2018



**Book of Abstracts of the Production and Operations Management Society (POMS)
International Conference Sri Lanka 2018**

Editorial Committee

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Dr. Ruwan Navarathne
Dr. Aruna Manipura
Dr. Kanthi Perera
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Message from the POMS president



It is with great honor and pride that I welcome you to be part of the 2018 POMS Sri Lanka International Conference! I have been heavily involved with Production and Operations Management Society since the very beginning, seeing the trajectory of the society's growth towards its impressive scale and impact until today. We have been a society that is always inclusive to embrace rigor, challenge, innovation, change, and diversity, which have made us successful in the last three decades, leading our way to be the most important society for research and practice of production and operations management. Having witnessed the evolution of the society, I must say that every new global outreach through international conferences and engagement of scholars from all over the globe have becoming a new height for POMS. I am particularly excited to include Sri Lanka, my birth place, into our wing of international venues for POMS events.

Organizing a conference of this quality and magnitude requires a substantial effort from a dedicated group of volunteers who have donated tremendous amount of their time to make this conference a success. On behalf of POMS, I would like to express my deepest gratitude and thanks to Convener of the steering committee of POMS 2018, Kandy Sri Lanka, Dr. Chanaka D. Senanayake and the Conference Chair Dr. Asela K. Kulatunga for their dedication to this conference. Furthermore, I would like to extend my sincere thanks to all the organizing committee members of the conference.

As I mentioned earlier, POMS has always been an inclusive society, continuously expanding our boundaries to enhance our presence and impact. This conference is taking place at a particularly exciting time, when we are in a new era for exciting new technologies, data analytics and the need for global coordination for climate control and sustainability. We are at a time to expand our boundaries on developing new models and methodologies for applications in these exiting areas. I am sure that you will find invoking thoughts on how the need for sustainability is reshaping various domains and industries in our field from our esteemed keynote speakers and conference presenters.

I am looking forward to seeing and welcoming all of you in Kandy, Sri Lanka!

J. George Shanthikumar
Richard E. Dauch Chair in Manufacturing and Operations Management
Distinguished University Professor of Management
Krannert School of Management
Purdue University



Message from the Vice Chancellor



I am pleased and privileged to forward this message as the Vice Chancellor of University of Peradeniya on the occasion of POMS2018, International Conference, Sri Lanka to be held on 14th – 16th December 2018. We are very grateful to POMS - USA for having collaborated with us to organize this conference in Sri Lanka for the very first time. I am sure that this conference will create a platform for local and international participants to share their experiences and exchange new knowledge and recent developments in the field of Production & Operations Management and Industrial Engineering. It is very important to advance research in this field because of two reasons; First, Operations Management is directly relevant to several industries in the country, including the logistics sector, manufacturing sector, and services sector. Secondly, it is necessary to educate and upgrade those who are working in this field that will help them to take up leadership positions in the corporate sector so that they can effectively face future challenges caused by modern technology, as well as changing environmental and market conditions while staying relevant to current and future trends.

I am happy to note that POMS 2018 Sri Lanka is a joint venture between a number of professionals, institutions and especially three faculties of University of Peradeniya namely, Engineering, Science and Management. While congratulating the Organizing Committee of POMS 2018, I convey my very best wishes to make this event a grand success.

Prof. Upul B. Dissanayake
Vice chancellor
University of Peradeniya



Message from the Dean



It gives me great pleasure to welcome all delegates to the Production and Operations Management Society (POMS) International Conference 2018, at Kandy. This conference is organized by the Department of Manufacturing and Industrial Engineering; Faculty of Engineering, University of Peradeniya in collaboration with Departments of Engineering Management and Engineering Mathematics; Faculty of Engineering, Department of Computer & Statistics; Faculty of Science and Department of Operations Management; Faculty of Management of University of Peradeniya, Sri Lanka.

It is well known that the manufacturing sector of a country can play a key in driving its economy. At a time when Sri Lanka is striving hard to achieve the status of a developed country, an international event of this nature focusing on the latest R&D and modern technological innovations related to manufacturing processes and its management is a timely requirement for the country. This conference will be a golden opportunity for researchers and industry players to enrich their knowledge in industrial production and operations both during the presentations and through the networking amongst the experts. With many renowned foreign and local researches, industrialist and managers participating in the event, I wish all of you a very productive gathering and hope that all shall seize the opportunity offered by the POMS 2018 to further expand and develop each potential research and knowledge to the fullest.

Let me take this opportunity to thank the conference chair and the organizing committee for their tireless commitments making this event a success. I hope all foreign delegates will take this opportunity to have some time out to visit our beautiful university which is among ten most beautiful universities in the world and to explore Kandy a UNESCO World Heritage city with many cultural and scenic places to visit. Finally, I wish all participants a happy stay in Sri Lanka.

Prof. G. B. B. Herath
Dean
Faculty of Engineering
University of Peradeniya



Message from the Programme Chair



We are proud to host the first POMS International Conference in Sri Lanka during December 14-16 at the beautiful Amaya Hills Hotel Kandy. Production and Operations Management is a broad area which is relevant to many industries of the country. This is a great opportunity for local academics and professionals working in the logistics, manufacturing and service sectors in particular to network with international experts in this field and enhance their knowledge.

The Institution of Engineers Sri Lanka and the Chartered Institute of Logistics and Transport, Sri Lanka joined as Technical Co-Sponsors of POMS 2018 Sri Lanka, while the University of Peradeniya and IEEE Sri Lanka Chapter also contributed as Technical Co-Sponsors of the event.

POMS 2018 Sri Lanka comprises of technical sessions and workshops. Most POMS conferences worldwide invite submissions mainly in abstract-only format. Apart from abstract submissions, we also encouraged authors to submit full papers for this event. There were 60 abstract-only submissions, with 50 of them being from authors affiliated to international universities/institutions. Out of these, 58 of them were accepted to be presented at POMS 2018 Sri Lanka.

The full paper submission format was of about 6-8 pages in length on IEEE template. The Easy Chair system was used for handling of submissions, allocating reviewers and communicating reviews and decisions. Each submission was assigned to at least 3 reviewers who were experts in the field, in a double-blind review process. 96% of the reviewers were PhD holders while the rest were Master's holders. 70% of the reviewers were affiliated to local universities and institutions while 30% of the reviewers were affiliated to overseas universities. Each paper was scanned for plagiarism and were reviewed by the Editorial Committee after revision. This way, the highest standards of paper review were upheld. There were 67 full paper submissions in total with 39 of them from foreign universities and institutions. After undergoing a rigorous review process, only 38



of the full papers were accepted. Therefore, the acceptance rate was just below 57%, which was well in par with IEEE standards.

As Programme Chair, I would first like to thank the members of the programme committee, Dr. Ruwan Navarathne, Dr. Aruna Manipura, Dr. Kanthi Perera, and Dr. S. Maheswaran for their excellent support. Secondly, I would like to thank the panel of reviewers, both local and international who sent very valuable comments and never compromised the quality of reviewing. Finally, I thank all authors who submitted to POMS 2018 Sri Lanka, both in abstract form and full paper format and congratulate those whose papers were accepted to be submitted to IEEE Xplore.

C.D. Senanayake, PhD
Programme Chair – POMS 2018 Sri Lanka



Message from the Conference Chair



It is with great pleasure that I write this message as the Conference Chair of POMS International Conference Kandy, 2018. This is one of the unique and memorable occasions to Sri Lanka as this is the first time a leading international conference in the field of Operations Management will be held in this region. With the profound reputation among the Production and Operations Management professionals and academia towards POMS, we are very much fortunate to get this golden opportunity to host it in Sri Lanka at a picturesque venue, Hotel Amaya Hills at one of the world heritage cities, Kandy. We are very much thankful to the steering committee of POMS for keeping their faith in us and providing this opportunity to host this event. This is a golden opportunity for local academics and professionals working in the logistics, manufacturing and service sectors in particular to network with international experts in this field and enhance their knowledge. This conference contains many activities: Keynotes from global academia, technical paper and abstract presentations, workshops oriented towards graduate students and industrial participants and roundtable discussions on national issues such as logistics in Sri Lanka with the participation of all stakeholders. I would like to extend my sincere gratitude to the technical co-sponsors University of Peradeniya, The Sri Lanka Chapter of IEEE, The Institution of Engineers Sri Lanka, the Chartered Institute of Logistics and Transport, Sri Lanka who joined with us to organize POMS 2018, Sri Lanka. Furthermore, I would like to extend my sincere gratitude to all the members of the steering committee of the conference, local advisory committee and the scientific committee for their valuable advice and guidance to organize POMS 2018, Kandy – Sri Lanka. The contributions from sponsors of the event also need to be acknowledged and those contributions supported greatly to organize the event at this level. The editorial committee headed by Dr. Chanaka Senanayake has done tremendous work to complete all the reviewing and editorial work successfully and to submit accepted full papers to IEEE Xplore in future. This kind of event could not be organized without the invaluable volunteer works of many individuals who have served in various sub-committees. My sincere gratitude goes



to all the co-chairs of sub committees including Dr. Chanaka Senanayake (Editorial & Fund Raising), Dr. Risheeka Ekanayake (Financial), Pramila Gamage (Programme), Dr. Chamila Walgampaya (Logistics), Mr. Namal Bandaranayake (Audio visual), Mr. Malan Jayawickrama and Ms. Leeza de Siva (Inauguration) and all the other staff members from all the departments of three faculties: Engineering, Science and Management of University of Peradeniya for their excellent support.. Furthermore, I would like to extend my sincere thanks to all student volunteers and nonacademic staff members for their untiring efforts rendered to organize this event.

I wish all the delegates will have a very productive time at POMS and hope they will take the time to enjoy the environment of our sacred city Kandy and the cultural diversity of Sri Lanka.

Asela K. Kulatunga, PhD

Conference Chair – POMS 2018, Kandy – Sri Lanka





Keynote Speakers

1. Prof. David Yao
Columbia University, New York, USA
2. Prof. Chelliah Sriskandarajah
Texas A&M University, College Station, Texas, USA
3. Prof. J. George Shanthikumar
Purdue University, Indiana, USA
4. Prof. Jose Arturo Garza-Reyes
University of Derby, Derby, UK
5. Prof. Fazleena Badurdeen
University of Kentucky, Lexington, KY, USA
6. Prof. Saman Halgamuge
University of Melbourne, Melbourne, Australia
7. Prof. Sushil Gupta
Florida International University, Miami, FL, USA
8. Prof. Yan Houmin
City University of Hong Kong, Hong Kong





Prof. David D. Yao

Piyasombatkul Family Professor

Industrial Engineering and Operations Research

Columbia University, New York, USA

Bio: David D. Yao is the Piyasombatkul Family Professor of Industrial Engineering and Operations Research at Columbia University, where he is the founding chair of the Financial and Business Analytics Center at Columbia Data Science Institute. His research and teaching interests are in applied probability and stochastic systems, focusing on resource control and risk management issues. Author/co-author of over 200 scientific publications, he is a principal investigator of over thirty grants and contracts from government agencies and industrial sources, and a holder of eight U.S. patents. His honors and awards include the Presidential Young Investigator Award from the National Science Foundation, Guggenheim Fellowship from the John Simon Guggenheim Foundation, Franz Edelman Award from the Institute for Operations Research and Management Sciences, SIAM Outstanding Paper Prize from the Society for Industrial and Applied Mathematics, Outstanding Technical Achievement Award from IBM Research, Great Teacher Award from the Society of Columbia Graduates, and the IBM Faculty Award. He is an IEEE Fellow, an INFORMS Fellow, and a member of the National Academy of Engineering. He currently serves on the Board on Mathematical Sciences and Analytics of the National Academies of Science, Engineering and Medicine.



Presentation Title: Minimizing Misclassification Cost in Machine Learning, with Probabilistic Guarantees

Abstract: Motivated by healthcare associated infection (HAI), which is estimated to cost US hospitals \$9.8 billion per year, we develop a machine-learning (ML) based scheme to administer patient-targeted preventive measures upon admissions to the hospital. The model involves two interlaced optimization problems. At the top is a cost minimization problem that explicitly accounts for the asymmetry between the cost of missing an infection (type 1 error) and the cost of a "false alarm" (type-2 error), the former (real cost to the hospital) could be order-of-magnitude higher than the latter (minor expenses for certain preventive measures). The infection probabilities used in the cost model are solutions to a cross-entropy (CE) minimization problem that fits data with a suitable ML algorithm (e.g., logit regression, random forest, deep neural network, etc). Here, the challenge is to deal with the intrinsic bias in data: infected cases are only around 1-2% of all patients. Our approach is to add a weighting (or "oversampling") coefficient to the CE objective and make it a decision variable too, in the same spirit as a Lagrangian multiplier. An algorithm is developed to iterate between the CE minimization and the cost minimization until the two are jointly optimized. We show the optimal classification scheme has a threshold structure similar to the Neyman-Pearson test. We also provide convergence and rate-of-convergence results, in the form of distribution-free probabilistic guarantees on the (minimized) misclassification cost, using a variation of the Dvoretzkey-Kiefer-Wolfowitz bound (as refined by Massart). We illustrate the performance of the model with real data from several largest hospitals in New York City. (Joint work with Elioth Sanabria, and in collaboration with Columbia University Medical Center.)





Prof. Chelliah Sriskandarajah

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Station, Texas, USA

Bio: Chelliah Sriskandarajah is a professor of Operations Management and holds the Hugh Roy Cullen Chair at the Mays Business School, Texas A&M University. He obtained B.Sc. Engineering Degree in 1977 from University of Moratuwa, Sri Lanka, and Master of Engineering Degree in Industrial Engineering and Management in 1981 from Asian Institute of Technology (A.I.T.) Bangkok, Thailand. He has a Ph.D degree (1986) from the National Polytechnic Institute of Grenoble (France) in the field of Production Management. His research interests lie in the general area of supply chain management, logistics, production planning and scheduling, and performance evaluation of production/ service systems. He was inducted as a POMS fellow in April 2012, the most prestigious honor awarded by the Production and Operations Management Society. He won Ricky W. Griffin Research Excellence Award in 2015 from Mays Business School, Texas A&M University. His 2011 paper in *Interfaces* was named a finalist for the Wagner Prize for Excellence in Operations Research Practice. He has published over 120 scholarly articles in leading international journals, and 32 articles have appeared in four top-tier journals in Operations Management field. He currently serves as Department Editor of POM journal and Associate Editor of MSOM, and is a member of professional societies: INFORMS, MSOM and POMS. He has served as the Associate Executive Director of POMS from March 2004 to April 2012.



