

PROGRAMME & ABSTRACTS



22nd Cambridge International Manufacturing Symposium | 27-28 September 2018

Supply chain transformation enabled by advanced technologies

Implications for producers, consumers and society



UNIVERSITY OF
CAMBRIDGE
Department of Engineering



Centre for
International Manufacturing

Symposium Organisers

The Symposium is organised and hosted by the Centre for International Manufacturing (CIM), one of several research centres within the University of Cambridge's Institute for Manufacturing (IfM).

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CHAIRMAN'S INTRODUCTION



The 22nd Cambridge International Manufacturing Symposium will once again bring together industry, academia and policymakers, providing an opportunity for open dialogue and insights into practice and research. This year's Symposium will focus on the theme of supply chain transformation enabled by advanced technologies.

Previously, advances in supply chain and operations management have been centred around continuous improvement. But do new digital and production technologies represent a more fundamental disruption, to the extent that we are rethinking how supply chains work? These developments are significant not just for producers and their supply chains, but also for consumers and society at large. There are several trends that are converging

which may support a more radical development: For example, consumers have more opportunity to demand visibility and transparency, particularly in regard to product integrity and provenance. At the same time, advanced technologies are opening up the prospect of 'democratised manufacturing' with opportunities for end-users to be more involved in product design and production. At a societal level, a move towards increased localisation is being stimulated by 3D printing, promising manufacturing nearer to the point of consumption with more efficient use of resources. As sustainability gains increasing attention, technological developments around the concept of the 'circular economy' suggest ways to reduce resource intensity and waste.

For producers, there remain considerable challenges and open questions around technology adoption. How do companies choose which technologies to focus on? What strategic partnerships are required? And how do companies develop the right skills, not only for implementing those technologies, but also for understanding the opportunities they present and making good strategic decisions? Beyond company walls, supply chains of the future will require different governance, with industry, academia and regulators working together. It is not about applying established rules to new technologies, but instead defining new approaches to achieving better outcomes.

The Symposium provides an opportunity to share experiences across industry partners, hear insights from academics, and consider policy implications. As per our usual format, we have some outstanding senior industrial speakers on the first day of our Symposium, representing exemplars of manufacturing supply chain initiatives. Senior executives from **AstraZeneca, Cisco, Ford Motor Company, Innocent, Schneider Electric, Siemens UK, and Signify (formerly Philips Lighting)** will be sharing their thoughts on the future configurations of international manufacturing supply networks.

On day two we will be presenting insights from leading academics. Our keynote academic speakers this year are Professor Jan Olhager (**Lund University**), Professor Fabrizio Salvador (**IE Business School**), and Dr Sandeep Kapur (**Punjab Agricultural University**) who will share their research insights. This will be followed by parallel tracks on the topics relating to our main themes this year.

I am sure you will enjoy the engaging yet informal atmosphere of our rather unique academic-practitioner-policy community, one that has developed its own modus operandi in shaping the forward research agenda. As part of this continued exchange of ideas we are very much looking forward to welcoming you to the 2018 Cambridge International Manufacturing Symposium.

Dr Jagjit Singh Srai

Symposium Chair

Head of Centre for International Manufacturing

University of Cambridge Institute for Manufacturing

AGENDA | THURSDAY 27 SEPTEMBER

- 09.00 Registration and refreshments
- 09.30 **Welcome and introduction**
Dr Jagjit Singh Srail, Head, Centre for International Manufacturing,
IfM, University of Cambridge
- 09.45 **Digital Transformation Ford's Aluminium F150 Truck**
John Fleming, Former Executive Vice President Global Manufacturing and Labour Affairs,
Ford Motor Company
- 10.30 Refreshments
- 11.00 **What is beyond Industry 4.0?**
Michelle Shi-Verdaasdonk, Vice President, Head of Global Manufacturing,
Signify (Formerly known as Philips Lighting)
- 11.45 **Cisco's supply chain digitized**
Edwin de Boer, Senior Director, Supply Chain Operations,
Cisco
- 12.30 Lunch and networking
- 13.45 **Integrated supply chain in the cloud**
Alain Leroy, SVP GSC Strategy & Transformation, Global Supply Chain,
Schneider Electric
- 14.30 **The importance of supply chain agility to enable business growth**
Chris Fielden, Group Supply Chain Director,
Innocent
- 15.15 Refreshments
- 15.45 **Made Smarter - UK's place in the 4th Industrial Revolution**
Juergen Maier, CEO,
Siemens UK
- 16.30 **Transforming the development, manufacture and supply of medicines**
Jon-Paul Sherlock, Global Technology Strategy Director,
AstraZeneca
- 17.15 Wrap up and close of session
- 19.00 Symposium Dinner at Christ's College

AGENDA | FRIDAY 28 SEPTEMBER

08.30 Registration and refreshments

09.00 **Designing and redesigning international manufacturing networks**
Professor Jan Olhager,
Lund University

Resource Efficiency in Food Supply Chains – a perspective from the green plains of Punjab

Dr Sandeep Kapur,
Punjab Agricultural University

Work Analytics: the human side of industry 4.0

Professor Fabrizio Salvador,
IE Business School

11.15 Refreshments

11.30 **RESEARCH THEMES | SESSION ONE**

Global supply networks

Automotive track I

Supply chain transformation enabled by advanced technologies I

Digital supply chain design, analysis and operation

13.00 Lunch

14.00 **RESEARCH THEMES | SESSION TWO**

Global manufacturing and China track I

Automotive track II

Food track

Sustainability and the circular economy

15.30 Refreshments

15.45 **RESEARCH THEMES | SESSION THREE**

Global manufacturing and China track II

Global value chain

Supply chain transformation enabled by advanced technologies II

Digital supply chain analytics

17.00 Close

Global supply networks

(Chair: Hiroshi Katayama)

A study on digital visual management for providing the right transparency against emergencies

Koichi Murata

Coopetitive Theory and Standardization: A review on the patent pools and Consortia Literature

Felix Andres Conde Chaux

Extension of KPI measures for effective lean management

Hiroshi Katayama

The Development Process at The Suppliers End: A systematic literature review

Rihab Alam, Fahian Huq, Grigory Pishchulov

Automotive track I

(Chairs: Jagjit Singh Srail, Patrick Hennelly, Gary Graham, Anthony Brown, Laird Burns)

Autonomous economic agents for low friction, connected travel and supply chain efficiency

Humayun Sheikh

Downstream innovations to upstream supply chain implications

David Wong

Competitive advantage from unused capacity: Innovating business models to capture uncaptured value

Ulrich F. Von Tuerckheim

Supply chain transformation enabled by advanced technologies I

(Chair: Naoum Tsolakis)

An exploration of blockchain technology in supply chain management

Alexandre Arnaldo Boschi, Rogério Borin, Julio Cesar Raimundo, Antonio Batocchio

Cloud-based manufacturing ecosystems: application development for sheet metal industry

Petri Helo, Yuqiuge Hao

Exploring social media as a vehicle for knowledge transmission across a horizontal supply chain: a case in insurance

Susan Grant

Development of Asian Landbridge from Finland - Current State and Future Prospects

Olli-Pekka Hilmola, Ville Henttu, Yulia Panova

Digital supply chain design, analysis and operation

(Chair: Ettore Settanni)

Exploring trajectories of procurement digitalization in manufacturing firms

Harri Lorentz, Sini Laari

Power configurations in digital global supply chains as revealed by upgrading cases

Afonso Fleury, Luis Oliveira, Maria Tereza Fleury

Combining field data analysis and simulation to evaluate an alternative Just-In-Time clinical trial supply strategy

Ettore Settanni, Jagjit Singh Srail, V. Mark Kothapalli

Global manufacturing firm investments - an explorative study in the Nordic context

Jussi Heikkilä

Global manufacturing and China I

(Chair: Xiaobo Wu)

Comparison Study of Exercise of Dynamic Capabilities vs Ad Hoc Problem Solving: Evidence from Latecomer High-Tech EM-NCs Facing Threats from Intellectual Property

Ziyan Tan

How do latecomers from emerging countries seize the window of opportunity: Catch-up evidence from Hikvision

Xiaobo Wu, Yanan Fu

Emergence and Evolution of an Electronics Industrial Cluster - HQB: Inspirations and Learnings from Perspective of Business Ecosystem

Jiawei Liu, Yuankun Luo, Yongjiang Shi

Dynamic Process: International Diversification and Innovation Performance

Jian Du, Qiuxia Zheng, Xiaoran Chang

TMT Compensation Gap, Executive-employee Compensation Gap and Firm Performance

Bin Guo, Zhen Wang

Automotive track II

(Chairs: Patrick Hennelly, Gary Graham, Anthony Brown, Laird Burns)

The role of remanufacturing in Ford's supply chain

Louise Gouldstone

The changing role of the actors in the automotive remanufacturing value chain

David Fitzsimons

Innovation and knowledge transfer in the connected and autonomous vehicle sector

George Filip

Food track

(Chair: Jagjit Singh Srail)

Government-to-Government (G2G) Contracts for India's Pulses Procurement: Ad-Hoc Bargaining, Long-Term Contracting and Supplier Diversification

