

# Decarbonising supply chain operations

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## Abstract

The United Nations (UN) developed sustainable development goals (SDGs) in 2015 to end poverty as a global agenda for the future to protect the planet, create peace and prosperity for its population. The UN emphasises the development should be balancing environmental, economic, and social sustainability. Also, nowadays governments, customers, and stakeholders' pressure to remark environmental and social footprints have been increased. Decarbonising and sustainability of the supply chain is one of such novel ideas involving all the business value-adding operations. This includes purchasing, upstream, and downstream supply chains, distribution and collaboration with suppliers and patrons in a way that has the least negative environmental and social effects. To minimise energy consumption and carbon emissions in the supply chain operations we need to integrate carbon efficiency in suppliers, transportation, plants, distribution centers/warehouses all the way to the market. The main objective of this study is to investigate measuring eco-efficiency of suppliers in the supply chain with data envelopment analysis (DEA). It has the potential to minimise carbon footprints in the supply chain and to address the UN sustainability goals relating to creating a sustainable supply chain in measuring technical (operational), environmental and eco-efficiency of suppliers. In this paper, we model the necessity of simultaneous application of worst and best practice DEA in measuring eco-efficiency of suppliers to minimise carbon footprint in the supply chain. This model would help organisations to balance environmental, economic, and social sustainability in the supply chain in response to the UN sustainable development goals. It is found that this proposed model can provide a more reliable evaluation and selection of right suppliers considering their environmental and other traditional criteria. We also develop an integrated approach through DEA models for measuring technical (operational), environmental and eco-efficiency of suppliers. The proposed models are applied to evaluate the eco-efficiency of a manufacturing company in an automotive industry.

## Keywords

Low-carbon supply chain, data envelopment analysis; suppliers; eco-efficiency; sustainable supply chain

## Biographies

### Jay Daniel

Dr Jay Daniel is a Program Leader for MSc Global Operations and Supply Chain Management and Senior Lecturer in the Derby Business School at University of Derby. Before joining the Derby Business School, he was a Lecturer (Assistant Professor) in Supply Chain and Information Systems at University of Technology Sydney (UTS), Australia. Previously with DB Schenker, Australia, and Alliance International Registrar, Asia Pacific, he held positions of Senior

Management Consultant, Supply Chain Solution Analyst, Project Manager, Industry Trainer and Lead Auditor. He has made contributions to multiple research areas in the context of logistics and supply chain management with demonstrated practical applications across a wide range of industries. His primary areas of research focus are: Business Analytics and Supply Chain Management, Information Systems and Sustainable Supply Chain, Decision Making in Logistics and Supply Chain and Healthcare Supply Chain Management. He has been invited as a keynote speaker/invited speaker at international industry and academic workshops and conferences such as Keynote Speaker in Oracle Modern Business Experience Conference, etc. around the globe. An expert in applied and problem-driven research, he has used analytical tools and innovative optimization approaches to help managers create efficient, resilient and sustainable supply chains. He has been engaged in consulting to wide range of industries and organization structures, from small and medium size Australian companies to Fortune 500 corporations.

### **C. Kalpani Dissanayake**

Dr. Kalpani Dissanayake is an Assistant Professor at the Pennsylvania State University, USA involved in their Project and Supply Chain Management degree program. She received her Ph.D. in Systems and Engineering Management from the Texas Tech University (TTU) and obtained her B.Sc. in Engineering and the M.B.A. degrees from the University of Peradeniya, Sri Lanka. Dr. Dissanayake was honored as the “Banner Bearer for the Graduate School” at the TTU commencement ceremony in August 2017 for her best all-around achievements during the Ph.D. program. She has also won several other academic awards including the ‘Best Dissertation Award’ at the American Society of Engineering Management (ASEM) conference 2018, the ‘Merl Baker Award for the Best Student Paper’ at the ASEM Annual Conference 2015, the ‘J.T. and Margaret Talkington Fellowship Award 2015/2017’ from TTU, and the ‘Doctoral Degree Scholarship Award from the Ministry of Higher Education in Sri Lanka, 2013’. Prior to joining PennState, Dr. Dissanayake taught in several other universities including TTU, and has also worked in the private sector. Her current research interests include application of business analytics for organizational problem solving, performance improvement in supply chains, and in teaching pedagogy. Dr. Dissanayake also holds the PMP certification from the Project Management Institute and the Engineer-In-Training (EIT) license from the Texas Board of Professional Engineers.