Presentation Title: Novel Operations Problems Arising from Practical Applications

Abstract: In this talk, I will discuss three novel operations problems that I have encountered during my interaction with companies in the USA. The first problem occurs in the area of currency supply chain management. The Federal Reserve of the U.S. introduced its new currency recirculation policy in July 2007 with the aim of reducing the overuse of its currency processing services by depository institutions (banks). The aim of this policy is to minimize the societal cost of providing currency to the public. I will discuss the main elements of the policy and outline novel operational issues that have emerged due to its implementation. In this context, I will also discuss recent work performed with various parties involving the currency supply chain. The second problem involves in the oilfield services industry where I consider a supply chain planning problem via efficient cross-docking. In a typical supply chain setup of this industry, the companies ship raw materials to an international location (typically a Free Trade Zone), which serves as the stock consolidation point for the region, break-bulk and then ship to field locations (oil excavation sites also called plants). In this research, the consolidation points are hybrid cross-docks (HCD), where raw materials can be stored free of cost for a specific period of time. The supply chain problem involves minimizing the total inbound and outbound transportation costs and the inventory management costs at the cross-docking facility and the plants. In this research, I demonstrate the use of a modeling approach that not only meets this need for this specific industry, but also has the potential to be applied to other industries with similar supply chain structure. Finally, I will discuss my work with a Dallas-based manufacturer of robotic cells for the semiconductor industry. The throughput of a cell (i.e., the number of finished parts produced per unit time) critically depends on the sequence of actions of the robot(s). Over the past several years, I have developed theories and concepts to devise efficient optimization algorithms for such sequencing problems for a variety of robotic cells. These algorithms, which are typically programmed in the control mechanism of the cell, have significantly improved productivity in practical implementations.





Prof. J. George Shanthikumar

Richard E. Dauch Chair of Manufacturing and
Operations Management

Distinguished Professor of Management
Purdue University, IN, USA

Bio: J. George Shanthikumar is the Richard E. Dauch Chair Professor of Manufacturing and Operations Management and a University Distinguished Professor of Management at the Krannert School of Management, Purdue University, West Lafayette, IN and a Professor Emeritus of Industrial Engineering and Operations Research at the University of California, Berkeley, CA. Before joining Purdue, he was a Chancellor’s Professor of Industrial Engineering and Operations Research at the University of California, Berkeley, CA. He received the B. Sc. degree in Mechanical Engineering from the University of Sri Lanka, Peradeniya, and the M. A. Sc. and Ph. D. degrees in Industrial Engineering from the University of Toronto, Toronto, Canada. He is the president of POMS for the year 2018, is a Fellow of the Institute for Operations Research and Management Science (INFORMS) and Production and Operations Management (POM) Societies.



Presentation Title: Data Integrated Operations Management with Operational Data Analytics (F. Qi and J. George Shanthikumar - Krannert School of Management, Purdue University)

Abstract: This talk will review the current data integrated approaches for prescriptive solution to stochastic optimization problems in operations management. In particular we will review approaches such as Multi-Armed Bandit, Regularization in Sample Average Approximation and Data Driven Robust Optimization for generating prescriptive solutions to operations management problems. We will then provide a framework for data integrated methodology for prescriptive analytics for stochastic systems. Specific attention will be paid to overcoming structural and statistical errors. This is achieved through Operational Statistics and Objective Operational Learning which are built on the basis of data integration and cross validation. We will illustrate how, 1) regularization in sample approximation approaches and data driven robust optimization with cross validation relates to Operational Statistics, and 2) multi-armed bandit and machine learning approaches compares to Objectives Operational Learning. Applications in pricing and revenue management, inventory control, queueing systems design and staffing in service systems will be demonstrated.





Prof. Jose Arturo Garza-Reyes

Professor of Operations Management and
Head of the Centre for Supply Chain Improvement
College of Business, Law and Social Sciences
University of Derby, UK

Bio: Jose Arturo Garza-Reyes is a Professor of Operations Management and Head of the Centre for Supply Chain Improvement at the University of Derby, UK. He is actively involved in industrial projects where he combines his knowledge, expertise and industrial experience in operations management to help organizations achieve excellence in their internal functions and supply chains. As a leading academic, he has led and managed international research projects funded by the European Commission, British Academy, British Council and Mexico's National Council of Science and Technology (CONACYT). Professor Garza-Reyes has also published four books in the areas of operations management and innovation, manufacturing performance measurement and quality management systems. He is Co-founder and current Editor of the Int. Journal of Supply Chain and Operations Resilience (Inderscience), Associate Editor of the Int. Journal of Production and Operations Management, Associate Editor of the Journal of Manufacturing Technology Management and Editor-in-Chief of the Int. Journal of Industrial Engineering and Operations Management. Professor Garza-Reyes has also led and guest edited special issues for Supply Chain Management: An International Journal, Int. Journal of Lean Six Sigma, Int. Journal of Lean Enterprise Research, Int. Journal of Engineering Management and Economics, and Int. Journal of Engineering and Technology Innovation. Areas of expertise and interest for Professor Garza-Reyes include general aspects of operations and manufacturing management, business excellence, quality improvement, and performance measurement. He is a Chartered Engineer (CEng), a certified Six Sigma-Green Belt, and has over eight years of industrial experience working as Production Manager, Production Engineer and Operations Manager for several international and local companies in both the UK and Mexico. He is also a fellow member of the Higher Education Academy (FHEA) and a member of the Institution of Engineering Technology (MIET).



Presentation Title: The Contribution of Industrial Engineering and Operations Management towards Environmental Sustainability – A Review of Concepts and Methodologies

Abstract: Over the years, rapid industrialization around the globe has, on one hand, improved quality of life, whereas on the other hand, it has also had a significant negative effect on our environment. This has contributed for the phenomenon of environmental degradation arguably being one of the biggest challenges currently faced by mankind and the planet. In this scenario, governments, organizations, and societies in general have tried to take action to address this problem by formulating, developing, implementing and encouraging environmentally friendly policies, technologies, working practices and behaviors. In particular, the Industrial Engineering and Operations Management profession has made a relevant contribution to address the environmental degradation challenge by proposing and adapting concepts and methodologies that have been deployed by organizations to not only achieve traditional objectives such as profitability, efficiency, customer satisfaction, quality, and responsiveness but also a better environmental performance. This key note speech emphasizes the relevance of the environmental degradation challenge and reviews some of the wider concepts that have been proposed to tackle it. In particular, the talk delves into the concepts and methodologies that have been adapted and proposed by the Industrial Engineering and Operations Management fields to improve the environmental performance of companies' operations.





Prof. Fazleena Badurdeen

Professor of Mechanical Engineering

Director of Graduate Studies,

Manufacturing Systems Engineering, University of
Kentucky, Lexington, KY, USA

Bio: Dr. Fazleena Badurdeen is a Professor in the Department of Mechanical Engineering at the University of Kentucky (UK) and serves as the Director of Graduate Studies for the online Manufacturing Systems Engineering MS Program. She is also a core faculty at UK's Institute for Sustainable Manufacturing. Dr. Badurdeen's research interests are in sustainable product design, modeling and analysis of manufacturing systems and supply chains including the development of tools and visualization techniques to support decision making in these areas. Dr. Badurdeen's research has been funded by federal agencies such as the Department of Defense, National Science Foundation, and the National Institute for Standards and Technology as well as companies including GE Aviation, GE Transportation, and Coronado Mines. She has published over 150 peer reviewed papers and her team has received numerous accolades for their research. She is the founding Chair of the International Forum on Sustainable Manufacturing, is an Associate Editor for the Resources, Conservation, and Recycling journal, and serves on the editorial boards of a number of other journals. She is a member of the Institute of Industrial and Systems Engineers (IISE) and the Society of Manufacturing Engineers (SME). Dr. Badurdeen received her PhD in Integrated (Industrial and Mechanical) Engineering and MS in Industrial Engineering both from Ohio University, USA. She also holds an MBA from the Postgraduate Institute of Management, Sri Lanka and BS in Engineering from the University of Peradeniya, Sri Lanka.



Presentation Title: Manufacturing in the Sharing Economy: Opportunities and Challenges

Abstract: The sharing economy business model where the emphasis is on providing customers a service, or access to using goods, rather than selling the product, has gained popularity in recent years. The approach provides an opportunity for peer-to-peer sharing of less utilized assets through a community-engaged online platform. Given changing consumer preference to gain access over ownership, and a generation willing to embrace the concept, some estimates project an even more significant growth of this business model in the next decade. The sharing economy has already become a disruptive force in several industries such as tourism and transportation. As with any new business model, the sharing economy can also present opportunities and challenges for the manufacturing industry. Increased consumer product sharing can challenge the conventional business model where corporate success and profitability depends on the sale of product ownership. On the other hand, an industrial sharing economy can offer manufacturers novel opportunities for optimal use of under-utilized assets. Further, with shared spaces for design/prototyping and manufacturing, new comers to the manufacturing industry may no longer be limited by lack of asset ownership, a key a barrier to entry. This presentation will provide an overview of the developments in the sharing economy and examine the challenges imposed on the manufacturing industry. Strategies deployed by progressive companies to overcome those challenges and to leverage the opportunities offered by the sharing business model, as the digital and physical manufacturing environments converge rapidly, will also be presented.





Prof. Saman Halgamuge

Professor of Mechanical Engineering,

School of Electrical, Mechanical and Infrastructure
Engineering,

University of Melbourne, Australia

Honorary Professor of ANU College of Engineering and
Computer Science, The Australian National University,
Australia

Bio: Saman Halgamuge, Fellow of the IEEE, is a Professor in the Department of Mechanical Engineering of the School of Electrical, Mechanical and Infrastructure Engineering of University of Melbourne, an honorary Professor of Australian National University (ANU) and an honorary Member of ANU Energy Change Institute. He was previously the Director/Head of Research School of Engineering of Australian National University (2016-18), Professor, Associate Dean International, Associate Professor and Reader and Senior Lecturer at University of Melbourne (1997-2016). He graduated with Dipl.-Ing and PhD degrees in Data Engineering (“Datentechnik”) from Technical University of Darmstadt, Germany and B.Sc. Engineering from University of Moratuwa, Sri Lanka. He is an Associate Editor of BMC Bioinformatics, IEEE Transactions on Circuits and Systems II and Applied Mathematics (Hindawi). His research that led to 260 publications has been funded over the last 22 years by Australian Research Council (16 grants), National Health and Medical Research Council (2 grants), industry and other external organisations (13 grants or contracts) and funding to support stipends for about 50 PhD students. His research contributions are in AI and Data engineering, which includes Data Analytics based on Unsupervised and Near Unsupervised Learning and Optimization focusing on applications in Mechatronics, Energy, Biology and Medicine.



Presentation Title: Optimization & Data Analytics Applied to two problems in Smart Cities (Simon Dustall and Saman Halgamuge)

Abstract: A framework for learning algorithms and real options optimization underpinning the various projects of the two speakers including some collaboration between them is presented. A paradigm shift can be observed in wide-ranging application domains such as energy management, disaster management, environmental aware transport modelling, mechatronics and the broader spectrum of design, which are empowered by rapidly advancing technologies that can generate large quantities of “imperfect” data for analysis of processes and compounds. These technologies have been spurred by the improvements in processor technology (e.g. GPU) that have allowed practitioners and researchers to overcome the computational limitations of many algorithms. It is an irreversible trend that more people are opting to move to cities and creating smart cities has become common practice. It will reduce the congestion in already existing cities and a road network connecting these cities is essential to support the regional economic growth hence the sustainable population growth in the newly created cities. Given the model of animal migration, it is possible to minimize the damage to animals living in the region where the roads are being built. Recent work completed by Nick Davey in collaboration with the speakers demonstrates the feasibility of planning such networks [1,2]. In collaboration with A/Prof Guillermo Narsilio (University of Melbourne), Dr Julian de Hoog (IBM Research Lab Australia) and the speakers, Hansani Weeratunga has been investigating on how management of multiple energy sources can be made efficient in smart cities through optimization [3]. Some of the results from this study will also be reported.





Prof. Yan Houmin

Dean (College of Business)

Chair Professor of Management Sciences

City University of Hong Kong

Hong Kong

Bio: Professor Houmin Yan is Chair Professor of Management Sciences and Dean of the College of Business at the City University of Hong Kong. Prior to joining CityU, he served as Professor at the Chinese University of Hong Kong, and as Associate Director and Science Advisor for the Hong Kong R&D Center for Logistics and Supply Chain Management Enabling Technologies. He has also worked as a tenured Associate Professor at the School of Management, University of Texas at Dallas.

Professor Yan's main research areas are stochastic models, simulations, and supply chain management. He has published in journals such as *Operations Research*, *Manufacturing and Service Operations Management*, *IIE Transactions*, *Production and Operations Management*, *Journal of Optimization: Theory and Applications*, and *IEEE Transactions*. Professor Yan's work has won widespread recognition. In 2004, his paper (co-authored with Gan and Sethi) "Coordination of Supply Chains with Risk-Averse Agents" (*POM*, Vol. 13, 2004, 135 -149) received the Wickhan-Skinner Best Paper Award from the 2nd World Conference on Production and Operations Management and the Society of Production and Operations Management (POMs). In 2005, his paper (co-authored with Lee and Tan) "Designing An Assembly Process with Stochastic Material Arrivals" (*IIE Transactions*, Vol. 35, 2003, 803-815) has been awarded the Best Paper Award for "the focus issues on Operations Engineering for 2003-2004" from the Institute of Industrial Engineers(IIE). In 2012, his paper (co-authored with Buzacott and Zhang) "Risk Analysis of Commitment-Option Contracts with Forecast Updates" (*IIE Transactions*, Vol. 43, 2011, 415-431) has been awarded the Best Paper Prize in in Scheduling and Logistics from the Institute of Industrial Engineers(IIE). He received his B.S. and M.S. from Tsinghua University and his Ph.D. from the University of Toronto.



Presentation Title: Belt and Road Initiative and Global Supply Chain

Abstract: In the past 30+ years, globalization has resulted in the evolution in the global supply chain powered by the development of information and communication technology, and China’s economic development. The Belt and Road Initiative (BRI) expands the ever-changing networked global economy to new dimensions with profound opportunities and challenges. One of the key components of BRI is the call for a greater connectivity, which includes financial facilitation, transportation, and infrastructure development. We study the evolution of Asian supply chain networks and further develop the notions of supply chain master and supply chain host. With characterizations of supply chain master and supply chain host, we discuss successful factors of these two supply chain modes. Moreover, with our long time follow up and field studies of major investments in Asia, Africa, and Europe, China Merchandise, one of the largest state-owned Chinese corporations, we plan to articulate opportunities and challenges for Hambantota International Port Group, Sri Lanka, as a supply chain host.