Nagesh Gavirneni

Defining user profiles and socially responsible supply chains: a preliminary study based on erg theory

Tomás Harrington

Blockchain for food delivery

Dan Bumblauskas

Agriculture 4.0 as Enabler for Water Stewardship: An Emulation Tool for Drones in Farming Operations

Naoum Tsolakis, Dimitrios Bechtsis, Jagjit Singh Srail

Sustainability and the circular economy

(Chair: Pavan Manocha)

The new role of procurement in a circular economy system

Fabio Pollice, Antonio Batocchio

Exploring Sustainable Supply Chain Management in Mergers & Acquisitions - How Green is the Deal? target selection considerations within the lithium-ion battery supply chain

Pavan Manocha, Jagjit Singh Srail

Disruptive Technology as a Driver for the Sustainability of Traditional Manufacturing Supply Chains

Richard Cinderey

Action Plan Simulation for Manufacture 2030 bee

Simon J.F. Roberts, David Poulter, Allen Shaw, Emma Gollub, Aanand Davé, Mateusz Zalasiewicz, Matthew Freeman

Global manufacturing and China II (Chair: Yongjiang Shi)
Ecosystem Resource Utilisation: Case Study of Chinese Firms Xiaomi and Smartisan Frank Chuan Qin, Xianwei Shi, Yongjiang Shi
The business side of industrial symbiosis development Hanmin Huang, Yongjiang Shi
An Integrated Model of Knowledge Transfer from Global Flagships to Local Firms in Global Production Networks Jian Du, Xiaoran Chang, Dong Wu
When spatial crowdedness is good: the moderated U-shaped relationship between spatial crowdedness and cluster performance Bin Guo, Yuhang Jin, Qiang Li
Global value chain (Chair: Tomás Harrington)
A Study on Global Quality Value Chain organized by Japanese Manufacturers Masahiro Miyagawa
Hybrid perovskite solar cells redefine photovoltaics Global Value Chain Guendalina Anzolin, Marcello Righetto
MES/MOM systems for Manufacturing Networks Soujanya Mantravadi, Yang Cheng, Charles Møller
Start-ups: Integrating product, market and supply chain decisions to build-up market entry capabilities Luis F. Valente, Ana C. Barros, Catarina Maia, João P. Cunha
Blockchain application in supply chain chemical substance reporting Sukhraj Takhar, Kapila Liyanage
Supply chain transformation enabled by advanced technologies II (Chair: Parminder Kaur Aulakh)
Application of Analytical Hierarchy Process (AHP) for Comparative Evaluation of API Manufacturing Technologies Parminder Kaur Aulakh, Ettore Settanni, Jagjit Singh Srail
How much visibility has a company over its supply chain? A diagnostic metric to assess supply chain visibility A Dario Messina, Ana Cristina Barros, António Lucas Soares
Optimal Input Combination in Production Competition Considering the Presence of Carbon Market Ji Hyeok Jeong, Saedaseul Moon, Sang Min Yeo, Deok-Joo Lee, Hiroshi Katayama
The role of Collaborative Networks in Product-Service System Business Models for an Advanced Manufacturing Technology SME João Rodrigues Simões, J. M. Vilas-Boas da Silva, Isabel Duarte de Almeida
Digital supply chain analytics (Chair: Ulrich Ferdinand von Tuerckheim)
Anarchic Manufacturing & mass customisation: Solving customization and complexity with anarchy Andrew Ma, Aydin Nassehi, Chris Snider
Disrupting industrial systems: A strategic management approach to capturing uncaptured value from unused space capacity Ulrich Ferdinand von Tuerckheim, Sebastian Macmillan
Advanced Analytics in Action: a manufacturing plant cost index for strategic network design Vasilis Loulos, Dmitry Chernykh, Federico Rios
Production Networks Capabilities and Industrial Context: Performance Effects and Interaction Marian Wenking, Oliver Flaeschner, Thomas Friedli, Torbjørn Netland

SPEAKER

BIOGRAPHIES

SPEAKER BIOGRAPHIES



Edwin de Boer

Senior Director, Supply Chain Operations, Cisco

Edwin de Boer has worked at Cisco Systems for more than twenty years, joining Cisco in Amsterdam just after the start-up of the European Operations Centre. He has worked in Asia and United States, including a five year international assignment at Cisco headquarters in San Jose, USA.

Edwin is currently the Senior Director of Supply Chain Operations for EMEAR global manufacturing and logistics operations. He is also Supply Chain site leader for Amsterdam, as well as Managing Director and Board member for the Cisco International BV entity.

Edwin has worked in Finance, Manufacturing Operations, Sourcing, and Planning before moving into his current role of leading the teams responsible for engineering, materials management, fulfilment, logistics and delivery of Cisco products to customers in Europe, Middle-East, Africa and Russia. He has accountability for the local Manufacturing Operations in Russia, Poland and Czech Republic, as well as the logistics sites in The Netherlands, and the importation and delivery of products from global manufacturing sites to customers in EMEAR.

Prior to joining Cisco, his previous employers include suppliers of logistic ERP packages and business consulting firms. He has a Masters degree in Business from the University of Groningen, Netherlands, with specialisation in Supply Chain Management. He has in depth knowledge of Supply Chain Management solutions in large companies, and has performed sales, consultancy and operational management roles.

Other passions beside work are his family, but also golf and sailing if time allows. Australia has his special attention, as he grew up in Melbourne.



Chris Fielden

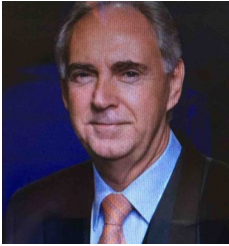
Group Supply Chain Director, Innocent

Chris Fielden originally trained as a Mechanical Engineer, specialising in Mechatronics at Loughborough University. Upon graduating he started his career working for Kodak in the engineering team before transitioning to operations. During this time Chris did numerous roles underpinned by implementing lean manufacturing and 6 sigma into the culture.

Chris then moved to PepsiCo as a shift manager before very quickly taking up the role of finance manager for their logistics operations where he undertook a project to transform the UK logistics operation resulting in the commission and building of new hub warehouse around the UK.

Chris then became the operations manager for one of the UK crisp factories and undertook a large scale terms and conditions change and significant capital investment program in the site. Following this he moved into outsourced manufacturing trying to find asset lite solutions for PepsiCo in the UK before taking up a role looking after all the outsourced manufacturing for Tropicana in Europe.

After 9 year at PepsiCo, Chris took up the role of head of operations at innocent before being promoted to the innocent board as supply chain director in 2017. Since joining innocent they have grown their business by over 50% and become a truly European business vs their UK origins. Here Chris looks after everything from fruit sourcing, technical and regulatory affairs, manufacturing and distribution. Building a supply chain to deliver this level of growth and complexity at pace is a truly exciting and challenging opportunity.



John Fleming

Formerly Ford Motor Company

John joined Ford Motor Company as an apprentice in 1967 and retired in December 2015 as Executive Vice President Global Manufacturing and Labor Affairs.

Prior to the last assignment was appointed as Chairman and Chief Executive Ford of Europe and Chairman Volvo Cars. The 48 years at Ford was spent in Manufacturing and General Management.

Since retiring in 2015, the time has been spent in the following areas:-

Board Advisor BEET Analytics Michigan.(Current)

Board member Republic Airways.(Current)

Chief Company Advisor and Leader of Lean Academy Changan Auto Chongqing China.

Chairman Manufacturing Leadership Council (Frost & Sullivan).

Chairman Fleming Peninsular Consulting.

Various Lecturing and Presentation events globally mainly on the subject of Digital Transformation in Manufacturing.



Alain Leroy

Senior Vice President Supply Chain Strategy & Transformation, Schneider-Electric

Alain Leroy has served as a SVP Global Supply Chain Transformation since 2017.

In this role, he is responsible for leading the Supply Chain strategy and the transformation globally.

Previously, he was Supply Chain SVP for the newly created Retail Business Unit.

Alain has shared his background between Lean Manufacturing, Plant Management, Supply Chain Management in different countries. He joined Schneider Electric in 1986 and served as a Lean Manufacturing Engineer before becoming Plant Manager early in his career in 1993.

Alain is an Engineer graduate of ENSAM, completed by leadership development with MESA Research Group, the School of Inspired Leadership and the INSEAD.



Juergen Maier

Chief Executive, Siemens UK

Juergen Maier was appointed Chief Executive on 1 July 2014. He has been a member of the Siemens UK Executive Board since 2008, and held senior roles within Siemens in the UK and Germany including Managing Director of Industrial activities for the UK and Manufacturing Director of the award-winning Drives factory in Congleton.

Juergen joined Siemens in 1986 with a BSc in production engineering from Nottingham Trent University, on a Siemens-sponsored graduate programme. He was made an honorary professor of Engineering at the University of Manchester in March 2014 and became a Fellow of the Royal Academy of Engineering in September 2017. Juergen has also received honorary doctorates for his services to UK Science and Engineering for the Universities of Lincoln, Nottingham Trent and Salford Manchester.

Juergen is a passionate advocate of the UK rebalancing its economy and has supported many UK-wide initiatives championing manufacturing, improved infrastructure and engineering skills. He has recently been asked by the Government department BEIS to lead a new review on Industrial Digitalisation for UK Manufacturing. Juergen also supports the modern re-industrialisation of the Northern Powerhouse and in that capacity is Chairman of the North West Business Leadership team and a board member of Greater Manchester LEP as well as the Northern Powerhouse Partnership.

Born 1964 in Germany with Austrian nationality, he came to the UK in 1974.



Jon-Paul Sherlock

Director Intelligent Pharmaceutical, AstraZeneca

Jon-Paul Sherlock, Director, Intelligent Pharmaceutical, leads Technology Strategy and Process Engineering for AstraZeneca Operations, with responsibility for the implementation of manufacturing technologies that improve quality and process robustness, improve supply chain agility and reduce cost. He is a chemical engineer and joined AstraZeneca after completing a PhD. Prior to this he led the development of innovative digital health solutions for emerging and established respiratory medicines. Before that he held senior roles in chemical, analytical and product development, supporting multiple therapeutic areas and all clinical phases including commercialisation. He is passionate about innovation and founded significant collaborations between industry and academia in the areas of formulation and physical processing, advanced manufacturing technologies and future pharmaceutical supply chains.

**Michelle Shi-Verdaasdonk**

Vice President, Head of Global Manufacturing, Signify

Trained as an Aerospace engineer, Michelle has worked in Research, R&D, Quality, Supply chain and Manufacturing in a diverse range of industries, such as automotive, food, household appliances and lighting.

Currently working at Signify (formerly known as Philips Lighting), the global leading lighting company with 125 years of innovation, which pioneered the world development of electric light & LED and today a leader in the intelligent lighting systems. Michelle is the Vice President, Head of Global Manufacturing. In this role, she leads the manufacturing function across over 40 factories around the world, delivering operational excellence while taking the function through its digital transformation.

Prior to Signify (Philips Lighting), Michelle held various management positions at PepsiCo, Ford Motor Company and Electrolux in Australia, Asia Pacific, Europe and USA.

Michelle is a thought leader in Industry 4.0, not only from technical aspect, but also from company strategic impact, change management, competency development and social impact aspects. In recent times, Michelle is advocating diversity and inclusion in the digitalization of “everything”, where diversity needs to be reflected in the world controlled by algorithms.

Michelle now lives in The Netherlands with her husband and two children.

**Sandeep Kapur**

Punjab Agricultural University

Dr Sandeep Kapur is professor of business management at Punjab Agricultural University, Ludhiana, India (PAU). He has also been given the additional responsibility of Comptroller at PAU. (This is a senior management position in the university and involves financial management. Annual budget of the university at present is around Rs.5 Billion). As a professor, he has teaching, research and consultancy responsibilities in marketing and strategy areas. He underwent a series of specialized training in the area of Business Strategy at various leading business schools in India. His current research interest includes Strategic Marketing, e-marketing, development of competitiveness with the help of “Cluster Development Approach”. He established Technology Marketing and IPR cell at PAU and designed various IPR related training courses.

He has guided the research work of more than 80 MBA and one PhD student. He has about 35 research papers to his credit in journals of national and international repute.



Jan Olhager
Lund University

Jan Olhager is Professor in Supply Chain and Operations Strategy at Lund University. He has published more than 60 papers in international scientific journals on topics ranging from international manufacturing networks and operations strategy to supply chain integration and operations planning and control, and two books on Operations Management and Manufacturing Planning and Control. He is Editor-in-Chief of Operations Management Research and Associate Editor of Decision Sciences and International Journal of Operations & Production Management. He is director of the Swedish Operations Strategy Centre, and has more than 30 years' experience as consultant to manufacturing firms, primarily in the Nordic countries.



Fabrizio Salvador
IE Business School

Fabrizio Salvador is Professor of Operations and Technology Management and Academic Director of Applied Research at IE Business School, IE University. He is also a founding member of the MIT Smart Customization Group. Dr. Salvador has been visiting professor at the Massachusetts Institute of Technology and Shanghai University, as well as adjunct Faculty Research Associate at Arizona State University. He received a Ph.D in Operations Management from the University of Padova, where he also graduated in Industrial Engineering.

Dr. Salvador research interests focus on the mechanisms through which organizations recombine or reuse their resources to respond to uncertainty in their operational environments. His award-winning research accumulated over 3000 citations in Google Scholar, and has been published in the Journal of Operations Management, Production and Operations Management, Organization Science, Decision Sciences, MIT Sloan Management Review, IEEE Transactions on Engineering Management, among the others. Dr Salvador also serves as Department Editor for the Journal of Operations Management, Senior Editor for Production and Operations Management as well as Associate Editor for the Decision Sciences Journal.

Dr. Salvador collaborated with numerous organizations towards improving operational performance through business analytics, digitalization and automation. These collaborations include AstraZeneca, DHL, Ernst&Young, IBM, John Deere, Nokia, Permasteelisa, Xerox, Tetra Pak, Unilever, CAP Gemini, Sener, PriceWaterhouseCoopers, WeCare, among the others.



AUTHOR ABSTRACTS

GLOBAL SUPPLY NETWORKS

A STUDY ON DIGITAL VISUAL MANAGEMENT FOR PROVIDING THE RIGHT TRANSPARENCY AGAINST EMERGENCIES

KOICHI MURATA, NIHON UNIVERSITY, COLLEGE OF INDUSTRIAL TECHNOLOGY, JAPAN

In the era of digital innovation, this paper discusses a new framework of visual management (digital visual management). With comparing with conventional visual management, this paper clarifies the improved functions of the framework from the perspective of the four capabilities; 1) visibility, 2) temporal capability, 3) problem-solving capability, and 4) geographical capability. For developing a system by this framework, this paper also indicates two approaches; a) the approach from the innovation of a visual tool as an interface with human, and b) the approach from the design of new data network. In addition, in the application stage of the framework, this paper discusses two troubles, 'the waste of visualization' and 'the omission of visualization', hidden in the established digital visual network system.

COOPETITIVE THEORY AND STANDARDIZATION: A REVIEW ON THE PATENT POOLS AND CONSORTIA LITERATURE

FELIX CONDE, ZHEJIANG UNIVERSITY, P.R. CHINA

This review paper is based on Coopetition, Standardization, industry consortia and patent pools. The findings from these studies suggest a close relation among these topics but a poor use of standardization, consortia, and patent pools settings to empirically test coopetition theories. The fore coming era of IoT would require a better understanding of coopetition, we can see how industries are cooperating for the development of new products, but also how those new technologies require the setting of standards, that per se are developed in a coopetition setting. Standard Setting Organizations (SSOs) are challenged to offer benefits for technology developers, implementers and society, while industry consortia and patent pools focus on benefits for the firms involved. This paper refers to two specific studies where coopetition is discussed but without using it as a base theory, Gallini (2014) and Baron & Pohlmann (2013). Future research on Standardization, Consortia and patent pools as settings of coopetition for empirical studies is suggested.

EXTENSION OF KPI MEASURES FOR EFFECTIVE LEAN MANAGEMENTHIROSHI KATAYAMA^A AND DEOK-JOO LEE^B, ^AWASEDA UNIVERSITY, JAPAN, ^BSEOUL NATIONAL UNIVERSITY, KOREA

The word "lean production" was born during late 70s to early 80s through International Motor Vehicle Program, a US-driven international project, and has been well known world-widely thereafter. It has been provided substantial contribution for corporate performance management and now, it is the time to change the industrial world again by its extended scheme. The topics being discussed in this paper include, as a starting point, interpretation of historical constitutional concept, the way of thinking and the sense of value of lean management followed by introduction of recent conceptual/ technological advancements in the world industrial scene. There are many evolutionary directions recently launched and/or attempted to realise by leading industries to cope with drastically changing business environment. Some significant issues such as structuring of KPIs, IoT-assisted leanised management, evolution on PDCA style of management, black-box technology and hybrid management style of reactive and proactive operations are spotlighted and discussed, all of which will bring us to hopeful future.

THE DEVELOPMENT PROCESS AT THE SUPPLIERS END: A SYSTEMATIC LITERATURE REVIEW

RIHAB ALAM, FAHIAN HUQ AND GRIGORY PISHCHULOV, UNIVERSITY OF MANCHESTER, UK

The purpose of this study is to conduct a systematic literature review, to synthesise previous work in the area of supplier development and arrive to a theoretical framework of the development process. To date, many empirical studies have captured the efforts in improving the supply base of a certain buyer. These studies has not been precise about; the overall outcomes of the development process, the approaches utilised to attain certain outcomes, interdependencies between different outcomes, and interactions between the different approaches. For this reason, we consider the systematic literature review as a necessity to find the rationale between outcomes and approaches. Our theoretical framework assist our understanding about the following inquiries: (1) what are the outcomes of the development process, (2) what are the approaches utilised to reach each outcome, and (3) how different contexts and industries can explain the rational between desired outcomes and selected approaches?