Prof. Sushil Gupta

Professor

Department of Information Systems and Business
Analytics College of Business

Florida International University

Miami, FL, USA

Bio: Dr. Sushil K. Gupta is a Professor in the College of Business, Florida International University (FIU), Miami, Florida, U.S.A. Dr. Gupta has also served FIU as Vice Provost, Academic Affairs, and Associate Dean, College of Engineering. Dr. Gupta is an honorary professor at Universidad Ricardo Palma, Lima, Peru. Dr. Gupta is a highly esteemed scholar in the field of Production and Operations Management. His research interests include disaster management, healthcare, mathematical modeling, project management, supply chain management, and e-business. Dr. Gupta is one of the founding members of the Production and Operations Management Society (POMS) and has played a key role in its initiation, development and growth. He was POMS Vice President for Member Activities (1994), POMS President (1996) and is currently serving as its Executive Director (since 1997). He also serves on the advisory board of Production and Operations Management – the Flagship Journal of POMS, POMS Board and on the Board of POMS College of Humanitarian Operations and Crisis Management. Dr. Gupta holds Bachelor of Technology in Mechanical Engineering from Indian Institute of Technology, Bombay, India, M.B.A. from Faculty of Management Studies (FMS), University of Delhi, India, Master of Applied Sciences in Industrial Engineering from University of Toronto, Canada, and Ph.D. from FMS, University of Delhi, India. Dr. Gupta was elected a POMS Fellow in 2004. POMS also bestowed the honor on Dr. Gupta by awarding him the first POMS Distinguished Service Award in 2012. This award, starting in 2013, is renamed as the Sushil K. Gupta POMS Distinguished Service Award to honor Dr. Gupta for his dedicated services to POMS.



Presentation Title: Managing Disasters – Contributions of POM Research

Abstract: In this presentation, I want to share the academic research for managing disasters. For researchers in the fields of Production and Operations Management, Industrial Engineering, Operations Research/ Management Science and Logistics this presentation is expected to generate ideas for future research. Disaster Management is a relatively new field for researchers in these fields. This presentation is based on a review of the research published in major journals in these fields. Disasters can be categorized as natural or man-made. Natural disasters occur due to natural phenomenon like hurricanes, tornadoes, floods, and tsunamis etc. Man-made disasters are created by human beings due to terror and error. Terror subsumes terrorist activities and errors lead to industrial and transportation (air, rail and ship) accidents. Managing disasters need collaborative and cooperative efforts by professionals from all disciplines like: business executives, engineers, scientists, IT experts, doctors and social scientists. Not only a multi-discipline effort, disaster management is a multi-agency endeavor requiring joint efforts of public and private organizations at local, national and international levels. Nonprofit humanitarian organizations also play an important role. The goals of managing disasters are to save lives and reduce human suffering. We also study the relevance of disaster management research from the perspective of disaster management organizations. We define a “disaster domain” based on function, time and type of disaster and a “solution domain” based on data type and data analysis technique. Administrators will find disaster domain of interest whereas the researchers’ focus will be on solution domain.



List of Abstracts



Benefits of complex event processing and predictive analytics in transportation and logistics - result of a systematic literature review

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Abstract

In the light of ubiquitous availability of sensors and the related increase of data streams, complex event processing and predictive analytics have gained traction in several business areas. Particularly transportation and logistics processes with their large number of involved parties appear to be viable application fields for these promising technologies. Apart from the progress in pure technical developments, determining suitable application areas and identifying represent open research field have remained open research questions. By addressing these questions, the awareness for the business benefits of the technologies is raised among both developers and vendors of solutions and potential users. By knowing about the benefits of the technologies, the economic sense of an adoption and a careful examination of the suitability to different application areas can be evaluated reliably. The research article presents the results of a structured literature review of articles about the application of the above-mentioned technologies in various areas of transportation and logistics as well as a distribution of the benefits described therein. Based on the findings from research, a collection of those benefit categories that stem from the use of complex event processing and predictive analytics and are relevant to transportation and logistics is developed. As this collection is based on findings from theory, the benefits need to be validated by practitioners before eventually developing a reference model.

Keywords- Logistics, Predictive Analytics, Complex Event Processing, Transportation, Supply Chain Management, Benefit Assessment



Impacts and challenges of 3D printing implementation in supply chains: A systematic literature review and case study

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Abstract

Three-dimensional (3D) printing is considered as one of the disruptive technologies. It has the potential to change the way supply chains operate and are managed. The objective of this paper is to investigate the current trend of 3D printing research in the context of supply chains and identify the impacts and challenges of 3D printing implementation in supply chains by using the current literature and employing a case study. To locate the relevant articles pertaining to 3D printing and supply chain management we conduct a systematic literature search amongst the academic journals until October 2017. This search process produced a total of forty two articles relating to impacts and challenges of 3D printing on supply chains. Using the selected literature we identified 13 impacts and 11 challenges which are then analyzed under the DEMATEL framework to assess the relationships between impacts and challenges and develop policies for implementation. Results show that three most important impacts are on flexibility and simplicity in manufacturing, mass customization and quick response, whereas, the most critical challenges are cost and raw materials, requirement of new skills, and production in high volume.

Keywords- 3D printing, Case study, DEMATEL, Supply chain



Reverse logistics models for the collection of waste electrical and electronic equipment: The Brazilian case

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Abstract

In 2010, the legislation regarding the Brazilian Policy of Solid Waste (BPSW) was introduced in Brazil. It is the legal framework for solid waste management that differentiates what is recyclable from what is not. The BPSW features innovations such as Reverse Logistics (RL) which determines that manufacturers, importers, distributors and retailers must perform the collection of used packaging and products like batteries, light bulbs, electronics, etc. The aim of this paper is to propose a framework that helps indicating which would be, among the National Collective and Clearing House models used in European countries, the most suitable scheme for reverse logistics of Waste Electrical and Electronic Equipment (WEEE) according to the Brazilian reality. For this purpose, the paper analyses the existing literature and various relevant practices used in Europe. Moreover, data regarding the Brazilian environmental legislation and the characteristics of each state were used to evaluate the possible use of the European reverse logistics models. The framework helps to define the Brazilian case in three stages and suggests that the most suitable model for Brazil is the National Collective. This decision is urgent since it has been proposed that many European countries should also implement this model instead of the currently employed. Finally, a structured framework is proposed, facilitating the decision-making process to be carried out by various stakeholders such as the Brazilian Federal Government, municipal authorities, industries, recyclers and service providers. In this way, the WEEE management and logistics organization would be easier in the Brazilian territory.

Keywords- Reverse Logistics, Recycling, Framework, Model, WEEE, Brazil



An integrated warehouse design and optimization modelling approach to enhance supply chain performance

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Abstract

In spite of the globalization and high customer demand, the performance of a company is evaluated by means of value for money created at the least cost. As a critical component of the supply chain, warehouses are faced with immense pressure to fulfil the above expectation. However, major part of this challenge can only be influenced at the design of a warehouse. Many studies have been published on the diverse set of approaches in optimizing a warehouse design; however, these lack practical attributes. Therefore, the objective of this paper is twofold. In the first phase the study bridges the gap by a thorough systematic review of literature to identify and assess the warehouse design parameters and the associated factors and in the second phase develops a comprehensive warehouse design framework to facilitate decision making to enhance overall supply chain performance.

Keywords- warehousing systems, distribution center layout design, Supply Chain Performance



A Sustainable Vehicle Routing Problem for Indian Agri-Food Supply Chain Network Design

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Abstract

The agri-food supply chain network design plays a significant role in the economy of the country. The existing traditional agri-food supply chain (AFSC) network in India is a vast supply chain which has been operating haphazardly in an unstructured manner. The system is basically controlled by various intermediaries; this is leading unsustainable and inefficient supply chain in terms of time and money. The most affecting factor in the agri-food supply chain goes in credit of the unorganized manner of transportation from the farmers to the nearest food hub (market) wherein, they sell their products. This process has been a major bottleneck in terms of profitability to the farmers wherein the transportation costs are the major contributor to the overall costs. In traditional Indian AFSC, geographically dispersed individual farmers bring their product into the market for selling. In this phenomenon, they have to pay higher transportation cost. Therefore, we propose the vehicle routing for the collection of products from farmers to the hub. A single period vehicle routing model is developed to form an optimum travel route incurring minimum costs and allowing a pool of products (from the farmers) supply to reach the destination hub. Genetic algorithm (GA) and particle swarm optimization (PSO) is used to solve the proposed mathematical model and validated on a practical case scenario of the central part of India

Keywords- Agri-Food supply chain, supply chain network design, multi-depot vehicle routing.



Factors that drive green procurement implementation and its impact on firm performance: An Indian study

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Abstract

Environmental pollution and degradation is a pressing concern for most environmentally-conscious firms, globally. No business entity can focus solely on making profits without concern for the environment. Like any other business function (production or logistics), procurement by organizations can also play a pivotal role in making the environment less harmful. Though some scholars in the western world have paid some attention on the role of green procurement on the environment, limited research exists in the emerging economies. Based on review of the current supply chain management literature, a structured questionnaire was prepared to examine the various factors that influence the adoption of green procurement initiatives in India. It further explored the relationship between the level of green procurement adoption and various parameters of firm performance. Using web-based field-survey, data was collected from eighty manufacturing firms (large, medium, small), and analysed using multivariate data analysis. The first finding of the research indicates that external factors (competitive pressure for green products, supplier collaboration) and internal factors (management support, organizations' own concern for environmental issues) were positively related to adoption of green procurement initiatives. The second find indicates that adoption of green procurement had positive linkages with various parameters of firm performance: financial, operational, social, environmental and market related. The first finding validates the work of other scholars, albeit in the Indian context. The second finding adds value to the limited body of research that currently exists on green procurement practices on firm performance in India.

Keywords- Green Procurement, Green Supply Chain



Textile manufacturing in Sri Lanka

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Abstract

Based on an ethnographic study of textile workers in Sri Lanka, we report operational differences in textile operations between Sri Lanka and the West. An overall introduction to the industry is also provided.

Keywords- National Culture, Religion, Textile



Supply management & ethical decision making: A behavioral experiment

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Abstract

Supply managers and executives are under direct pressure to perform. Top management and external constituents expect supply management to reduce spend in order to bolster profitability. Thus, they may institute a compensation structure that motivates supply managers and executives to restraint spend. To exacerbate the situation, supply managers and executives may get tempted to stray from ethical behavior due to the large amount of money they handle and due to lucrative but often unethical actions by sales personnel. This research uses a lab experiment approach to examine whether the reward structure and other salient factors (such as context, motivation, and personal characteristics) have an effect on ethical behavior. Specifically, we posit that the beneficiary of a bonus (the individual who undertakes the decision, or the group/organization), the timing (in the near future - next paycheck, or in about a year – at the anniversary of contract), and the safety of the product (low, or high probability of failure that can result in injury or even death) may impact ethical behavior. The participants included about 2,000 subjects that completed the assignment on two different administrations, spread one week apart



Optimal procurement contracts under hidden information and actions about supply disruptions

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Abstract

We consider a single period problem where a buyer sources from a supplier whose reliability is private information and, therefore, the supplier's effort to improve reliability is unobservable (hidden action). We study the buyer's optimal procurement contracts. Compared with centralized system where no hidden information and actions is considered, we find that the supplier receives lower incentive and thus exerts less effort, and consequently an unreliable supplier is more likely to be excluded from the market. Owing to hidden information and actions, we find that a more reliable supplier is motivated to exert a higher level of effort. Moreover, we consider a backup option to either the supplier or buyer, and we interestingly find that the backup option always makes the supplier worse off and the buyer better off.

Keywords- Disruptions



The Sustainable Forward and Reverse Supply Chain Network Design for New and Refurbished Products

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Abstract

In recent trends, the customer's satisfactions are a major concern to the E-commerce companies and immense growth in the selling of finished and refurbished products in the online market. Nowadays, the customers' have two choices to go for the refurbished products and new products on the basis of available budgets. For this, E-commerce companies focused to develop the forward and reverse logistics supply chain network design within the same time horizon, so that transportation cost could minimize and will not cause major effects on the final selling cost of products. Therefore, E-commerce logistics service providers starving towards to design the sustainable multi-period supply chain network design. To address the complexity associated with E-commerce logistic company, this paper studies the forward-reverse supply chain network design with customer pickup and demand facility within the promising time horizon as per GPS module. We have developed a MINLP model to minimize the total transportation cost associated with forward and reverse supply chain network and minimize the demurrage cost due to Earliness and tardiness in the network. The Factory algorithm and fish swarm optimization are proposed to solve and validate the model. The computational Experiment shows the comparative chart for all practical case studies.

Keywords: forward reverse logistics, refurbished products, multi modal transportation, meta-heuristic



Optimal fleet assignment using ant colony algorithm

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Abstract

Demand for logistical services is highly dynamic, due to its high market growth. In Bangladesh, air logistics is evolving at a fast pace, both in terms of passenger and cargo transportation. As a result, several local private and international airlines are trying to capture market share in this promising sector. For survival in such tough competition, optimization in operations is indispensable. This research focuses on the optimal fleet assignment with Ant Colony algorithm. In this rapidly expanding market, short to mid-term demands of passengers were estimated using regression analysis. Then, from a database of routes and aircraft capacity, a model was developed to estimate profitability from fleet assignment with relative ease. Finally, ant colony algorithm was used to find the optimal assignment. Although previous researches on fleet assignment were done using Genetic algorithm, only current-level of demand for logistical service was considered. This research considers it as dynamic and projected into the future. The results obtained in this research show that dynamic demand consideration gives much better results as well as better utilization of resources. And these contributed to the reduction of operational cost as well as the increase in revenue. As a result, profit was optimized. For mid-term and long-term projection, demand becomes gradually probabilistic. However, this research considered it as deterministic; otherwise, the problem becomes an NP-hard problem, which is difficult to solve. This research is expected to be of immense help to the air industry of Bangladesh. Because of similarity in business nature, this can be marginally adapted in other countries as well.

Keywords- logistics; fleet assignment problem; ant colony algorithm



Multi criteria decision making techniques to select appropriate renewable energy technology for microgrid perspective

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Abstract

This research presents the appropriate renewable micro grid power generation for Northern Province, Sri Lanka. Micro grid is a small-scale power generation that can operate independently or in conjunction with electrical grids. Since Sri Lanka is moving towards rapid industrialization and the development of infrastructure, energy demand is keeps on increasing every year this will be further aggregated when urban railway transportation is also electrified within next 5 years. According to Ceylon Electricity Board and Provincial Council reports, it is clear that the electrification level is low and the grid connectivity is in a weaker position in Northern Province. One of the easier and sustainable ways to cater to the electricity demand to this region is to incorporate micro grid connectivity with renewable energy sources. Northern Province investment plan report recommends that the Wind and Solar are the appropriate renewable energy resources due to the fact that Northern Province has an extensive coastal line and is sunny for most of the year. However, there are enormous Biomass resources available and it can be cultivated in available abundance of bare land. There are a number of factors affecting this renewable energy selection process. Therefore, this has to be analyzed and solved as a Multi Criteria Decision Making Process. In this study, Analytical Hierarchy Process, Fuzzy-AHP and TOPSIS method are used to find the most suitable energy source out of the three: Solar, Wind, and Biomass. The results shows that the solar micro grid power generation is the best choice and the Biomass as the second.