AUTOMOTIVE TRACK I

The Centre for International manufacturing in collaboration with Leeds University Business School and University of Huntsville in Alabama are hosting a unique workshop on the future of the automotive industry. This will bring academics and industry together in collaboration to clarify key questions about how the automotive industry and associated supply chains will transform in the future and which trends are influencing this development. Together we will explore a series of exemplary projects on firms who are successfully seizing on technology trends and transforming their business models. The workshop will address key challenges and opportunities in the automotive industry in terms of digital and advanced technology implementation.

Workshop organisers:

- Jagjit Singh Srail – Head, Centre for International Manufacturing, University of Cambridge, UK
- Patrick Hennelly – Research Assistant, Centre for International Manufacturing, University of Cambridge, UK
- Gary Graham – Associate Professor, Leeds University Business School, UK
- Anthony Brown – Research Assistant, Leeds University Business School, UK
- Laird Burns – Associate Professor, The University of Alabama in Huntsville, USA

AUTONOMOUS ECONOMIC AGENTS FOR LOW FRICTION, CONNECTED TRAVEL AND SUPPLY CHAIN EFFICIENCY

HUMAYUN SHEIKH, FOUNDER AND CEO, FETCH.AI

Humayun Sheikh is the chief executive and co-founder of Fetch.AI. The company operates at the juncture of blockchain, AI and machine learning technology and has developed the world's first adaptive, self-organising 'smart ledger'. This network, invented by world-leading AI experts, provides a platform for emerging and future marketplaces where autonomous agents can perform proactive economic activity. With unrivalled performance and scalability, Fetch is the missing critical infrastructure for tomorrow's digital economy. Earlier this year Fetch raised \$15m through a private sale. In the coming days, the company intends to publicly launch their test-net, with the main net scheduled for June next year. Humayun is an entrepreneur with a track record of success and Fetch is his fourth major venture. His first brought an entirely new way of thinking to the steel recycling sector, transforming his start-up company, Metallis, into a £40m business within six years. He was a lead investor in DeepMind, having the vision to provide early-stage support to artificial intelligence and deep neural network technology. DeepMind was ultimately acquired by Google for \$500m in 2014.

DOWNSTREAM INNOVATIONS TO UPSTREAM SUPPLY CHAIN IMPLICATIONS

DAVID WONG, SENIOR TECHNOLOGY AND INNOVATION MANAGER, SMMT

David Wong is Senior Technology and Innovation Manager at the Society of Motor Manufacturers and Traders, the UK's automotive industry trade body. Established in 1902, SMMT acts as the voice of the UK automotive industry by supporting and promoting the interests of more than 700 member companies at home and abroad.

David runs SMMT's technology and innovation portfolio which includes connected and autonomous vehicles, electro-mobility, hydrogen-mobility, digital and future mobility innovation, and design engineering. An integral part of his portfolio is working with key stakeholders from automotive (vehicle manufacturers and suppliers), technology, telecoms, data and digital, legal, insurance, infrastructure, academia and government to find solutions to some emerging challenges surrounding the development, testing and deployment of connected and autonomous vehicles.

David sits on the UK Automotive Council Technology Group, a government-industry partnership that sets strategic priorities and technology roadmaps for the automotive industry, and on the Board of Cenex, a low-carbon technology consultancy. He was a member of the Department for Digital, Culture, Media and Sport's Future Communications Challenge Group, which advised the UK Government on 5G strategy.

COMPETITIVE ADVANTAGE FROM UNUSED CAPACITY: INNOVATING BUSINESS MODELS TO CAPTURE UNCAPPED VALUE

ULRICH F. VON TUERCKHEIM, SENIOR ARCHITECT, ARUP

Ulrich is a senior team and project lead at Arup with an extensive history of managing complex projects for public and private sector clients from across many industries. Since 2008, Ulrich is developing and delivering projects and solutions for the manufacturing, pharmaceutical, automotive or finance sectors, amongst others. He studied at ETH Zurich (Swiss Federal Institute of Technology), Technical University Berlin, and University of Cambridge. In addition to his enthusiasm for his profession Ulrich recently completed a Master of Studies at the University of Cambridge Institute for Sustainability Leadership. His research focuses on capacity utilisation, sustainable business model innovation, strategic management and behaviour change.

SUPPLY CHAIN TRANSFORMATION ENABLED BY ADVANCED TECHNOLOGIES I

AN EXPLORATION OF BLOCKCHAIN TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

ALEXANDRE A. BOSCHI^A, ROGÉRIO BORIN^A, JULIO CESAR RAIMUNDO^B AND ANTONIO BATOCCHIO^A, ^AUNICAMP, BRAZIL, ^BUNIP, BRAZIL

Day by day new technologies is applied to the business environment. Since the start of the fourth industrial revolution, the digital tools allows productivity improvement. Different kinds of technologies used to support the companies in the tasks of sending and receiving information. The information exchanged between companies has always being a concern when having in mind trust, speed, and safety. During few decades, EDI (electronic data exchange) was the main technology the supply chain used to send and receive information. Recently, with the rise of the fourth industrial revolution and the Internet of Things (IoT), many aspects of the business environment have changed. Individuals and organizations are required to be more productive. One of the mainstreams for the business environment is blockchain. Some researches argued that bitcoin is the pioneer of blockchain technology. Financial companies joined forces to build a technological infrastructure to use the cryptocurrency on the market. The first blockchain conceived in 2008, in the wake of the global financial crisis and it has never been hacked. Supply chains are complex networks of distant, separate entities that exchange goods, payments, and data across a dynamic, continuously evolving landscape. Blockchain technology allows visibility providing the customer the opportunity to understand how the supply chain works and how to get more information about products traceability. However, there are some challenges to implement blockchain in logistic and supply chain. The paper presents a theoretical review including the principles of the blockchain operations and the required infrastructure to implement and it does not cover the technology architecture applied to the blockchain. The potential benefit of the blockchain will be cover to understand how to apply in logistic and supply chain environment, presenting some examples already implemented or identified.

CLOUD-BASED MANUFACTURING ECOSYSTEMS: APPLICATION DEVELOPMENT FOR SHEET METAL INDUSTRY

PETRI HELO AND YUQIUGE HAO, UNIVERSITY OF VAASA, FINLAND

Manufacturing industry is facing the impact of dynamic market and intense competition. Cloud computing enables the offering of manufacturing services over the Internet. The sharing of resources and capabilities between different stakeholders on cloud-based solution in collaborative relationships is widely accepted to be a fundamental support to business and physical production. The purpose of this study is to explore the approaches moving toward a cloud manufacturing ecosystems and presents possible implication for practice.

EXPLORING SOCIAL MEDIA AS A VEHICLE FOR KNOWLEDGE TRANSMISSION ACROSS A HORIZONTAL SUPPLY CHAIN: A CASE IN INSURANCE

SUSAN GRANT, BRUNEL UNIVERSITY, UK

The paper explores the introduction and launch of a dedicated social supplier network across a claims supply chain for home insurance in the UK. The paper presents a case study documenting an insurer's strategy to generate informal knowledge sharing across competitive service suppliers using a range of strategies to get suppliers to engage with the platform. Competitive and co-operative influences were linked to information and knowledge sharing behaviours. Social capital development was seen to moderate fiercely rivalrous behaviour over time and develop the foundations or means for better social relations, and provide the basis for informal knowledge sharing behaviour.

Interviews were conducted with users, highlighting the value of the platform in supporting knowledge sharing, even in typically competitive networks where information and knowledge exchange is usually guarded. The paper concludes with a consideration of managerial implications of the findings.

DEVELOPMENT OF ASIAN LANDBRIDGE FROM FINLAND - CURRENT STATE AND FUTURE PROSPECTS

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Finland has decades long history in railway transports using the Russian Trans-Siberian Railway (TSR). In 2004, Asian landbridge volumes increased to 124,000 TEUs per annum, and container balance was rather good in both directions. This favourable situation changed drastically in a short amount of time with Russian tariff increases, and volumes nearly completely disappeared. The situation was nearly such until China, in collaboration with Kazakhstan, started to implement ambitious "One Belt and One Road Initiative" (in 2015-2016).

DIGITAL SUPPLY CHAIN DESIGN, ANALYSIS AND OPERATION

EXPLORING TRAJECTORIES OF PROCUREMENT DIGITALIZATION IN MANUFACTURING FIRMS

HARRI LORENTZ AND SINI LAARI, UNIVERSITY OF TURKU, FINLAND

The aim of this paper is to explore the trajectories of procurement digitalization in manufacturing firms, i.e. to shed light on the current state of digitalization, as well as on the short-term and long-term plans regarding the same. A recently introduced framework for exploring procurement digitalization is adopted and operationalised for a web-based survey questionnaire. Drawing on the resulting data set from a small sample of Finnish manufacturing firms, we analyse dominant digital technology use and targeted drivers in three time windows: current time, near future, and long-term. A stylised trajectory of procurement digitalization is proposed, including key technology themes and targeted value drivers.