Keywords- Micro grid, Multi Criteria Decision making, Renewable energy source



Factors influencing the effective information sharing in Sri Lankan export-led manufacturing supply chains

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Abstract

Supply chain management strategies focused on enhancing information sharing in supply chains are capable of making a huge impact on the overall supply chain with the advanced development of information and communication technology. Hence, Sri Lankan export-led manufacturing industry can be benefited from these strategies to take advantage of the rapidly growing phase of the market. In doing so, it is vital to understand the requirements that maintain effective information sharing flow within this industry. Therefore, the purpose of this study is to analyse the management perspective of the industry in deriving the factors which affect the effective information sharing in Sri Lankan export-led manufacturing supply chains. This study further shows that proper functioning of information sharing creates a significant impact on the Sri Lankan export-led manufacturing supply chains. Exploratory factor analysis was used to identify six major factors which influence the effective information sharing in the supply chain: (1) barriers to effective information sharing flow, (2) quality of the information sharing platform, (3) security level of the information sharing flow, (4) resource availability for the information sharing operations, (5) top management's concern, and (6) level of alignment of the information sharing platform with external members of the supply chain. Since a similar study has not been carried out in this area with respect to Sri Lankan context, the key findings of this study can act as guidelines for the Sri Lankan export-led manufacturing industry to select the most suitable strategies in order to enhance the supply chain information flow.

Keywords- information sharing, exploratory factor analysis, supply chain management



The challenges of GSCM implementation in the UK manufacturing SMEs

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Abstract

The importance of green supply chain management has long attracted the interest of both researchers and practitioners in the industry. As environmental concerns are becoming one of the major issues discussed in the 21st century, countries with manufacturing as its principal economy contributor are always on the lookout for innovations and new approaches to balance both environmental considerations and profit making. The UK, being one of the top manufacturing countries in the world already considered green initiatives among their manufacturers. According to reports from the industry, large and international manufacturing companies from the UK have successfully implemented some green initiatives with significant improvements across the supply chain. However, the adoption of green initiatives is mainly focused on large companies rather than the real backbone of the UK manufacturing industry, which is the small and medium-sized enterprises (SMEs). This paper therefore sets out to determine the implementation level of GSCM among the SMEs. The paper adopts a mixed methods based approach and findings are based on 57 survey responses and 5 semi-structured interviews from the UK manufacturing SMEs. The findings show that the level of GSCM implementation among the UK manufacturing SMEs is low compared to large organisations. Cost of implementing green supply chain management (GSCM) practices emerged as a key challenge faced by the UK manufacturing SMEs which was followed by the lack of knowledge within the organisation. This study thus adds to the limited literature on the manufacturing SMEs and provides evidence from the UK manufacturing sector on the adoption of GSCM practices.



Business view on the development of an industrial plant-wide optimization tool

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Abstract

Process industry faces a strong need to increase product quality and reduce operating costs and environmental footprint. A plant-wide monitoring and control mechanism is a requirement for achieving economically and environmentally efficient operation. The Coordinating Optimization of Complex Industrial Processes (COCOP) -project's objective is to define, design and implement a concept that integrates existing industrial control systems with efficient data management and optimization methods and provide means to monitor and control large industrial production processes. This paper looks at the COCOP development from the business perspective of a copper-smelting pilot case. Business Model Canvas and Business Environmental Map methodologies were used in pilot case workshops for studying potential business models and business environment related to COCOP solution.

Keywords- Optimization, Modelling, Business model, Business environment



A novel learning heuristic applied for computationally hard managerial decision making and transportation operations control

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Abstract

Planning and scheduling transportation operations is considered computationally hard and time demanding. We consider a complex network of interconnected links across a set of locations and a set of vehicle movements on these links to fulfil some traffic demands. In such a set-up, basically two types of computational solutions are sought: one is decision making, if a link (and / or a vehicle) is to be included in a route and second, is computation of a specific time duration during which a link and a vehicle are allocated to fulfil a traffic demand. Such planning efforts are undertaken at a strategic level. At the operational level, the planned schedules are executed. For any unforeseen reasons, if a planned schedule gets disrupted, while en-route, the entire planning efforts turn futile. Using an available approach to reschedule disrupted transportation services, we developed a learning architecture that is capable of learning and creating a knowledge base from the solved instances of disruption resolution. When a new disruption happens, the learner deduces the applicability of any solved instances in the knowledge base to quickly resolve the disruption. If not, the disruption is resolved completely and the resolution is added to the existing knowledge base. The combined abilities of the agents based architecture include monitoring, identification, deduction, decision making, and resolution execution, by learning, storing solution seeds and facilitating quick resolutions. The architecture and the application were developed using JADE on Ubuntu OS; The agent architecture and empirical results are presented in this paper. Our proposed architecture is faster than traditional methods and novel as an evidence of agent capabilities in solving real life complex problems.

Keywords- learning, agents, matching, confidence level



Size matters, so does duration: The interplay between offer size and offer deadline

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Abstract

This paper investigates the interplay between offer size and deadline in a Stackelberg game involving a proposer and responder. The proposer acts first by making an offer with a deadline to the responder who, concurrently following a continuous finite-horizon search for alternative offers, has to respond to the proposer's offer by the deadline. The responder's strategy is captured by a "reservation value policy" that depends on both the proposer's offer size and deadline and the distribution of alternative offers. Taking this into account, the proposer's optimal strategy can vary from an exploding offer—an offer that has to be accepted or rejected on the spot—to an offer with extended deadline under different market conditions, proxied by characteristics of the alternative offer distribution. In particular, the proposer should offer an exploding offer when the alternative offer market is unfavorable to the responder, and the harsher it is, the smaller the offer size. On the other hand, when the alternative offer market is favorable to the responder, the proposer can profit from making a smaller (compared to the exploding offer) non-exploding offer, and the more favorable the market, the smaller the offer size and the longer the deadline. Finally, our analyses in cases where only the offer deadline or offer size is at the proposer's disposal contribute additional insights into similar real-world practices. Interestingly, our results indicate that when the proposer is only allowed to manipulate offer size, the optimal offer size first decreases then increases in the given offer duration.

Keywords: search theory, ultimatum, offer size, offer deadline, mean residual life order



A review on the impact of process energy on the environmental performance of milling

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Abstract

Manufacturing by material removal processes leaves a significant environmental footprint caused by the energy and resources consumed, and releases. Thus, there is an increased attention on sustainable manufacturing methods. This leads to quantification of environmental performance of manufacturing processes to direct preventive measures for promoting green manufacturing. Milling is a widely used machining method in conventional manufacturing. The objective of this review is to investigate the significance of energy consumption in milling machining to their environmental footprint. The review shows that process energy consumption leaves a significant environmental footprint and suggests operations related improvements to reduce the energy consumption for the better environmental performance of milling.

Keywords- Milling, Energy Consumption, Environmental Sustainability.



Benchmarking wholesale stores productivity using data envelopment analysis

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Abstract

The retail landscape in India is undergoing an exponential growth, and with increase in organized retailing, it is expected to contribute more to the GDP and employment in the coming years. Key factors behind this tremendous growth are rising incomes and lifestyle changes by middle class, fast urbanisation, and increasing digital presence of customers. In a retail supply chain, key functions of a wholesaler are to improve retail supply chain efficiency, helping sellers to reach retailers more effectively, break-bulk and to serve as an extended warehouse for distributors. Many researchers have worked towards increasing the productivity of retail stores, warehouses and manufacturing plants, but very few have focused their attention towards wholesale business. The purpose of this paper is to measure the productivity and efficiency of the selected Indian wholesalers through benchmarking. A DEA model is developed and results are analysed for different case settings. Findings will enable wholesalers to identify the best business practices and key areas for their performance improvement.

Keywords- supply chain, benchmarking, data envelopment analysis (DEA), productivity, performance, optimization



Teammate selection and performance in online crowdsourcing competitions

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Abstract

Crowdsourcing technologies and platforms allow individuals who are typically unaffiliated with an organization to organize through digital platforms and find solutions to vital business problems. Many organizations successfully use this web-based business model to find creative solutions to their problems. These problems are generally from a diverse range of disciplines, including marketing, product development, and customer service. Despite the popularity of crowdsourcing, not many studies have investigated how solvers organize into teams in these competitions. Crowdsourcing teams are different from traditional organizational teams, for they are not only global and virtual but also self-organizing. Moreover, these teams compete against each other for a reward. Thus, while teaming in crowdsourcing can enhance the odds of winning, it also means that members now incur a cost of sharing the reward. We empirically explore answers to the following research questions: 1) How do solvers select their teammates in crowdsourcing competitions? 2) How do the differences and similarities among team members influence the performance of the team? Specifically, we investigated how language similarity, skill distance, tenure disparity, past collaborations, and geo distance play a role in teammate selection and team performance. We test our hypotheses using a large dataset from an online crowdsourcing platform. Our preliminary results indicated that geo distance, language similarity, and past collaborations play a role in team member selection decision while skill distance, tenure disparity, language similarity, and past collaboration have a significant impact on team performance. The findings have strong implications for both theory and practice.

Keywords- Crowdsourcing, Virtual teams, Self-organizing team



Remanufacture for sustainability: A review of the barriers and the solutions to promote remanufacturing

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Abstract

Remanufacturing is the only end-of-life process where used products are brought back to the Original Equipment Manufacturers' (OEM) performance specification from the customers' perspective. At the same time, it offers a warranty equal or better to that of corresponding new products. During this process, products are returned to their original state with minimum waste of material and energy. Moreover, the benefits of remanufacturing are not only limited to ecological aspects but also it provides a win-win situation for both the customer and the remanufacturer. Nevertheless, remanufacturing systems are inherited with more complex production planning and control activities due to the difficulties and uncertainties in product take-back compared to traditional manufacturing. The purpose of this review is to identify the main barriers of remanufacturing. Identified barriers are categorised according to the triple helix of the innovation model. The paper also reviews the solutions provided in the rest of the world in addressing the barriers of remanufacturing.

Keywords- Remanufacturing, Product recovery management, Sustainable manufacturing.



Factors affecting the sustainability of SME industries: A case study in the southern province of Sri Lanka

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Abstract

The Small and Medium Enterprises' (SMEs) growth in Sri Lanka is negatively affected by several factors such as lack of financial management, education facilities for the SMEs, less technological support, social issues, obstructive legal policies, limited financial support schemes, and problematic ethical factors. The current study is focusing on the Southern Province of Sri Lanka since it was noticed that the relative dominance of these factors is different compared to the other Provinces in Sri Lanka. This project focuses on evaluating fundamental factors required for developing a strong foundation for emerging sustainable SMEs and comparison of these factors statistically, and qualitatively in SMEs of the Southern Province of Sri Lanka. The coordination of the research was comprised with literature review, questionnaires, interviews and inspection analysis to provide information for solutions. The studies in legal policies, balance maintenance on asymmetrical knowledge, political stability, capital strength, organization morale, technical background were analyzed on countries such as USA, India, and China, and also on well-established Provinces in Sri Lanka like the Western and Central Provinces, which eventually provided us with a good contrast. These data were used to investigate the shortcomings of SMEs in the Southern Province and showed an overall result that 53% of SMEs have failed due to above factors. The study can also be expanded to a wider picture to answer factors affecting the sustainability of SMEs in Sri Lanka compared to other nations. The research will provide valuable insights to support the growth of SMEs in the Southern Province of Sri Lanka.

Keywords- Problematic issues of SME, SME Industries in Southern Province, Sustainability of SME



Simulating cutting line of a furniture industry

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Abstract

Furniture manufacturing is getting more and more competitive due to shorter product life cycles and ever-increasing customer demand. As a result, furniture manufacturers often need to re-engineer their production lines to satiate the preferences of different consumers. One of the key challenges here is the expense to re-engineer the production lines and to analyze the development of a new product or a customization on an old product. In today's progressive manufacturing system, simulation of a production line can be invaluable in making re-engineering decisions. With the help of simulation, it is possible to accurately model engineering processes before making drastic changes. In this paper, a simulation model of the cutting line of a furniture manufacturing industry is developed and presented. The resultant model facilitated in identifying two configurations of machine sets. The first one maximized the machine utilization and the second one minimized the waiting time of parts in the queue. The variations of these performance parameters for different batch sizes are also illustrated.

Keywords- Simulation, Arena, furniture manufacturing, machine utilization, optimization



A game theoretic approach to assessing additive manufacturing as a strategic choice

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Abstract

This paper studies the impact of demand uncertainty and competition on a firms' technology selection decision between Additive Manufacturing (AM) and conventional tool-based Dedicated Manufacturing (DM). The paper uses game theory to model n competing firms in two markets to help them make three sequential decisions under demand uncertainty: (i) choice of technology, (ii) capacity investment, and (iii) production quantities. We adopt the solution concept of subgame-perfect equilibrium to compute the expected profit of each firm given the technology profile in the market. We then compare how competing firms respond to a given flexibility premium (AM) under demand uncertainty. We find that the conventional wisdom of choosing between flexible manufacturing technology and dedicated tool-based technology holds in the case of AM given there is no demand uncertainty. However, once we take the demand uncertainty into account, a game-theoretical analysis is essential to examine the profitability of switching manufacturing technologies to AM. The research will contribute towards developing an industrially accessible decision support tool for the adoption of AM in a production environment.

Keywords- Additive Manufacturing; 3d Printing; Dedicated Manufacturing; Tool-based Manufacturing; Game theory; Technology Choice; Technology Selection; Decision Support tool



Commitment Mechanism and Auditing for Enhancing Supplier's Compliance to Sustainability Code of Conduct

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Abstract

We model a supply chain in which the buyer audits the supplier's compliance with the code of conduct. We investigate the effect of buyer's upfront commitment to price and quantity on supplier's compliance. We also analyze implications of raising the standard of code of conduct on sustainability and financial performance.

Keywords- Sustainable business practices, Sustainability code of conduct, Auditing,



Cluster-based vehicle routing optimization approach for pharmaceutical supply chains (PSC)

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Abstract

This study concentrates on Vehicle Routing Problem (VRP) for Pharmaceutical Supply Chains (PSC), as the challenges faced by the global medicinal drug prices increase annually and efficient VRP approaches are needed, to reduce the cost of drugs on patients while improving the medical service levels. The study offers a two-fold solution approach i.e. simulation-based solution approach along with an exact mathematical optimization approach, to arrive at a minimum transportation cost, solving the VRP for PSC. It utilizes five product characteristic-based clusters and uses test cases from literature and benchmark instances from CVRPLib repository. The simulation models are developed using the SupplyChainGuru® modelling and simulation platform. The baseline VRP model is compared with the cluster specific VRP models and, trade-off analyses have been carried out to evaluate transportation costs of dedicated cluster-based VRPs versus pooled cluster-based VRP models. In the second phase, the aforementioned clusters are formulated as mathematical models and are solved using CPLEX. Subsequently, the simulation-based results are compared with the exact mathematical results to carry out a detailed comparison and validation. Outcomes of the study yield dynamic VRP models with minimum total transportation cost and trade-off analyses of the most optimal pools of clusters to be transported together.