POWER CONFIGURATIONS IN DIGITAL GLOBAL SUPPLY CHAINS AS REVEALED BY UPGRADING CASES

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We discuss digitalization's effects on the upgrading of small- and medium-sized firms. Departing from mainstream literature about value chain upgrading, inter-firm power relationships, and digitalization's impacts on businesses and industries, we predict that global value chains with higher digitization degrees are more conducive to upgrading opportunities due to shifts in value chain coordination and organization, value creation logic, and the nature of upgrading strategies. A multiple-case study with firms intentionally sampled from the Digital Games Industry provided empirical support for the propositions. Our findings disclose a scenario that allows for questioning the association of upgrading with the conventional idea of moving up the value chain. We contribute to the value chain-related literature, as well as inform practitioners about ways to extract superior benefits from digital industries.

COMBINING FIELD DATA ANALYSIS AND SIMULATION TO EVALUATE AN ALTERNATIVE JUST-IN-TIME CLINICAL TRIAL SUPPLY STRATEGY

ETTORE SETTANNI^A, JAGJIT SINGH SRAI^A AND V. MARK KOTHAPALLI^B, ^AUNIVERSITY OF CAMBRIDGE, INSTITUTE FOR MANUFACTURING, UK, ^BGSK RD PLATFORM TECHNOLOGY & SCIENCE, USA

This paper combines recurrence analysis of field data from clinical trial supply with a proof-of-concept inventory profile simulation to evaluate an alternative packing capability that supports just-in-time (JIT) manufacturing and distribution of investigational medicinal products. Assumptions for JIT packing supply capabilities and expedite quality release were taken from a detailed design prototype recently commissioned by a leading pharmaceutical consortium. The suggested technological intervention is assessed in its ability to reduce finished good inventory while adequately responding to the dynamics of uncertain patient recruitment and required service levels. The proposed combination of field data analysis and simulation enables practitioners to consider the possibilities for a more economically viable adaptive clinical trial supply based on JIT technologies and near real-time product utilisation information across multiple locations.

GLOBAL MANUFACTURING FIRM INVESTMENTS - AN EXPLORATIVE STUDY IN THE NORDIC CONTEXT

JUSSI HEIKKILÄ, TAMPERE UNIVERSITY OF TECHNOLOGY, FINLAND

A strong research trend has recently focused on movements of manufacturing across regional boundaries. However, this research perspective depicts only a partial picture of global manufacturing strategies. More recently, revival of manufacturing in the high cost countries is related to collaboration in broader industrial ecosystems, particularly in the context of technology innovation. The purpose of this paper is to analyse and compare the various types of capital investments of large Nordic manufacturing firms in various parts of the world to build a global presence, i.e. direct capital expenditures, R&D expenditures and acquisitions and divestments. The aim is at understanding the various forms of building the global manufacturing firm footprints in different manufacturing industries under different contingencies, with a special focus on the role of technology in the major investment decisions of Nordic manufacturing firms. A novel approach and new avenues is searched to the recent research on global manufacturing movements.

GLOBAL MANUFACTURING AND CHINA TRACK I

COMPARISON STUDY OF EXERCISE OF DYNAMIC CAPABILITIES VS AD HOC PROBLEM SOLVING: EVIDENCE FROM LATECOMER HIGH-TECH EMNCS FACING THREATS FROM INTELLECTUAL PROPERTY

XIAOBO WU, ZIYAN TAN, HAoyu ZHANG, ZHEJIANG UNIVERSITY, CHINA

This study incorporates dynamic capabilities into threat management. To do so we carry on a comparative longitudinal case study. Building upon Winter (2003), we found that there are three interactional dimensions of dynamic capabilities: the capacity to sense and recognize threats, the capacity to adapt, and the capacity to reconfigure and transform. We also explore the determinants for firms to exercise dynamic capabilities; and whether “exercise of dynamic capabilities” is wise considered both from the attributes of the threats and the focal companies. Through the analysis, our study provides insight into the role of dynamic capabilities as an important factor in threat management. Further we open the “black box” regarding capability hierarchy and offers managerial implications for IP management and competitiveness development to latecomers.

HOW DO LATECOMERS FROM EMERGING COUNTRIES SEIZE THE WINDOW OF OPPORTUNITY: CATCH-UP EVIDENCE FROM HIKVISION

XIAOBO WU AND YANAN FU, ZHEJIANG UNIVERSITY, CHINA

More and more Chinese firms are emerging in the world. How the latecomers in China catch up with forerunners become the main issue in innovation research. Based on multiple case analysis of video surveillance company, we attempt to identify different kinds of window of opportunity and the catch-up strategies to seize the window of opportunity. Our research suggests that window of opportunity helps to improve the catch-up performance of latecomer enterprises. And the fit of window of opportunity and catch-up strategy has different effects on the catch-up performance of latecomers. So the catch-up strategy depends on the kind of window of opportunity and catch-up phase.

EMERGENCE AND EVOLUTION OF AN ELECTRONICS INDUSTRIAL CLUSTER - HQB: INSPIRATIONS AND LEARNINGS FROM PERSPECTIVE OF BUSINESS ECOSYSTEM

JIAWEI LIU, YUANKUN LUO, AND YONGJIANG SHI, INSTITUTE FOR MANUFACTURING, UK

The past thirty years have witnessed rapid development of electronics industry at Pearl River Delta Region in China. HuaQiangBei (HQB) cluster as the center of China's electronics industry and innovation hub, is an intriguing place to explore cluster's evolution behaviour and characteristics. Current literatures on cluster have mainly focused on cluster's functional characteristics, social network and technology diffusion. Theories of dynamic evolution of cluster, are still in an explorative stage. Very limited researches have mentioned cluster players' dynamic roles, strategies and interaction during transformation. Using data collected from eleven semi-structured interviews with identified key players within this cluster, research question 'How does the electronics cluster at HQB emerges and evolves from a business ecosystem's perspective' is answered in several steps. It is proposed in this paper that business ecosystem can be used as a new approach to explain HQB cluster's complex and adaptive business environment as HQB cluster. How dynamic conceptual models and lifecycle framework from Business Ecosystem domain could be utilized for structuring and analyzing cluster's lifecycle stages is explained in this paper.

DYNAMIC PROCESS: INTERNATIONAL DIVERSIFICATION AND INNOVATION PERFORMANCE

JIAN DU, QIUXIA ZHENG, XIAORAN CHANG, ZHEJIANG UNIVERSITY, CHINA

Drawing upon the Uppsala internationalization process model and organizational learning theory, this study examines how international diversification influences its innovation performance. We propose that there are three phases in the process of international diversification: expansion phase, conflict phase and convergence phase. With a longitudinal data set, we find that there is an inverted-S relationship between international diversification and innovation performance. In the expansion phase, international diversification is positively associated with innovation performance, while in the conflict phase, international diversification is accompanied by lower innovation performance. However, international diversification reaps innovation again in the convergence phase. We also find that the product development experience negatively moderates the effect of international diversification. When firms have more product development experience, the effect of international diversification on innovation performance is even weaker.

TMT COMPENSATION GAP, EXECUTIVE-EMPLOYEE COMPENSATION GAP AND FIRM PERFORMANCE

BIN GUOA, ZHEN WANGA, ZHEJIANG UNIVERSITY, CHINA

The effect of compensation gap among employees on firm performance has gotten many attentions of scholars in corporate governance domain. Utilizing the data of Chinese listed companies from 1999-2015, this paper investigates the effects that TMT compensation gap and executive-employee compensation gap have on firm performance, controlling the characteristics of firms including the intensity of invisible asset, asset-liability ratio, firm size, the number of employee, the change of capital structure, the duality of CEO and the ratio of independent director, as well as the industry dummies and the year dummies. Results show that there is a U-shaped relationship between TMT compensation gap and firm performance, and the executive-employee compensation gap has a positive effect on firm performance.

AUTOMOTIVE TRACK II

THE ROLE OF REMANUFACTURING IN FORD'S SUPPLY CHAIN

LOUISE GOULDSTONE, PURCHASE MANAGER, POWERTRAIN, ELECTRICAL, CORE CONTROL AND REMANUFACTURING, FORD MOTOR COMPANY

Louise has worked for Ford Motor Company for 30 years, joining as a graduate trainee.

Throughout her career, Louise has worked exclusively for the Customer Service Division in a range of roles covering Supply Chain, managing the transport operations in the UK and a period spent running the Inbound Operations of the UK Parts Distribution Centre.

Louise has spent the majority of her career in Purchasing. Moving from a Junior Buyer role through to a Specialist Buyer prior to undertaking operational roles within the Customer Service Division. Louise is now responsible for managing the Purchasing activities of Ford's Aftermarket Powertrain and re-manufacturing activities in Europe.

THE CHANGING ROLE OF THE ACTORS IN THE AUTOMOTIVE REMANUFACTURING VALUE CHAIN

DAVID FITZSIMONS, DIRECTOR, EUROPEAN COUNCIL FOR REMANUFACTURING

David is Managing Director at Oakdene Hollins and an alumnus of London Business School. He represents the European Remanufacturing Council at Ellen MacArthur Foundation CE100 meetings. In January 2018 he received a Highly Commended "Circulars Award" at Davos for his leadership on the issue of remanufacturing.