Keywords- Pharmaceutical Supply Chains (PSC), Optimization techniques, Vehicle Routing Problem (VRP)



Determinants of automated teller machine loading demand requirements in Sri Lankan cash supply chains

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Abstract

Physical cash is a regular exchange medium and the most liquid asset, which is accepted all around the globe. It is vital to study on cash logistics in developing countries with the continuous expansion of commercial bank branches and Automated Teller Machine (ATM) network. The cash supply chain is a valuable product flowing supply chain. The Central Bank Statistics of Sri Lanka (2017), indicates exponential growth in ATM transaction value from 2013 to 2017 and 8.58% increment of ATM terminals in 2017 compared to 2016. Sri Lanka is bearing a physical cash economy and attitudes towards money is different from foreign countries. This study has been conducted to answer the main question of what is the most suitable forecasting technique to predict ATM cash demand in Sri Lanka, this study has been conducted. The entire research is conducted on customer perspective. Based on literature survey, direct interviews with bank managers and customer survey findings, the location of the ATM, income status of the user, day of the week, salary day, weather condition and holidays have been identified as the determinants of ATM cash withdrawal decision. The most contributory holidays are Sinhala and Hindu New Year (lasts more than 10 days), January New Year season and Christmas season. Mondays and Fridays are recorded as the days with highest cash withdrawals. Rain has a negative impact on ATM cash demand. Out of regression and time series analysis techniques, time series analysis is recognized as the best method to develop a forecasting model for a selected ATM.

Keywords- Supply Chain, cash logistics, Automated Teller Machine Operations, Cash Demand Forecasting Model, Multiple Regression, Time Series Analysis



Development of a social life cycle assessment framework for manufacturing organizations

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Abstract

Modern manufacturing organizations have started to adopt sustainable manufacturing strategies to enhance their competitiveness and to enrich their business practices at an enterprise level. This is achieved by creating a balance between the environmental, economic and societal dimensions of sustainability. Life Cycle Assessment (LCA) is one of the approaches of sustainable manufacturing that models the complex interaction between the aforesaid dimensions of a product, from cradle to grave. LCA can be performed as Environmental Life Cycle Assessment (E - LCA) and Social Life Cycle Assessment (S -LCA) considering the need and contribution of stakeholders involved. Very few studies have focused on the Social LCA part and no concrete research has been reported on the development of a generic Social LCA framework for manufacturing organizations. This study presents the development of a generic framework for conducting Social LCA for manufacturing organizations. The developed framework is a two-level model consisting of first level stakeholders and second level sub-categories. The model consists of three first level stakeholders and nine second level sub categories. Three impact categories namely Working Conditions (WC), Health and Safety (HS), Socio-economic repercussions (SE) were selected for this study. The framework was validated with a case study conducted at a manufacturing organization. The results of the assessment are discussed to obtain inference. The developed framework would be useful for manufacturing organizations for conducting Social LCA and to augment their societal dimension of sustainability.

Keywords- Sustainable Manufacturing; Life Cycle Assessment; Manufacturing Organizations; Life Cycle Assessment; Social Life Cycle Assessment



A conceptual framework to assess the applicability of agile manufacturing techniques

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Abstract

Agile manufacturing has emerged as an extension to lean manufacturing to increase the quickness, flexibility, responsiveness, and the competence in the manufacturing facilities. The agility drivers can be used to investigate the necessity of being agile in the business environment. When the agile manufacturing techniques are implemented and agility is achieved, the identification of existing capabilities of the industry has to be done first. Afterwards the missing capabilities can be identified and those have to be acquired. The objective of present study is to develop a conceptual framework to assess whether the industry is required to be agile and capable enough to implement agile manufacturing techniques. In achieving it, a content analysis was performed using available literature and the industry experts were interviewed. The propositions that have been introduced by the present study could be tested and validated by future researchers to draw theoretical and managerial implications of the proposed conceptual framework.

Keywords-agile manufacturing, agility drivers, agility enablers, capabilities



Simulation model to analyze logistics behavior in Megapolis context: megacity logistics of Sri Lanka

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Abstract

Due to heavy urbanization and industrialization, Colombo - the commercial capital of Sri Lanka is gradually being transformed into a Megacity. Having experienced the consequences of unplanned and non-systematic nature of freight transportation in Colombo city, authorities have come up with a megacity development strategic plan- The Western Region Megapolis Master Plan. This initiative aims to reduce drawbacks associated with inland freight transportation in urban areas. It focuses on a two – tier transportation network structure where the freight is consolidated and value added at hub locations via planned highway network and transported to the port for shipping. In this scenario, the transportation structure which connects the consolidation hub with the port and different spokes of the network can be considered as the elementary operational unit of this logistics framework. For the optimization process of this scenario, simulation-based optimization can be utilized in order to predict the future operational performance of the proposed logistics plan. Having identified the elementary operational unit of functionality in the developed logistics framework, a computer based simulation model of the elementary unit is developed using Arena software by Rockwell Automation and validated in order to predict the performance of the two-tier transportation network. This quantitative model has the capability to provide strategic decision-making ability to analyse different scenarios, in terms of traffic congestion, road network utilization and the impact of different truck type combinations for the purpose of truck fleet optimization.

Keywords- Megacity Logistics, Megapolis, Inland Freight, Two-tier Transportation Network, Hub, Computer Simulation



A novel framework and effective scheduling of cross-docking center for multi-objective truck scheduling problem

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Abstract

Cross-docking is a technique used for scheduling the vehicles in distribution centers more effectively. Cross-Docking Centre (CDC) acts as a temporary distribution center that undergoes three important functions i.e., the goods from inbound trucks are continuously sorted, consolidated and then loaded onto outbound trucks for delivery to the customers. In this paper, an effective Cross-docking framework by considering the different performance measures in inbound and outbound doors has been developed. Subsequently, a multi-objective linear programming model has been developed for optimizing the objectives i.e., minimization of earliness and tardiness for the outbound trucks in a stochastic environment. Moreover, with FLEXSIM based simulation approach the analysis has been conducted and the effectiveness of the proposed framework. Finally, the results are evaluated and validated.

Keywords-Cross-docking center, framework, time window, make span, throughput, earliness, tardiness



Enabling the transition from product provider to service provider: An empirical investigation in the Sri Lankan apparel industry

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Abstract

The ongoing success of Sri Lankan apparel manufacturers is dependent either on their ability to continue to compete as a low-cost source of supply, or to develop new capabilities to differentiate their offering. Increasingly this includes the provision of value-added services to the customer (typically branded apparel retailers); a shift from providing simple products to more complex product-service combinations. This process is known as industry upgrade. Based on a single instrumental case study, of a leading Sri Lankan apparel manufacturer, this study explores the relationship between different offerings, competitive priorities, collaborative intensity and integrative capabilities required for industry upgrade. Over the last 20 years this company has undergone multiple iterations of industry upgrade to create 4 different business units, with different product: service provisions. These include the provision of low-cost briefs, an agile offering (14 days from order to warehouse) for briefs, a technology sophisticated sports product, and R&D-led offering. The output is an empirically tested framework that seeks to explain the way in which the different competitive priorities, collaborative intensity, demand and supply chain integration and integrative capabilities required to successfully deliver different product: service offerings. It demonstrated that a company could successfully operate across multiple stages in the product: service continuum. This was achieved by keeping them as completely separate business units. These business units had extremely strong strategic alignment with the strategic priorities of their customers, and supply chains configured to specifically meet the competitive priorities of the offering.

Keywords- industry upgrade, servitization, supply chain, dynamic capabilities



Improving the reliability of warehouse operations in the 3PL industry: An Australian 3PL case study

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Abstract

Warehouses play an important value-adding role to provide a competitive edge, support business growth and efficiency throughout their supply chains. This paper explores warehouse operations (i.e. receiving, put away, picking, packing and shipping) and a series of challenges faced in managing warehouse operations in general and the 3PL industry in particular. Especially, the paper analyses the warehouse and logistics operations of an Australian 3PL company. By utilizing a mixed method approach both qualitative and quantitative data was gathered through in-depth interviews, direct observations and warehouse operations records. The collected data were then analyzed using thematic analysis. The data was screened and coded to further develop major themes to identify the problematic areas. This analysis helped to identify issues in operations related to the receiving process, missing, picking and locating items as well as human errors. While multiple approaches could be utilized to improve the operations, there yet remained a major challenge to manage operations within the planned budgetary limits. This research, therefore, provides some solutions/recommendations to improve the case company's warehouse operations through staff empowerment, management process improvement, order dispatch and return process improvement, improvement in record keeping, and recruiting more personnel. These recommendations ensure company's efficiency while balancing its challenges both in operations and budgetary constraints. This study thus provides an evidence to improve the reliability of warehouse operations through systematic process improvement.

Keywords- Warehouse Operations management, Logistics, 3PL Industry



Process optimization plan to enhance sustainability in ceramic tile industry with Life Cycle Assessment: Case study of floor tile manufacturing in Sri Lanka

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Abstract

Environmental performances of a product depend on the exchanges flown between the industry and environment within the product life cycle. Process optimization is a one key technique to enhance the sustainability by controlling life cycle exchanges. In ceramic industry, raw materials and energy consumes largely and generate more emissions in the life cycle. Manufacturing process can be optimized as eco-friendly process only if environmental hotspots have been identified properly. Life cycle assessment (LCA) is the scientific methodology to identify environmental impact contributions during the process flow. This research has been focused to guide industry towards a process optimization by analysing process scenarios and controlling process parameters to mitigate higher environmental impacts. A case study was conducted in a ceramic floor tile manufacturing factory in Sri Lanka and a Life cycle inventory was developed within the cradle to gate scope. Life cycle impact assessment (LCIA) was conducted by using SimaPro LCA software to generate impact levels according to the IPCC 2013 GWP 100 method and ReCiPe Endpoint (H) method. By this study, firing stage and spray drying stage were selected as environment hotspots. Based on impact assessment results eco-design parameters and scenarios were introduced to industry to develop process plan. As a future work, environment performance gain will be assessed by a scenario analysis for optimized plan.

Keywords- Life Cycle Assessment, Eco-design, Product and Process Optimization



Development of IoT based conceptual framework for parametric life cycle assessment: case study for tea industry in Sri Lanka

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Abstract

Life cycle assessments are currently carried out predominantly using the data and information collected manually. Data collection for life cycle assessment is one of the difficult tasks which needs significant number of days and human resources. Furthermore, manually collecting of information will lead to many complications for the data collection environment/process as well as this process can have human errors in the data collection. Conversely, when the life cycle inventory data being used for life cycle management (LCM) of a product, it is required to model different scenarios of life cycle for the improvement of LCM. At this stage, some of previous research work has been conducted general LCA for tea industry, nevertheless there is no any real time environmental performance evaluation is available for real time life cycle assessment. This research focuses on linking IoT technology with manufacturing process of the tea industry to update the real time life cycle inventory database with more reliable and effective to conduct LCA. Moreover, this study develops a parametric LCA model for Sri Lankan tea industry, in order to test the effectiveness of parametric model to calculate the environmental impact. Through parametric LCA, raw data will be represented via formulas instead of numeric values in unit process dataset. The environmental performance of the tea processing is analyse using LCA technique from time to time depend on the different atmospheric and processing settings. Through this study local tea industry can improve its LCM which will enhance the overall sustainability of the tea leaf processing.

Keywords- Life cycle assessment, Internet of things, life cycle management



Investigation and comparative study on safe bio-packaging in dairy industry using value stream mapping

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Abstract

Lean approach is widely used in many manufacturing firms. Value Stream Mapping (VSM) is one of the key lean tools to identify and eliminate lean wastes. Lean principles always shows clear results such as minimizing work-in-process inventory, eliminating the non-value-added time and reducing the production lead time. VSM is used as a visual tool to optimize both value & non-value added time and analyze the hidden and root cause of wastes to eliminate them subsequently. A current state is mapped to visualize the production flow and a future state is developed after eliminating the waste and reducing the non-value added time and cycle time. In this article value stream mapping is used as a visual comparative tool to identify the best way of packing in dairy firms with respect to cost, cycle time and environmental aspects. Three different methods of packing were compared in this report such as plastic packets, glass bottles and tetra pack. Results clearly depicts total cycle time for plastic, glass and tetra packs are 25, 19 and 17 hours respectively. Non-value added time for plastic, glass and tetra packs were 3.5, 0.5 and 0.5 hours respectively. The results clearly depict glass bottle packaging will improve the productivity as well as sustainability.

Keywords-Lean manufacturing, value stream mapping, Lean production.



Police Staffing and Workload Assignment in Law Enforcement Using Multi-Server Queueing Models

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Abstract

In recent years, there has been a significant increase in the number of criminal activities all over the world. However, at the same time, it may be difficult to recruit and cultivate eligible police officers, and countries often suffer from a scarcity of police offices. In addition, the distribution of police forces is quite unbalanced in many countries and areas. In this research, we study the law enforcement problem to address the aforementioned situation by dividing it into two sub-problems, i.e., the police staffing problem and the workload assignment problem. To improve staffing efficiency and service quality, we propose a double-resource queueing model (DRQM) with referral and a single-resource queueing model (SRQM) with inner classification. We solve the optimal police staffing level and optimize the workload assignment problem by solving the optimal referral threshold or inner classification criterion in the DRQM and SRQM. Results show that the SRQM with inner classification can always achieve higher staffing efficiency than the DRQM with referral. On service quality, dependent on the optimal referral threshold in DRQM or the optimal inner classification criterion in SRQM, either DRQM or SRQM is preferred.

Keywords- law enforcement, police staffing, workload assignment, queueing model



Is dismissing irrelevant with quitting? An empirical study of the dynamics of employee Turnover

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Abstract

We use a secondary data set from a large distribution center to examine the dynamics between monthly voluntary and involuntary employee turnover. Our results reveal a complex, intertwined relationship between voluntary and involuntary turnover. First, voluntary turnover is positively related between consecutive months. Second, high involuntary turnover is negatively related to voluntary turnover in the following month. Third, high voluntary turnover is, surprisingly, followed by high involuntary turnover. These complex dynamics reveal that over a long period of time, dismissals on the one hand help to reduce the average voluntary leaves; on the other hand, it will increase the average new hires. This observation implies a trade-off between maintaining the existing workforce with high productivity and avoiding the cost associated with hiring new employees. Our analysis shows that the “tolerate” policy with few dismissals yields a higher average profit than a “stringent” policy with many dismissals does when either the hiring cost or the net productivity gap between the experienced and new employees is sufficiently high. Otherwise, the “stringent” policy is better than the “tolerate” policy for a firm's profitability. This study also develops a stylized model to demonstrate how the dynamics of employee turnover influences a firm's recruitment decision and profitability.