The European Remanufacturing Council aims to triple the value of Europe's remanufacturing sector to €100 billion by 2030. Members include IBM, Lexmark, Autocraft, Volvo, Michelin, SKF, Panalpina and syncreon amongst others.

"Recycling grew from 5% in the 1980's to 50% - let's see if we can do the same for remanufacturing. The policy agenda is set to move away from smashing products and components to meet material recycling targets and toward value retention." Said David at the World Steel Association conference on 10th September 2018.

INNOVATION AND KNOWLEDGE TRANSFER IN THE CONNECTED AND AUTONOMOUS VEHICLE SECTOR

GEORGE FILIP, MANAGER FOR CONNECTED AND AUTOMATED VEHICLES AT KNOWLEDGE TRANSFER NETWORK

George Filip is the Knowledge Transfer Manager for Connected and Autonomous Vehicles. He is a researcher at the University of Nottingham, looking into issues of Cybersecurity and Transparency for CAVs.

FOOD TRACK

GOVERNMENT-TO-GOVERNMENT (G2G) CONTRACTS FOR INDIA'S PULSES PROCUREMENT: AD-HOC BARGAINING, LONG-TERM CONTRACTING AND SUPPLIER DIVERSIFICATION

NAGESH GAVIRNENI, CORNELL UNIVERSITY, USA

Pulses are a vital source of plant-based protein for the large number of vegetarians in India. Domestic production satisfies only about 70% of the demand often leaving India at the mercy of global producers. Unpredictable domestic yields and limited import availability in times of need have recently caused crises (retail prices have been known to increase by 50-100% in a matter of days) for Indian households. Many solutions (e.g. export restrictions, minimum support prices, long term contract) have been proposed to address the issues inherent to these supply chains. India recently executed Government-to-Government (G2G) contracts with Mozambique and Myanmar to source those pulses that are exclusively cultivated there. We examine the role of ad-hoc bargaining, long-term contracting and supplier diversification in evaluating the effectiveness of these G2G contracts. We show that when the buyer bargaining power is low (high), ad-hoc negotiation is better (worse) than having a long-term contract. However, negotiating a long-term contract with the understanding that if it fails, an ad-hoc bargaining still can be pursued, is uniformly dominant. We further show that simultaneous negotiation of long-term contracts with multiple suppliers can also achieve a similar efficiency. Presence of a tighter budget constraint makes ad-hoc bargaining more attractive whereas the ability to store inventory has the opposite effect of making long-term contracts more attractive.

DEFINING USER PROFILES AND SOCIALLY RESPONSIBLE SUPPLY CHAINS: A PRELIMINARY STUDY BASED ON ERG THEORY

TOMÁS HARRINGTON, NORWICH BUSINESS SCHOOL, UK

Socially responsible supply chains remains a nascent research area in operations management. This preliminary study explores societal needs, in the context of designing socially responsible supply chains, as part of the TIGR2ESS programme. User-centred design, linked to requirements and goals, is employed to define a set of user profiles (personas) based around e.g., gender, generation, geography, social/ethnic group, holding (farm size), offering (crop), and support network (individual, family, community, farmer-producer organisations (FPOs)). Taking a social psychology perspective, ERG (Existence – Relatedness – Growth) theory is introduced as the basis of linking user group profiles to proposed outcomes from the TIGR2ESS Flagship Project on supply chain network design and modelling for sustainable livelihoods (FP5). Future work will involve the development of scenarios for test involving specific user profiles. These scenarios will be based on changing customer demand profiles, emerging technologies, and adoption of sustainable cropping systems that could support more resilient food systems and sustainable water use in northern and southern India. The approach, based on ERG theory, could also be extended as a mechanism for integrating specific outcomes across the six TIGR2ESS Flagship Projects to design socially responsible supply chains – specifically where piloting intervention models that look to balance the interests of farmers, the food industry, and consumers. Finally, a set of exploratory research questions are introduced based on preliminary user profiles and research opportunities recently reported in the area of socially responsible supply chains (Tsang, 2018), around (i) the economic and social value of information and technology, (ii) the establishment of norms for social responsibility in supply chains and (iii) the creation of more value for user groups.

BLOCKCHAIN FOR FOOD DELIVERY

DAN BUMBLAUSKAS, UNIVERSITY OF NORTHERN IOWA, USA

There is a lot of buzz in industry and academia about blockchain and its various uses in crypto currency, transportation logistics and supply chain management. How is this technology being applied in the food & beverage industry? How can producers, distributors, retailers, etc. use blockchain to more accurately and transparently move raw materials and finished goods through their supply networks into last mile delivery?

How are organizations such as SAP working with Blockchain? Learn more about some of the initiatives being developed on the front line of blockchain. A case study from Bytable Foods, a midwestern USA start up company, which is utilizing blockchain technology in tracking food will be discussed. Specific examples include egg and cattle distribution.

AGRICULTURE 4.0 AS ENABLER FOR WATER STEWARDSHIP: AN EMULATION TOOL FOR DRONES IN FARMING OPERATIONSNAOUM TSOLAKIS^A, DIMITRIOS BECHTSIS^B, JAGJIT SINGH SRAI^A, ^AINSTITUTE FOR MANUFACTURING, UK, ^BALEXANDER TECHNOLOGICAL EDUCATIONAL INSTITUTE OF THESSALONIKI, GREECE

This paper aims to provide an emulation tool for the ex-ante assessment of drone technologies and sensory applications that could be deployed in agricultural operations to monitor plantations status in terms of water requirements and inform respective precision agriculture operations to ensure freshwater stewardship, especially in water scarce areas like India. The tool combines the technical capabilities of a 3D dynamic simulator and a robotics middleware to accurately and efficiently emulate the autonomous surveillance operations of an intelligent systems in an outdoor environment. The emulated intelligent system's technology, comprising of a drone equipped with optical sensors, is assessed in terms of recognising individual plantations in agro-fields and evaluating their respective needs for water. The proposed proof-of-concept emulation tool could further inform practitioners to consider the development of a real-world test beds for the ex-ante performance evaluation and testing of an equivalent physical system.

SUSTAINABILITY AND THE CIRCULAR ECONOMY

THE NEW ROLE OF PROCUREMENT IN A CIRCULAR ECONOMY SYSTEM

FABIO POLLICE AND ANTONIO BATOCCHIO, UNIVERSITY OF CAMPINAS, BRAZIL

This paper explores the new role of Procurement and Supply Management (PSM) in a circular economy framework. Traditional procurement strategies are focused on a “take-make-disposal” approach, aligned to the current linear economy agenda. However, circular economy principles are becoming more important every day, impacting the well established procurement way of working. PSM models are required to evolve into this new environment, supporting the business in broader and more strategic activities than today’s norm. To tackle the challenges of the Circular Economy, a value chain orientation won’t be enough. This is not about improving reverse logistics or sustainable sources. This is about partnering with designers and developers to have materials that can be reused, repaired and remake for several loops ahead. And develop strategic suppliers that can provide and manage these material chains over time. A new mindset will be needed for the PSM teams, new performance measurement systems, new skills and competencies. This paper details these new requirements and presents the outcomes of a case study done in a global consumer goods company that is moving from a traditional buying approach to this circular procurement mindset.

EXPLORING SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN MERGERS & ACQUISITIONS – HOW GREEN IS THE DEAL? TARGET SELECTION CONSIDERATIONS WITHIN THE LITHIUM-ION BATTERY SUPPLY CHAIN

PAVAN MANOCHA AND JAGJIT SINGH SRAI, INSTITUTE FOR MANUFACTURING, UK

Organisations are challenged with implementing global commitments for sustainability, such as the UN 2030 Agenda for Sustainable Development and the Paris Climate Accord (2015, COP21) within the context of their operations and value networks. Networks which are increasingly fuelled by mergers and acquisitions (M&As), which in 2016 accounted for \$4.8 trillion in global deal value (Dealogic, 2017). While the performance outcomes of M&As produce mixed results, merger synergies fundamentally change the economic, social and environmental footprint of an organisation and its product supply chain. These compounding challenges of post-merger supply chain performance and operations sustainability is not adequately explored in the literature (Manocha, Srai and Kumar, 2016), or practically considered during target selection. In this paper we consider the factors that determine how green is the deal? A case study research approach is adopted drawing upon an exemplar deal within the U.S. lithium-ion battery (LIB) product-supply chain for electric vehicles (EV) where high M&A deal-interest and sustainability considerations exist. The five capitals model (Porritt, 2007) is the theoretical lens, and an investigative framework developed from sustainability assessment, M&A transaction-execution, and supply-chain re-configuration literature is tested. Findings suggest that due diligence of natural capitals (resources, sinks and eco-system services) in supply chain operations represents an under-explored consideration in M&A target selection, and a gap of both theoretical and practical relevance.

DISRUPTIVE TECHNOLOGY AS A DRIVER FOR THE SUSTAINABILITY OF TRADITIONAL MANUFACTURING SUPPLY CHAINS

RICHARD CINDERREY, PRIMETALS TECHNOLOGIES, UK

The reconfiguration of manufacturing supply chains may be a desirable business objective for reasons of efficiency, cost and quality, amongst other things. However, the introduction of disruptive technology which in itself provides intrinsic manufacturing benefits may, as a consequence, necessitate that traditional organisations need to adopt new practices to accommodate the introduction of such novel processes. This paper examines how the activity of introducing breakthrough innovation must consider the wider impact beyond process technology and its implications for traditional manufacturing organisations.

ACTION PLAN SIMULATION FOR MANUFACTURE 2030 BEE

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A report on the progress of a 6 month feasibility study into modelling collaborative operational action plans for energy efficiency. Action planning is an archetypical practice for operations improvements and Kanban or PDCA boards are commonplace in operations management. However operational action plans are seldom collaboratively developed, shared or effectively deployed for energy, water and materials efficiency improvements and best practices. Collaboration is seen as the key to accelerating the adoption of best practices for resource efficiency and a new platform (Manufacture2030 bee) is a web-based software tool which can enable this.

Manufacture2030 bee has a library of over 300 resource efficiency actions with benchmark data for savings potential. These actions cover cross-cutting utilities and systems, such as boilers, compressed air, HVAC, process heat, refrigeration and others. M2030 bee currently facilitates individual actions to be compared for decision making purposes. However, an opportunity to develop a portfolio approach and tailor a range of anticipated savings to a user’s facility has been identified. This tailoring will allow decision makers to study the cumulative effects of improvements.

GLOBAL MANUFACTURING AND CHINA TRACK II

ECOSYSTEM RESOURCE UTILISATION: CASE STUDY OF CHINESE FIRMS XIAOMI AND SMARTISAN

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The development of ecosystem-based companies and platforms draws attention following the rapid growth of internet industry in China. Some of the firms choose to use light asset models which provide massive potentials in terms of utilising resources across the ecosystem. The pioneers include mobile phones and internet of things (IoT) industries. Current literature does not capture the unique characteristics and operation modes of such businesses and their collaborations. Two related research topics company capability and business ecosystem are also within their development phase. Therefore, this research presents the research question of “How does relatively new Chinese phone and IoT companies utilise different external resources within the ecosystem?”

THE BUSINESS SIDE OF INDUSTRIAL SYMBIOSIS DEVELOPMENT

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Successful Kalunborg industrial symbiosis has been thoroughly studied and widely imitated. But many such planned industrial symbiosis projects “never came into fruition”, as noted by scholars cited in Chewtow (2009, p.13). To understand why, we need to know how and why industrial symbiosis emerged, evolved and developed. Although industrial ecology research has led to a “number of practical actions in the movement towards sustainability” (Tsvetkova and Gustafsson, 2012, p.246), it has little to say in explaining the successful industrial symbiosis development. This task has recently been taken up by a number of social scientists whose research has shown that industrial symbiosis ecosystem emerged serendipitously as firms collaborated to utilize their waste. Yet, even such research seldom addresses directly what accounted for the success or failure of industrial symbiosis development. Our current research attempts to fill this research gap. Using case study methodology, we studied the evolution of forty-eight waste utilization business projects since 1960s in the sugar industry of Chongzuo City, China, and we explored how such business evolution led to the emergence and evolution of the industrial symbiosis ecosystems in the region. From these case studies, we have found that successful development of industrial symbiosis ecosystem depends on the network firms’ growth dynamics, or more specifically, on the dynamics of developing their business of manufacturing and selling by-products made from waste, rather than on the dynamics of intrafirm organizational changes and interfirm collaboration which are only enabling conditions. We identified five necessary conditions for the success of the waste utilization business which in turn became the sufficient condition for the successful development of the industrial symbiosis ecosystem.

AN INTEGRATED MODEL OF KNOWLEDGE TRANSFER FROM GLOBAL FLAGSHIPS TO LOCAL FIRMS IN GLOBAL PRODUCTION NETWORKS

JIAN DU, XIAORAN CHANG, DONG WU, ZHEJIANG UNIVERSITY, CHINA

One of the major challenges a local firm faces is how to manage the knowledge transfer in global production networks. The paper aims to clarify an integrated two-stage model of knowledge transfer from global flagships to local firms. Adopting a sample of 105 Chinese firms, we find that the global flagship’s capacity and willingness to engage in knowledge transfer positively impact on local firm’s performance through the knowledge contributed by global flagship. Meanwhile, the organizational distance and the local firm’s absorptive capacity also affect local firm’s performance varying with different types of ties between local firms and their global flagships.

WHEN SPATIAL CROWDEDNESS IS GOOD: THE MODERATED U-SHAPED RELATIONSHIP BETWEEN SPATIAL CROWDEDNESS AND CLUSTER PERFORMANCEBIN GUO^A, YUHAN JIN^A, QIANG LI^B, ^AZHEJIANG UNIVERSITY, CHINA, ^BZHEJIANG UNIVERSITY CITY COLLEGE, CHINA

The spatial crowdedness or agglomeration phenomenon occurred to interconnected cluster firms can be benefited to clusters due to increased productivity, new business formation and innovation. Yet, the benefits from spatial crowdedness can be outweighed by congestion effects. While previous researches explained either positive or negative effects of the spatial crowdedness on cluster performance, they didn’t represent them in a more cluster-specific perspective or the potential inverted U-shaped relationship. The paper aims to investigate how spatial crowdedness influence cluster performance in perspective of the resource connection, and answer under what condition the spatial crowdedness is good. We expect that: firstly, the interaction of resource connection opportunity and motivation leads to the inverted U-shaped relationship; secondly the structure of knowledge interaction or distribution, that is, the industry-level technological complexity and vertical industrial value chain model are vital to enhancing the opportunity and motivation of resource connection with increasing spatial crowdedness. Using a sample of 171 county-level industrial clusters in China via secondary data collected from each cluster’s local county Bureau of Statistics, Municipal Commission of Economy and Information Technology, and firm-based patent database, we find support for negative moderating effects of technological complexity on the inverted U-shaped relationship between spatial crowdedness and cluster performance. The findings extend the resource-based view from firm’s internal resource to the connection of external and internal resource. The findings uphold the necessity of enhancing local industrial technological complexity and vertical business and knowledge connection to enhance the positive effects of spatial crowdedness and alleviate the congestion effects. In sum, we develop a more precise perspective to elucidate the moderated inverted U-shaped relationship between spatial crowdedness and cluster performance.

GLOBAL VALUE CHAIN

A STUDY ON GLOBAL QUALITY VALUE CHAIN ORGANIZED BY JAPANESE MANUFACTURERS

MASAHIRO MIYAGAWA, CHUKYO UNIVERSITY, JAPAN

Japanese global manufacturers have been challenging to remain competitive in the global marketplace by organizing global value chains for the last three decades. This paper focuses on global manufacturing and quality supply networks, and aims to evaluate the quality oriented operations management in changing environments.

HYBRID PEROVSKITE SOLAR CELLS REDEFINE PHOTOVOLTAICS GLOBAL VALUE CHAIN

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More than one billion people around the world have no access to electricity. Despite its increasing trend, the growth of energy access was almost entirely fuelled by non-renewable energy resources. Therefore, improving the use of alternative resources is of paramount importance. Among the different renewable resources, solar Photovoltaics (PV) is growing at a fast pace, thereby raising much expectation, especially for its enormous potential in "out-of-the-grid" applications. Nowadays, solar cells are (almost) exclusively made out of silicon which has high costs of production both regarding infrastructure and energy consumption. This paper aims to provide insights on perovskite solar cell technologies, which constitute one of the most promising advances in the PV field.

MES/MOM SYSTEMS FOR MANUFACTURING NETWORKS

SOUJANYA MANTRAVADI, YANG CHENG AND CHARLES MØLLER, AALBORG UNIVERSITY, DENMARK

The purpose of this paper is to explore the role of information systems (in smart factories) to support the coordination practices in the international manufacturing networks (IMN). It attempts to study the usefulness of manufacturing IT tools to enable IMN coordination for optimization of physical distribution. Theoretical propositions made on manufacturing operations management (MOM) systems for IMN coordination (based on the literature study) were empirically examined using two case studies of companies. Based on the qualitative analysis of propositions and empirical findings, the paper identified manufacturing execution systems (MES) to have the potential for achieving IMN coordination goals. As a result, the priorities for developing research agenda in this area to design factories of the future and to achieve Industry 4.0 vision were established. It is the first attempt to analyse the concepts of MES/MOM systems to empirically investigate their application in IMN coordination.

START-UPS: INTEGRATING PRODUCT, MARKET AND SUPPLY CHAIN DECISIONS TO BUILD-UP MARKET ENTRY CAPABILITIES

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Start-ups are new ventures created to introduce new products and services into the market. They are an important part of the world economic system, since start-ups lead the introduction of many innovations into the market and contribute to job generation. While searching for their business model, start-ups constantly adapt to new markets and customer needs, which leads to changes in product features and internal operations. The importance of product adaptation to market needs has been emphasized in entrepreneurship literature. On the other hand, operations management literature recognize the important role of product design in shaping a firm's supply chain. Therefore, studying the integration of product, market and supply chain decisions to build-up market entry capabilities in start-ups seems to be a prominent area of research. The present study proposes a framework of product, market and supply chain decisions for start-ups. In addition, it carries out a multiple case study to develop insights on how start-ups may use the proposed framework to develop their market entry capabilities.