Keywords- Capacity Management, Employee Turnover, Human Resource Analytics, Empirical Research



Productivity improvement & waste elimination through continuous material flow: An apparel industry case study

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Abstract

Lean Manufacturing is widely applied in the apparel industry all over the world as a process improvement tactic. The continuous material flow is a major element in lean manufacturing concept and this research discusses how continuous flow concept could impact productivity improvement through waste elimination using a real-world apparel industry case study in a leading apparel manufacturing company in Sri Lanka. In the beginning, the existing process constraints were diagnosed using a current state value stream map and future state company's blue sky was mapped based on the business priorities with the stakeholders. Major constraints of the plant were fabric cutting and the sewing sections. Then material pull system, supermarkets, cellular manufacturing, single piece flow and other continuous flow tools were implemented to the constraints of the plant. After analyzing the key performance indicators of the cutting and sewing sections, it is evident that implemented tools have created positive trends on the company's safety, quality, delivery, cost and moral measurements. Especially there is a significant relationship between "Cutting section inventory vs company's first time through figures" and "Sewing section work in progress reduction vs company's plan to performance improvement". Also, this practical & actual condition case study-based research further shows many tangible and intangible results that continuous material flow could bring in to the apparel industry.

Keywords- Lean manufacturing, Continuous flow, Material pull, Value stream mapping, Productivity improvement, Cellular manufacturing, One-piece flow



A maturity model for assessing the warehousing 4.0 readiness and maturity of 3PL service providers

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Abstract

Currently, warehousing has been identified as a significant component of the supply chain infrastructure as a strategic facility to provide competitive advantage. With the emergent trend of outsourcing logistics function, 3PL firms play a critical role as business partners in providing warehouse facilities in the business world. Warehouses enabled with Industry 4.0-driven technologies can be identified as the concept of “smart warehousing” which will facilitate 3PL firms to adapt to the dynamic changes in the business environment. Although, smart warehouse concept has been widely spread across the world, it is still in its infancy in the developing countries such as Sri Lanka, India etc. So, there is a high necessity for conducting research in this area in order to explore the opportunities for implementing these advanced technologies. This paper presents a maturity model developed for assessing the Industry 4.0 readiness of 3PL warehouses to assess the current maturity level. This model consists five maturity levels (Initial, Defined, Managed, Integrated / Interoperable and Digital Oriented) and four key dimensions (Design of the warehouse, Means for the warehouse, Operations in the warehouse, Management of the warehouse), has been developed by combining the digital maturity model and critical success factors of warehouse performance improvement. The developed model was evaluated through an empirical study which was conducted among four leading 3PL firms in Sri Lanka. The results of this study provides useful information for Sri Lankan 3PL service providers to improve their capabilities to cope with the dynamic requirements in the future.

Keywords: Smart Warehouse, Third-Party Logistics (3PL) warehousing, Maturity Model, Industry 4.0, Warehousing 4.0



Modelling sustainable supply networks with adaptive agents

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Abstract

This paper proposes a multi-agent modelling approach that supports supply network configuration decisions towards sustaining operations excellence in terms of economic, business continuity and environmental performance. Two types of agents are employed, namely, physical agents to represent supply entities and auxiliary agents to deal with supply network configuration decisions. While using the evolutionary algorithm, Non-dominated Sorting Genetic Algorithm-II to optimize both cost and lead time at the supply network level, agents are modelled with an architecture which consists of decision-making, learning and communication modules. The physical agents make decisions considering varying situations to suit specific product-market profiles thereby generating alternative supply network configurations. These supply network configurations are then evaluated against a set of performance metrics, including the energy consumption of the supply chain processes concerned and the transportation distances between supply entities. Simulation results generated through the application of this approach to a refrigerator production network show that the selected supply network configurations are capable of meeting intended sustainable goals while catering to the respective product-market profiles.

Keywords- supply network configuration, adaptive agents, sustainable operations excellence



Cost impact of urban time-windows restrictions on movement of spare parts in automotive supply chain using MCDM/A

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Abstract

In this paper a multi-criteria decision-making (MCDM) model has been developed to identify the per unit cost of urban freight regulation in moving spare parts within the supply chain for an automobile industry. The paper develops a social cost model where, government introduces toll and time-windows based regulation for vehicle entry restriction to reduce congestion and pollution within the urban area. Service levels were introduced for back-orders and delayed deliveries. Movement of five spare parts was analysed from manufacturing plant to assembling plant in India. The model was run for scenarios when urban freight regulations were in place and when they were not. It was found that for various levels of service profit differential varied between -6% to 6%. The result substantiated the need for study of urban freight regulations for independent supply chains which is missing for the current literature. In addition, the model can be extended to other products and effect can be analysed. Further, the model can be used by the local administration to regulate movement of certain goods or establishment of industries within the urban areas.

Keywords- Time-windows, urban freight regulation, multi-criteria decision-making, automobile industry



Combining industry 4.0 with lean healthcare to optimize operational performance of Sri Lankan healthcare industry

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Abstract

Healthcare is one of the industries that requires the highest quality services for the wellbeing of the society. Today, the demand for healthcare is growing rapidly with increasing aging population, rapid urbanization, changing diets, inactive lifestyles and rising obesity levels. The Industry 4.0 technologies and lean techniques can be used to enhance the operational performance of the healthcare supply chain and the patient flow. This paper examines the factors contributing for the inefficiencies in Sri Lankan Healthcare sector and how the operational performance can be optimized through pre-medical diagnosis of diseases by incorporating Industry 4.0 technologies and lean techniques. Based on a systematic review of literature and feedback of healthcare professionals, the paper identifies the inefficiencies in the current healthcare system. A conceptual framework has been developed by considering the direct impacts from lean management practices and Industry 4.0 technologies on improving operational performance through pre-medical diagnosis of diseases. Thus, patients can take preventive actions and be more health conscious while the healthcare providers and other related parties can plan their medical services and supporting services for arising health requirements making the healthcare industry much more efficient.

Keywords- Healthcare, Lean Management, Industry 4.0, Operational Performance, Pre-medical diagnosis of diseases



Applicability of lean and green concepts in logistics 4.0: A systematic review of literature

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Abstract

Sustainability is emerging as a main consideration throughout the industrial world due to the environmental pollution and degradation happening in a major scale as a result of industrial wastes while lean management is becoming a popular management tool in minimizing waste. Logistics industry contributes for these issues due to the wastes released in a considerable amount. Experts have highlighted that implementing lean principles in parallel to green concepts is more successful; which could lead to waste and cost reduction. A theoretical gap has been identified in the field of logistics in applying lean and green concepts in the context of Industry 4.0. A comprehensive literature review was conducted to address the identified research gap with the objective of examining the important lean practices and green concepts which are expected to enhance the operational performance of logistics functions. A key word based search, analysis of the topic and abstract, full text review were the steps followed respectively, for selecting the most relevant research papers which have been proven as valid, accepted and published to extract the knowledge for this study. As the major contribution, authors have developed a conceptual framework which focuses on the enhancement of operational performance of logistics operations by applying lean and green concepts with special reference to Industry 4.0 technologies. The results of the study will be beneficial for the logistics service providers as it will suggest the strategies, concepts and techniques to enhance the operational performance of logistics functions.

Keywords- Green Concepts, Industry 4.0, Lean Management, Logistics, Operational Performance



Embedding priority UNSDG's in corporate strategy

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Abstract

The Paris agreement signed in December 2015 by 195 UN signatory nations made a bold commitment to hold global temperatures below a +2 Degrees centigrade gain by 2030. This commitment made it mandatory for to 'Embed, mobilize and impact' the 17 UN Sustainable development goals (UNSDG's). Each Nation had to commit to do so with measurable NDC's (Nationally Determined Contributions) to contribute to doing so. However, The Emission Gap report (UNEP November 2017) highlights that when all the NDC's were added up covered only one third of what was required to achieve the goal. In other word's a gap of two third or over 66%. Increasing private sector engagement of the UNSDG's has been highlighted as a possible solution, especially after only three of the eight UNMDG's (2000-2015) were achieved. CEO's when asked attribute the complexity of 17 UNSDG's and competing shareholder value creating goals to achieve business results as one of the key reasons for not doing so. The paper presents a 'more focused' approach which challenges each business to select one to four priority UNSDG's to 'engage, embed and impact' by embedding them in corporate strategy. This approach is backed by two INSEAD Case studies on the apparel sector (2006 and 2008) and the Tea industry (2009) which jointly contribute nearly 70% of all export revenues to Sri Lanka which confirm the impact and value of this approach. In addition, it presents a UNSDG/SCS Business Engagement Matrix (refer figure 1 below), which can be used by any Business to identify the priority UNSDG's based on the business it is engaged in.

Keywords- Sustainability, UNSDG, Strategy, Embedding



Global sourcing decisions: a multivariate analysis approach

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Abstract

Sourcing strategies by manufacturers have generally been studied in isolation. This has given rise to vast research streams on (local) production capacity expansions, offshore manufacturing and, recently, ‘manufacturing reshoring’ (i.e. the repatriation of previously offshore productive assets). However, modern, global firms may simultaneously implement all three archetypical sourcing strategies, driven by various strategic considerations, market conditions and customer requirements. The purpose of this work is to model the three sourcing strategies jointly, and understand their contextual determinants and strategic motivations. Following a survey design based on self-reports by key informants from 315 UK-based manufacturing firms, we construct a unique dataset of sourcing decisions taken between 2011 and 2016. To analyse the data, we deploy a trivariate probit estimation framework and various post-estimation tests to compare the determinants of offshoring, reshoring and local production capacity expansion decisions, while controlling for various firm- and industry-specific characteristics and accounting for the dependence between the three sourcing strategies. Analysis is ongoing, and the findings will be presented and discussed in the 2018 Production and Operations Management International Conference. This research contributes to the general theme of Global Production Networks by modelling and understanding the factors that drive the alternative sourcing strategies.

Keywords- Global sourcing, offshoring, reshoring, multivariate analysis



How Sourcing of Interdependent Components affects Quality in Automotive Supply Chains

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Abstract

In the automotive industry, many firms source key components from different suppliers, even though the components may function interdependently. In this study, we investigate how component level interdependence impacts quality performance and analyze how various operational factors moderate this relation. We synthesize information from several case studies to model the quality challenges faced by an automotive firm. For several sub-assemblies that go into its products, the firm sourced key components from two different suppliers. The sub-assemblies would fail whenever a component fails, but due to interdependent operations, failure of one component could cause the failure of the other. The firm found it challenging to improve the suppliers' quality performance as it was difficult to trace the failures to specific components. Our analysis reveals that - (i) the impact of interdependence is governed by the supply chain structure: reducing the interdependence between components improves quality when suppliers provide the components, but reducing interdependence worsens quality when the firm manufactures the entire sub-assembly; and (ii) the relation between interdependence and quality performance is moderated by factors such as penalties, production costs, and interdependence costs. Additionally, we find that quality performance is lower when the firm outsources the components than when the firm manufactures the entire sub-assembly. We identify coordinating mechanisms that leverage incentives and penalties to bridge the quality performance gap.

Keywords- Quality, Interdependence, Coordination



Taxonomy for classifying products on the customization spectrum

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Abstract

A recent trend has been to compete in the marketplace by allowing customers to personalize products to best meet their needs and taste. Enhanced customization increases variability and complexity in the manufacturing systems and supply chains supporting the manufacture and delivery of these products. The range or amount of customization practical for a product depends on several factors, such as its architecture, materials, manufacturing processes, supplier capabilities, customer interaction with design architecture, etc. Products can be placed on a spectrum of customization, ranging from Mass-Production (minimal customization), to Mass-Customization (standard design with some degree of customization), to Mass-Individualization (customer involved in the design process to co-create the product). A key question for the organization is to determine which of these levels of customization is best suited for their product, given the customer requirements, the product architecture, and the necessary manufacturing capabilities. This paper reviews the extant literature on personalization and customization. We propose a taxonomy to identify salient characteristics of different customization paradigms. We use this taxonomy to identify what products belong to each customization paradigm. Additionally, we summarize different taxonomies considering their application context, pros, and cons of each. Finally, we apply our taxonomy to three example products, where we consider customer engagement point, product architecture, assembly configuration, and technology flexibility.

Keywords- Taxonomy, Customization, Personalization, Product Architecture, Product Design, Complexity



Green supply chain analysis and coordination considering package size, transportation and shelf space allocation decisions

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Abstract

This paper examines a manufacturer-retailer dyad where the manufacturer undertakes greening efforts in terms of pack-size reduction and transportation cost reduction. The retailer decides shelf-space allocation for the product. Both the players benefit from greening efforts of the manufacturer. In such a setting, through a game theoretic analysis, we examine strategic decisions of the players and compare and contrast the performance of the decentralized supply chain with the centralized supply chain. We also examine the effect of collaborative mechanisms by modeling two contracts in which the retailer offers a transportation cost reduction effort based contract and a two-part tariff contract. We find that the decentralized supply chain leads to lower greening efforts and shelf-space allocation decisions. We also find that the contracts improve pack-size reduction effort, transportation cost reduction effort and shelf-space allocation, while also improving the profitability of individual players. The findings demonstrate a scope for supply chain collaboration between manufacturer-retailer pairs in this setting. The paper, thus, uniquely combines three critical elements in supply chains, namely, product design, transportation, and retailing decisions, and aims to provide insights into the decision making of players considering environmental waste and pollution. The paper also reflects consumer behavior and trade-offs that the supply chain players face.

Keywords- Sustainable Transportation, Green Product Design, Shelf-Space Allocation, Pack-Size, Game Theory



Technology transfer solutions for SMEs in Sri Lanka through university-industry collaboration

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Abstract

The development of Small & Medium Enterprises (SMEs) is a vital factor for Sri Lanka as SMEs currently contribute to 52 % of the GDP. The growth of SMEs in Sri Lanka is mainly affected by the technology related problems such as, lack of customized machinery providers, limited resource availability for technological consultancy, lack of technical skill development programs and access to information. This research aims to investigate the opportunity of promoting the University-Industry collaboration as an influential tool to address the technological problems of SMEs by means of utilizing the research and innovative capabilities of universities. The data for the study were collected through review of previous literature, questionnaires, semi-structured interviews with SMEs & Industrial Development Board. Qualitative and quantitative analysis of this data aided authors to recognize the technological needs of SMEs that can be fulfilled through the university participation. Furthermore, this relationship will benefit both the parties to have a mutual gain where the knowledge and skills of universities are practically used in industrial applications and SMEs will receive technological support. Also, it was identified that, the application of entrepreneurial university concept can further strengthen this relationship in future, where an entrepreneur can be erected from a university background who can act as the technology transfer intermediary between SMEs and universities.

Keywords - SMEs in Sri Lanka, Technological Problems, University-Industry Collaboration



An augmented reality-based, prototyping support system for apparel industry

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Abstract

Augmented Reality (AR) technologies have revolutionized prototyping and manufacturing operations in many industries despite limited applications in the context of apparel. Digital technologies are demanded in apparel 'design to manufacturing' process to improve the efficiency while maintaining the product defects to a minimum level. It is believed that significant percentage of product defects have occurred due to misinterpretation of product design as well as assembly instructions by the manufacturing team. This study intends to provide necessary information to develop an AR-enabled tool, to guide the prototyping and manufacturing operations at each step of product assembly. This study was conducted in two stages; the first stage has employed the single case study approach to gather main causes which affect design to manufacturing failures and capture requirements to develop an AR-enabled tool to minimize those errors. One of the leading intimate apparel organizations was selected for the data collection and validation of the study. Mainly, qualitative data analysis methods were used for the requirements analysis of the proposed tool. The second stage of the study was focused on presenting a concept of the proposed AR tool and validates the proposed AR tool at the same organization. More precisely, a prototype of the proposed AR tool was presented to the sewing team and gathered their feedback for further improvements of the tool. The findings of this study are important to various stakeholders in the new product development domain including product designer, product developer and manufacturer. It is contended that AR technologies will be an enabler for apparel industry to minimize the failures in product development process.

Keywords- Apparel industry, augmented reality, design for assembly, prototyping



Designing supply contracts: When “going green” and CSR come together

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Abstract

In the past decade, the increase in carbon emissions and associated policies regulated by the government influenced retail goods companies to produce biodegradable (green) products. In this paper, we study a two-level supply chain problem for two complementary green products with one manufacturer and one retailer where the manufacturer faces a cap-and-trade policy. The retailer sells these two products in the market and puts the effort regarding corporate social responsibility (CSR). The model is formulated as a game theoretic problem and is solved taking the manufacturer as a leader and retailer as a follower. We first analyze the optimal decisions of the manufacturer and the retailer in a decentralized setting. Then the green level of product, retailer's CSR level and profit of the whole supply chain are compared with those in the centralized case. The results show that the performance in the decentralized channel is lower than the centralized channel. To improve the efficiency of the decentralized channel, we propose three contracts, namely, two-part tariff (TT), green cost Sharing (CS) and the contract based on the effort to corporate social responsibility (CSR). The results show that the two-part tariff contract only coordinates the channel and the other two contracts (CS, CSR) improve the supply chain performance but do not coordinate the whole chain. Further, we numerically analyse the impact of various parameters on the optimal decisions and profits.



Strengthening the Sri Lankan clothing supply chain

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Abstract

Organizational buyers have identified, developing their suppliers, which is called as ‘Supplier Development Practices’ as a rewarding and emerging way to maintain the competitive position. This study aims at exploring from suppliers’ perspective whether there is an impact of implementing supplier development practices by retailers on suppliers’ performance in the clothing industry in Sri Lanka. The central research problem of this study identified three research gaps prevail and laid the path for the following three research objectives; (1) to assess the degree of business performance of suppliers, (2) to assess the degree of supplier development practices initiated by retailers on suppliers, (3) to examine the impact of supplier development practices initiated by retailers on suppliers’ performance. A structured questionnaire is used as the data collection instrument from a sample of 100 clothing manufacturers in Sri Lanka. Structural Equation Model (SEM) is employed as the main analysis approach using SMARTPLS. The survey data collected was first used to validate the measurement properties and then hypotheses were tested. The test results showed a significant relationship between supplier development practices and supplier performance. Accordingly, the results of this study support the view that supplier development practices do influence supplier performance. The key findings were compared with prevailing literature based on developed and developing economies and managerial implications were drawn as to how and what type of supplier development practices can be initiated by retailers in future for better supplier performance, which would lead to yield competitive advantages for both parties involved.

Keywords- Supplier Development Practices, Supplier Performance, Sri Lanka



Developing an employee performance evaluation framework in an Indian automobile firm using AHP

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Abstract

In today's global economy, modern organizations face high levels of competition. In the wake of increasing competition in global market, the future survival of most of the companies depends mostly on effective human resource utilization. This has led organizations' focus towards formulating an integrated employee performance evaluation, so as to reward and attract personnel that are more productive. This paper is an attempt to develop an integrated employee performance evaluation framework in an Indian automobile firm. Performance evaluation of employees is a highly complex task that must take into account quantitative as well as qualitative parameters to evaluate overall performance of an employee. Moreover, each employee is unique so the evaluation process should consider different facets of the job profile assigned to different employees. AHP is a multi-criteria decision making technique for structuring and analysis of complex decision-making problems and seems to be an ideal tool for this task. The model takes into consideration problems faced by an Indian automobile firm and segregates the framework in various main and sub-parameters. Data is collected from mid to senior level HR managers and then analysed to propose a comprehensive Employee Performance Evaluation Framework. The paper sheds light on several important aspects of performance evaluation that are highly relevant in today's world.

Keywords- employee performance evaluation, productivity, analytic hierarchy process (AHP)



Proposal for process re-engineering on job-shop environment: A case study on engineering faculty workshop

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Abstract

Increasing productivity while maintaining quality is a challenge for most managers. If this is to be done with available manpower and equipment the task is further complicated. The process becomes more challenging with the gaps in reliable measuring tools defined for public sector performance with increasing bureaucratization. Out of the few options available to address this problem, workflow re-engineering can be considered as one option that could have an impact on productivity. This case study research was carried out on a workshop that has practiced a routine workflow with traditional practices interwoven with redundant tasks. The process has a negative impact on delivery performance, product quality and accountability of the workers. An information black-box could be observed. The research study was carried out to investigate the present status of the engineering workshop and propose a workflow re-engineering for the workshop. A qualitative study, comprising of six in-depth interviews and two focus group discussions, were conducted in order to gather primary data and secondary data from office records were used to fill in gaps. Data analysis was done through transcribing, coding, and categorizing the data to identify general process flow. Thereafter, Key Performance Indicators (KPI's) were developed to measure the efficiency of primary operations at various levels. Finally, a process re-engineered model to improve job-shop productivity was proposed based on the analysis.

Keywords- Small job-shop environment, public sector, process re-engineering



Investigation of Policy Implications on Sri Lanka's Logistics Performance - Preliminary Study

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Abstract

Sri Lanka is located in close proximity to main international shipping routes with one of the world leading container ports in the region: Colombo. However, country's logistic performance has gradually declined and is currently at the 94th position in the Logistic Performance Index (LPI) published by the World Bank. This study explores secondary data published by various international organizations and attempts to combine them in novel ways to compare the logistics performance with competitor countries. The study breaks down the logistics performance in Sri Lanka along three dimensions of infrastructure, service quality and customs performance. The study shows that Colombo port leads the region and competitors in terms of connectivity and efficient port operations. However, the internal logistics performance in the country is lagging that of its export competitors for products such as apparels and tea. The comparison with competitor countries show that under-utilization of railways along with low speeds on roads as possible causes. Furthermore, it reveals that Sri Lanka also suffers from poor skills and attitudes of human resources in key institutions affecting logistics. The study reveals that Sri Lanka has not invested in novel logistics concepts such as freight villages or dedicated freight corridors as some of the competitors have done. The study emphasizes that there is a grave necessity to conduct detailed quantitative and qualitative studies in the future with primary data collection leading to a logistics roadmap for Sri Lanka driving a coherent government policy in various aspects of logistics.

Keywords- Logistics Performance Index, Logistics policy, Competitiveness, Sri Lanka.



An investigation on the eco-labelling system in Sri Lanka

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Abstract

The voluntary methods of environmental performance certification and the visual communication tools indicating environmentally preferable products, services or companies that are based on standards or criteria can be identified as eco-labelling. This study addressed the broad research problem of “what is the stance of eco-labelling systems of FMCG market in Sri Lanka?”. The main objective of the study is to evaluate the existing eco-labelling systems in Sri Lanka and to provide implications for future policy making. The exploratory research carried out conducting expert interviews in order to gain information on the current system of eco-labelling, loop-holes in existing system and need of such a policy framework to regulate the eco-labelling and sustainable manufacturing in competitive Business-Consumer market. The respondents for the interview were selected on judgmental sample method and interviewed employing a pre-set interview guide. The data gathered were analysed using thematic analysis and found that the experts were of the view that the current certification systems in Sri Lanka are not well established and a well-developed framework is highly essential in the current competitive market where products can better compete with the global competition and emerging consumer trend in sustainable consumption. The findings of the study help the national level policy makers for implementing an eco-labelling framework for consumer goods and the status of the current system provide implications for academics for future research avenues.

Keywords- Eco-labelling, Fast Moving Consumer Goods (FMCG)



Role of technological dependencies: The impact of mobile service quality on mobile cash service acceptance

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Abstract

Being a dependent technology on mobile connection, the usage of Mobile Cash (MC) would largely depend on the mobile service quality (MSQ). Since the researches on such dependencies are rare in literature, this study has investigated the impacts of dimensions of MSQ on the determinants of usage intention (UI) of MC services. The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) has been selected as the theoretical base together with seven dimensions representing both functional and technical quality aspects of MSQ. A questionnaire has been developed for the study which has shown an adequate level of reliability and validity during the pretesting. A survey has been administered in a university with a sample of 272 MC users. Partial Least Square – Structural Equation Modeling has been used in data analysis. The determination of goodness of fit of the structural models has been assessed using the standardized root mean square residual and the significant associations between variables were determined using bootstrapping procedures. Results revealed that only five UTAUT2 variables (Performance Expectancy, Social Influence, Facilitating Conditions, Price Value and Habit) have shown significant direct effects on UI and the six dimensions of functional quality aspect of MSQ (Reliability, Responsiveness, Assurance, Empathy, Tangibles, and Convenience) have indicated significant indirect effects on UI where Responsiveness have alone showed a negative effect. Since the technical quality dimension has not indicated any significant effect on UI, the service providers are recommended to focus more on functional quality rather than technical quality of MSQ to improve the use of MC services.

Keywords- Mobile Cash Services, Mobile Service Quality, PLS-SEM, Usage Intention, UTAUT2



Exploring the challenges in implementation of lean manufacturing in apparel industry, Sri Lanka

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Abstract

Operational activities play a key role in both the manufacturing and the service business environments. Lean Manufacturing is one of the concepts which has been practiced by many organizations in improving operational activities aiming on higher productivity on a systematic approach by identifying and eliminating non value adding activities. Hence, it has been identified that many challenges arise in the implementation process of Lean Manufacturing. The aim of this study was to identify such challenges with reference to Apparel industry in Sri Lanka. Being an exploratory study, the data were collected through twelve in-depth interviews with experts in the field. Data were analyzed using content analysis technique where the findings have illustrated the challenges identified through the research in relation to the literature under five key thematic areas namely; understanding the philosophy, operational and technical practices, organizational culture, leadership, organizational change. Findings of the study reveals that, the lean implementation efforts had no chance of achieving success without improving the five factors identified. Top management must appreciate the benefits of lean and efforts should be made into the possible adoptions. Explaining the changes to employees will motivate them to understand and adapt to lean initiatives. Customizing the lean implementations according to the business requirements will result in more effective systems. The challenges identified in this study can be used to guide organizations in conducting self-audits on lean initiatives, and to assist on systems and action plans.

Key words: Lean Manufacturing, Apparel industry, Lean initiatives



Reliability study of coherent systems equipped with one or more general standby components

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Abstract

It is an eternal truth that every system must collapse after certain time. For this reason, reliability engineers show their keen interest to find out different ways by which reliability of a system could be increased. Allocation of standby (also known as redundant or spare) component(s) into the system is an effective way to enhance the lifetime of a system. Then, the key question is - how, when and where to allocate redundancies into the system so that the system lifetime becomes optimum in some stochastic sense? Standby components are mostly of three types - hot (or active) standby, cold standby and general (or warm) standby. In this paper, we consider coherent systems equipped with one or more general standby components. Here, the standby component may initially be put into cold state and is switched over to warm state after a certain time period, up to which the system certainly does not fail. Then the standby component in warm state starts to work in active state at the time of failure of a component which may cause the system failure. The key findings of this paper are as follow. We develop an exact expression using system signature to calculate the reliability of a coherent system equipped with one general standby component. Further, we discuss an allocation strategy (using stochastic precedence order) for the 1-out-of-n warm standby system. Some Numerical examples are also provided to illustrate our proposed results.

Keywords- Coherent System, Reliability, Redundancy, Stochastic orders, Accelerated Lifetime Model, Virtual Age model, Signature



Examining the rhythm of dynamic team communication

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Abstract

Teams are pervasive in today's work environments. Yet, limited longitudinal research has focused on team processes. Team communication is a particularly important team process as it may be the mechanism regulating and coordinating other team processes. Moreover, the topics discussed change over time and these changes may influence teams' abilities to succeed. The purpose of this study is to examine the rhythm of team communication to ascertain if certain patterns may lead to enhanced team performance. Communication strings from 60 three-person teams meeting face-to-face to complete a laboratory task were transcribed. Teams created personnel schedules with varying daily requirements by assigning employees with varying wages. Specific rules, designed to ensure collaboration, were distributed among team members. Team performance was assessed as the schedule cost and time required to complete the task. The communication strings were coded to represent the topics being discussed (e.g., tactical strategy, action processes). The proportional hazards and Anderson-Gill intensity models from event history analysis were used to examine communication rhythm. Three findings are noteworthy. First, planning how to approach a task prior to starting it may lead to better performance outcomes than engaging in an iterative trial and error approach. Second, successful planning may be a two-step process starting with ascertaining what to do followed by determining who will do it. Third, recursive discussions may be detrimental to team performance. This investigation is original in that it makes theoretical contributions to longitudinal behavioral operations research and employs nontraditional methods to study dynamic team communication.

Key words: Lean Manufacturing, Apparel industry, Lean initiatives



A simulation based study on multi-echelon repairable parts inventory control of public transportation system

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Abstract

There are several real life systems involving commodities which need to be maintained optimally so that our daily operations run smoothly. Multi-echelon repairable parts inventory problems have been on the research radar for quite some time. The application areas include military spare parts, petro-chemical industries, refrigeration, air-conditioning, automobile, and computer spare parts etc., where utilization rate of equipment is relatively higher while making them vulnerable to failures. Instead of replacing the failed equipment with new ones, it is often worthwhile to replace it with a repaired one considering the cost and environmental factors. The current study intends to devise an s-1, s policy model for the 3 echelon repairable parts inventory of the tyres of a public transportation system. Discrete event simulation has been used to obtain the results. The study estimates the tyre inventory levels at the three stages of the supply chain such that the total cost is minimum. The total cost refers to the sum of system investment cost and the backorder cost. The study contributes to the literature of the multi-echelon repairable part inventory model based on (S-1, S) policy. For practitioners, the computational results provide insights for running a large scale multi-echelon inventory system. Given a trade-off between the costs of investment in tyres (equipment) versus expected backorder costs, the study is helpful for inventory allocation decisions across echelons.

Keywords- Repairable parts inventory, multi-echelon inventory, simulation, public transportation system



Risk pooling approach in multi-product multi- period inventory control model under uncertainty

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Abstract

Risk pooling is an approach which is majorly supportive for maintaining the safety stock up to a minimum level under uncertain conditions. This pooling method decreases the inventory carrying costs, overhead costs and other costs involved in maintain the facility, therefore this approach can be suitably implemented in an inventory control model. The major concentration of this study is to develop a multi-product multi-period inventory control model in two stage supply chain network which mainly consists of distributors and retailers. Inventory carrying costs, transportation costs, facility operating cost, ordering costs and facility cost are incorporated for the formulation of inventory control model in objective function under various constraints. A non-linear programming has been originated to solve the proposed mathematical model. The results and the performance parameters can be assessed under various uncertain levels.

Keywords- Risk Pooling, Multi-product, Multi-period, Inventory Control, Two Staged Supply chain, Distribution Network



Suppliers' commitment and dependability: Their role in the diffusion of sustainability practices

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Abstract

A key but often neglected topic in the sustainable SCM literature is the diffusion of sustainable practices. The literature has focused on the analysis of the relationship between buyers and their first-tier suppliers. However, to ensure that the entire supply chain is sustainable, these practices should also be diffused from first-tier suppliers to second-tier suppliers and so on. In our paper, we study how the implementation of first-tier supplier development practices influences the implementation of second-tier suppliers' practices. Furthermore, based on previous literature we analyze the moderating role of supplier dependability and commitment to sustainability. To analyze our model we collected data in China and performed a series of OLS regressions. Our results show that there is evidence for a diffusion effect in the particular area of sustainability. In addition, our results also show that relationship dependability and supplier's commitment play a role in this diffusion mechanism.

Keywords- sustainable supply chain management; diffusion; supplier development



Towards a strategic financial perspective for interpreting the costs of quality

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Abstract

The PAF framework of quality costs, namely Prevention, Appraisal and Failure costs, has been widely used within the quality management field for measuring the financial costs related to poor quality. While the PAF framework has proved very useful for expressing quality-related issues in financial terms, limitations of the framework's scope have been widely discussed in the quality literature. This research-in-progress explores a strategic financial perspective for evaluating quality costs that is based on the DuPont strategic profit model. Compared to the traditional PAF framework, this model is broader in scope and provides a strategic financial lens for interpreting the impact of quality-related costs on firm performance.

Keywords- Quality costs; Prevention, appraisal and failure costs; quality and process improvement



Process improvement through six sigma approaches in gas manufacturing plant in Sri Lanka

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Abstract

In this research we show how the highly structured, statistical-based quality improvement approach “Six Sigma” was used to significantly reduce power consumption per production unit (plant specific power) of a gas manufacturing plant. The statistically designed experiment (2^k full factorial involving 16 runs) enabled us to identify that the air flow rate and the production ratio (Nitrogen to Oxygen ratio) need to be adjusted (air flow rate to be lowered to 6700 N/m^3 per hour and production ratio needs to be set to 27 tons of Nitrogen to 30 tons of Oxygen) to minimize plant specific power. The resulting optimum settings and the confirmation experiment showed that our quality improvement reduces plant specific power by 2.92%, resulting in a cost saving of six hundred thousand Sri Lankan Rupees per month, which in turn results in significant gains in the company operating profit.



Enablers of hotel's risk management orientation: impact on hotel supply chain agility, resilience and performance

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Abstract

While green and lean issues are given importance in a hotel supply chain (SC), the literature on hotel SC management is sparsely developed. Although uncertainties are inherent in hotel SCs, allied studies are yet to explore the importance of risk management orientation. In this regard, the current study posits inter-departmental information sharing and collaboration as enablers of hotel's risk management orientation. Furthermore, hotel's risk management orientation is posited as a prominent enabler of hotel's SC agility and resilience, that may have positive effect on hotel's SC performance. To test this relationships, perceptual responses were collected from 122 hotel managers in India and were analyzed using partial least squares in Smart PLS 2.0.M3. Results showed that inter-departmental information sharing, and collaboration are prominent enablers for hotel's risk management orientation, while information sharing is also a prominent enabler for inter-departmental collaboration. Again, hotel's risk management orientation has positive and significant influence on hotel's supply chain agility and resilience. Furthermore, hotel's SC agility and resilience significantly enhances hotel's SC performance. However, hotel's risk management orientation does not have a prominent role in enhancing hotel's SC performance. The study is the first, therefore, to study risk management orientation in a hotel's SC. Furthermore, the current study is the foremost to extend the notions of agility, resilience, SC performance and risk management orientation to hotel's SC from manufacturing. Implications were also provided for practitioners and managers.

Keywords- hotel, supply chain, agility, resilience, risk management, orientation, performance



An Application of Chemical Leasing Model for Wastewater Treatment of apparel industry in Sri Lanka: Case study

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Abstract

The Sri Lankan Economy largely depends on the apparel export business which contributes to 56% of the total exports revenue. Garment washing and finishing is an integral component in the apparel manufacturing activity. The larger garment manufacturing plants are generating more than 2000 cubic meters of wastewater per day from the washing process and use different types of treatment chemicals including high risk and hazardous chemicals for the treatment process. Therefore, handling the large volumes of wastewater in an environmentally friendly manner is an essential requirement to drive the local apparel industry towards Sustainable Manufacturing. This paper describes a model based on the UNIDO chemical leasing concept, which results in a significant reduction of chemical consumption while improving the quality of treated wastewater discharged to the environment.

Keywords- Chemical Leasing, Wastewater treatment, Garment washing, Sustainable Manufacturing



Estimation of economic and environmental sustainability of voyage planning

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Abstract

The world's economic growth is closely linked to the efficiency of any process, whether it may be an industrial process or service process. Logistics and transportation are the fundamental tools for globalization and international trade. Due to industrialization and increasing use of fossil fuels the atmosphere of earth is degrading every day. Emissions from shipping are significant in portion and deteriorating air quality has a negative impact on climate and public health. Voyage Planning and slow streaming are the most effective operational parameters used nowadays to reduce carbon footprint. Hence, this study aims to determine an economical route for a ship to sail. A method consisting of three different items is proposed to achieve this aim. The first item is to acquire the one week forecasted data about the sea state. The second item is to estimate the economical speed for various sea states which is a breakeven between operational costs (which includes fuel cost and onboard crew member wages, etc.) and inventory cost. The last item is to find an economical route for minimal fuel consumption. The result shows that the shortest route is not always economical to sail as high winds from head direction and bad weather conditions increase fuel consumption. It is dynamic in nature. The results of this study can facilitate in building future navigation tools and contribute to environmental friendly shipping.

Keywords- GHG – Greenhouse Gas Emissions, Voyage Planning, Routing, Carbon-footprint, Inventory, Transportation Cost



An empirical investigation of relationship between lean and human factors: A structural equation model approach

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Abstract

Evidence suggests that lean implementation have both positive and negative impacts on workers quality of life and their performance. Moreover, Human Factors and Ergonomics (HFE) plays a vital role in lean implementation and its performance whereas, seldom research reported the relationship between HFE and lean. To fill this literature gap, the study aims to reveal the relationship between lean performance and three categories of HFE including physical factors, psychosocial factors and managerial factors. Measurement items were developed to measure each metrics of the individual HFE category in five-point Likert scale and validated by exploratory factor analysis and confirmatory factor analysis. The empirical data were collected through online survey from 76 targeted experts including ergonomist, lean experts, consultants, industrial engineers and managers around the world. Based on the previous studies, the relationships between HFE and lean performance were hypothesised and were tested through a structural equation model. Data analysis was conducted by using Statistical Package for the Social Sciences (SPSS) version 25. The result shows that physical factors, psychosocial factors and managerial factors have a positive relationship with lean performance. The consideration of associated human factors during lean implementation enhances lean performance and sustainability of its practices. The findings of the study contribute for better understanding of the importance of HFE in lean implementation to enhance organisational performance through lean.

Keywords- Lean implementation, Human factors and ergonomics, Lean performance, Structural equation model, Relationship



Development of sustainability of traditional cottage industries

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Abstract

With the introduction of open economic policy, traditional cottage industries have been struggling for its survival due to the rapid influx of cheap and attractive products from other countries which are opulent with advance manufacturing techniques. Though the medium and large-scale export-oriented manufacturers empowered with modern manufacturing techniques, majority of cottage industries have not been able to adapt appropriate technologies and managerial concepts due to various reasons. Hence, inefficiencies and pollution prone manufacturing processors can be seen without much attention to the society. However, there are some sustainability practices with respect to social and environmental domains due to socio-cultural values etc. However, economic sustainability is a serious concern. Therefore, this research focuses on developing user friendly sustainability evaluation tool which will direct cottage industries towards eco-innovations thereby to enhance competitiveness. The tool has been developed based on triple bottom lines of sustainability and evaluation is carried out in qualitatively using comparison scale. The synchronization of triple bottom lines has been done through Analytic Hierarchical process. The proposed tool can signify sustainability hot spots which pave the way for eco-innovation which eventually mitigate environmental and social hot spots considerably.

Keywords- Cottage Industries, Evaluation of Sustainability, Eco-innovation, Analytic hierarchical process



Going collocated or dispersed in product development projects

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Abstract

Choosing the composition of a development team, in particular, whether mainly focus on team members' ability or their collaboration capabilities is an important decision for a company. While the latter is less effective at collaboration, they potentially have better skills related to their specific tasks. We show that both the team composition and the optimal incentives differ dramatically for three types of collaboration: "helping", cost-reducing "knowledge sharing" and "information sharing" which allows for better coordination and more compatible design decisions. We find that for information sharing, collaboration should not even always be encouraged and that incentives must be adjusted differently when recruiting teams depending on the type of collaboration. Finally, for uncertain projects, the firm might be better off choosing team members with higher collaboration skills for information sharing, team members with high ability for helping if these team members have significantly improved abilities, and team members with high ability for knowledge sharing, even with only low levels of improvement in team member abilities. Moreover, our findings imply that depending on the different type of collaboration among team members, heterogeneous or homogeneous teams might be the optimal team composition.

Keywords- Product Development; Incentives for Collaboration; Team Composition



Input-price risk management: Technology improvement and financial hedging

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Abstract

We study the merits and limitations of technology improvement (TI) initiatives for managing input-price risk. Such initiatives (e.g., energy efficiency projects) typically reduce the consumption of an input commodity and so result in lower production costs, more sustainable operations, and/or an improved competitive position. This paper explores whether TI can also serve to hedge risks. Although TI clearly reduces both average cost and risk exposure, some firms may actually benefit from input-price uncertainty; the result, when combined with production flexibility, is an “option value” that firms may well be reluctant to forgo. We develop a stylized mathematical model to examine the incentives of different types of firms to adopt TI. Thus we derive a closed-form expression that quantifies a firm's attitude toward input-price risk by considering the firm's *certainty premium*, or what the firm would pay to “lock in” the unit input price, and then link that premium to various firm- and industry- specific characteristics. We also compare the risk management advantages of technology improvement versus financial hedging (FH) and give conditions under which these strategies are complements or substitutes. Our results show that, even when input-price uncertainty is desirable for firms, they can still benefit from investing in risk reduction measures--such as TI and FH--because the uncertainty's option value could thereby increase. A firm's ability to adjust its price in response to both market competition and input-price variation mediates the benefit of risk-reducing measures and also affects the complementarity of these two strategies.

Keywords- risk management, risk exposure, technology improvement, energy efficiency, financial hedging



Refining logistics performance of third-party logistics firms: A study of commercial road freight transport sector in Zimbabwe

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Abstract

Unreliable service provision by third party logistics firms in the commercial road freight transport sector in Zimbabwe has led to loss of customers and continuous decrease in profits over the past decade. This research is an exploratory descriptive research which seeks to explain what constitute logistics performance, challenges and strategies for improving third party logistics performance in Zimbabwe. A sample of one hundred and eight (108) companies was drawn from a population of one hundred and fifty (150) and was determined using the Krejcie and Morgan sample size determination formula. Questionnaires were administered to managers and supervisors of 3PL firms registered with the Shipping and Forwarding Association of Zimbabwe (SFAZ). The results have established that most third party logistics firms in Zimbabwe utilizes a few logistics performance measurement metrics such as total transportation cost and transportation cost per kilometer. The study also revealed that unavailability of modern technology, less return loads, ageing fleet and increasing foreign competition were the major challenges facing the 3PL firms. It was recommended that 3PL firms should adopt modern technologies, provide comprehensive services, register with stock exchange, and fully adopt logistics performance measurement metrics and ISO registration to improve their performance.

Keywords- Third party logistics firms, logistics, performance measurement



Procurement challenges in local authorities of Zimbabwe- a case of Mashonaland west province

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Abstract

The purpose of this research is to provide an overview of procurement challenges in local authorities with reference to Chinhoyi municipality. The study was aimed at identifying the roles of procurement in service delivery and identifying the challenges to procurement in local authorities. Accredited scholars and journals were used to gain explicit understanding of the topic under review. A descriptive survey research design was used to carry out the research. Questionnaires were employed as research instruments for primary data collection. Self-administered questionnaires distributed to the selected sample of 90 employees at Chinhoyi municipality. Findings from the research indicated a number of procurement challenges in local authorities. Major challenges included delays in decision making, lack of quorum, corruption, political interference, inadequate market inquiry and incompetence.

Keywords— Performance, Procurement, Public Procurement, Service Delivery



Factors influencing the adoption of sustainable procurement by NGOs in Matabeleland, Zimbabwe

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Abstract

The research sought to investigate factors influencing the adoption of sustainable procurement for NGOs in Matabeleland, Zimbabwe. A sample of twenty organizations was used. The research used the questionnaires for data collection. Five respondents were judgementally selected from each organization to come up with a total of 100 respondents. Data was analysed and presented using SPSS and excel. The research outcomes showed that compliance to regulations and legislations, managing risk and reputation, CSR Policy, demand for sustainable products or projects by beneficiaries, corporate governance and social or ethical considerations are major drivers to sustainable procurement in NGOs. The research revealed that sustainable procurement practices help NGOs in retain and attract more donor funding and also managing reputational risk through compliance to political, economic and environmental regulations. The study recommends for top management support, revamping of organisational structures, policies and procedures, changing the first cost mind-set and benchmarking in NGOs in order to ensure successful implementation of sustainable procurement practices. Over and above a sustainable procurement policy should be in place in NGOs to support its implementation.

Keywords –Sustainability; Sustainable procurement, environment, social, economic



Modelling sustainable manufacturing practices for plastic part manufacturing organization using interpretive structural modeling

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Abstract

Plastic part manufacturing has witnessed tremendous growth and significant contribution to GDP in India. Still, it has poor public image due to environmental vulnerability and adverse operators' health. Many companies have adopted sustainable manufacturing as a means of improving competitive advantage, public perception and to cope with government regulations. However, for enabling sustainability, practices need to be developed and deployed based on scientific prioritization. In this study, Interpretive Structural Modeling based framework has been developed to critically analyze interrelationships and interactions among practices pertaining to the plastic part manufacturing process. Based on the analysis, the practices have been hierarchically classified into Interdependent, Dependent, and Linkage construct. This hierarchy can be used by the decision maker during the implementation of sustainable manufacturing practices in other facility locations.

Keywords — sustainable manufacturing, interpretive structural modeling, sustainable manufacturing practices, plastic part manufacturing organization, product design



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