BLOCKCHAIN APPLICATION IN SUPPLY CHAIN CHEMICAL SUBSTANCE REPORTING

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Crypto-currencies have gained prominence in recent years due to: (1) potential large increase in values; (2) transferability between different users, and (3) security and; (4) traceability of data enabled by blockchain methods. Blockchains utilize an underlying digital ledger system which enables data to be encrypted, recorded and traced in a more efficient manner than traditional paper and electronic based systems. Chemical regulations impose the need on industry to record the use of hazardous chemicals, which can vary from: (1) simple reporting, through to; (2) permits to continue the use substances, until alternative substances are identified; or even (3) substances become restricted for use, within specific use cases, or restricted from use outright. The importance of obtaining supply chain chemical substance reporting cannot be understated, without accurate supply chain data, and concise internal product definitions, the process of identifying chemical substances in use: (1) where used; (2) if they appear on the finished part, or; (3) used as process chemicals used to manufacture parts, or (4) used within the maintenance and repair of parts. The process of collating supply chain chemical substance reporting is often a time intensive process as data needs to be requested, collated, checked, verified and rolled up to assess potential business continuity risks, as well as varying levels of reporting activity back to employees, consumers and chemical regulators.

SUPPLY CHAIN TRANSFORMATION ENABLED BY ADVANCED TECHNOLOGIES II

APPLICATION OF ANALYTICAL HIERARCHY PROCESS (AHP) FOR COMPARATIVE EVALUATION OF API MANUFACTURING TECHNOLOGIES

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The comparative evaluation of emerging API manufacturing technologies considering multiple criteria can be a challenge in the absence of detailed and specific quantitative data. To overcome this limitation, this study illustrates an application of the Analytical Hierarchical Process (AHP) to support early-stage assessment of five representative reactor technologies (conventional batch, microreactor, microwave, supercritical fluid--SCF, and mini-CSTR cascade). Each technology's performance is evaluated qualitatively based on secondary data with regards to a range of eleven criteria through a rigorous scoring system. Findings highlight that the ability of a specific emerging technology to replace conventional batch technology depends on the relative importance that experts assign to specific performance areas.

HOW MUCH VISIBILITY HAS A COMPANY OVER ITS SUPPLY CHAIN? A DIAGNOSTIC METRIC TO ASSESS SUPPLY CHAIN VISIBILITY

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In an interconnected and increasingly complex world, no supply chain is immune to disruptions. Managing supply chain visibility is being recognised by many researchers and practitioners as vital. In fact, visibility has been proven to reduce uncertainty and improve decision coordination, therefore increasing resilience. Still, quantifying the visibility remains a hard task for managers. This paper aims to describe an approach that, based on the types and properties of the shared information, allows managers to assess the degree of visibility over its supply chain partners. Our approach represents a first attempt to quantify the visibility necessary to deal with disruptions, taking into account a holistic view of the supply chain. The resulting metric represents the main contribution of this study. In particular, the metric should be used as diagnostic tool providing to decision-makers an overview of its supply chain in order for them to identify the nodes where improvement actions are more effective. Additionally, the metric can be used for benchmarking purposes. Main limitation of the study is related to the lack of a weight attribution for node differentiation. Future research will aim to differentiate the supply chain nodes in terms of their relevance but also to test the accuracy and practical usability of the metric in real context.

OPTIMAL INPUT COMBINATION IN PRODUCTION COMPETITION CONSIDERING THE PRESENCE OF CARBON MARKET

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As a result of Paris Agreement and the spread of carbon trading schemes, carbon emissions reduction has become an important factor in global economy. In the existence of carbon market, manufacturers have to modify their production plan to reduce carbon emissions as well as maintain profits. Especially, since each inputs used in manufacturing has a different emission level, modification of input combination should be considered. We suggest game theoretical model to find the optimal input combination of firms in duopoly market when the carbon trading scheme is adopted. Numerical analysis is conducted to explore the effect of carbon price to the market and environment. If carbon price increases, the total output of market decreases, and market price of goods increases. We find that firm's profit can increase in some cases even if the carbon price increases. Carbon emissions reduction effect is greater as the carbon price is higher.

THE ROLE OF COLLABORATIVE NETWORKS IN PRODUCT-SERVICE SYSTEM BUSINESS MODELS FOR AN ADVANCED MANUFACTURING TECHNOLOGY SME

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This research appreciates the relevance of servitization business models for an Advanced Manufacturing Technology (AMT) SME in the Ornamental Stones (OS) cluster. A holistic conceptual model was designed and tested addressing strategy, organizational structure and technological infrastructure. Primary data gathered by semi-structured interviews were completed by unstructured observation and documentation studying. The model usefulness/usability was qualitatively confirmed by the outcomes relevance. As regards results, primary stages of servitization are already occurring in the case. They might progress towards advanced servitization, if both digital business platforms and Industry4.0 and collaborative networks are deployed. Moreover, the lack of open innovation in the OS SME generates strong feelings of ownership towards resources, which constrains servitization progress and provides a threat to cluster survival. However, a mandatory progress towards Building Information Modelling is expected, which is going to demand virtual breeding environments and virtual organizations that will leverage competitive advantage and enable servitization progress.

DIGITAL SUPPLY CHAIN ANALYTICS

ANARCHIC MANUFACTURING & MASS CUSTOMISATION: SOLVING CUSTOMIZATION AND COMPLEXITY WITH ANARCHY

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Smart manufacturing has been heralded as the future of manufacturing with cloud-based manufacturing as the latest paradigm. One of the very challenging smart manufacturing objectives is providing mass customisation for which product variability and scale are key factors to manage. These factors are evaluated in this paper against different scheduling and control structures through agent-based simulation modelling. The model demonstrates that Anarchic Manufacturing, or controlling the production in complete absence of hierarchy offers improved performance as the scale increases, and traditional methods to manage complexity, by establishing hierarchical cell structures, significantly detriment performance under certain circumstances. Anarchic Manufacturing is an extremely distributed planning and control system based on the principles of the free market; it benefits from high scalability and emergent outcomes of self-organisation and high adaptability to complexity.

DISRUPTING INDUSTRIAL SYSTEMS: A STRATEGIC MANAGEMENT APPROACH TO CAPTURING UNCAPTURED VALUE FROM UNUSED SPACE CAPACITY

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Advanced technologies provide data about how capacities are used, disrupt operational processes and cause demand for capacities to change. This research investigates how advanced technologies affect capacity utilisation of teaching space at Cambridge University (CU) intending to identify how capacity utilisation of teaching space can be managed strategically in order to capture uncaptured value inherent in unused capacity. Furthermore, the investigation studies how incorporating sustainability into managing space capacity affects global supply networks and the industrial systems associated with the production and operation of space capacity. The theory employs literature from the fields of sustainable business model innovation, strategic management, supply chain design and capacity utilisation of teaching space, using a broader economic and strategic management perspective. Quantitative methods are conducted to identify the value uncaptured, and quantify the extent of unused capacity. The paper concludes with summarising managerial implications linked to improving efficiency and effectiveness of investments and resources in order to decrease the need to invest new capital carbon.

ADVANCED ANALYTICS IN ACTION: A MANUFACTURING PLANT COST INDEX FOR STRATEGIC NETWORK DESIGN

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The purpose of the paper is to present how Syngenta, a leading global company in crop protection and seeds responds to the challenges of network design using advanced analytics tools. It contributes to the topic of supply chain transformation enabled by digital technologies, addressed in the Cambridge International Manufacturing Symposium by presenting a manufacturing plan cost index for strategic network design. It further aims to make a connection between published frameworks (Institute for Manufacturing) and their applicability to a corporate environment and also address capabilities of advanced analytics and modelling technologies.

PRODUCTION NETWORKS CAPABILITIES AND INDUSTRIAL CONTEXT: PERFORMANCE EFFECTS AND INTERACTION

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This study investigates the performance effects of network capabilities and their interrelation with manufacturing companies' industrial context. We surveyed 106 senior Central European manufacturing executives, who are in charge of more than 2284 plants, and analyse the data with partial least squares structural equation modelling. Our study contributes quantitative evidence to the mainly qualitative and conceptual literature on manufacturing networks. We obtain four main results. Firstly, manufacturing companies can gain a competitive advantage from high capability manufacturing networks. Secondly, the performance of manufacturers is related to their system environment. Thirdly, negative effects from manufacturer's system environment can be mitigated by the capability level of their network system. Fourthly, the role of access as a network capability may require additional conceptual treatment by the literature. Furthermore, we discuss the implications of our results for future research and managerial practice.

DATES FOR YOUR DIARY

DEVELOPING END-TO-END SUPPLY CHAIN CAPABILITY

11 OCTOBER 2018, IFM, CAMBRIDGE

This open course helps attendees develop a strategic approach to identifying, addressing and developing supply chain capabilities, enhancing integration across networks.

MAKING THE RIGHT THINGS IN THE RIGHT PLACES

15 - 16 MAY 2019, IFM, CAMBRIDGE

Take a structured approach to developing and exploiting a global manufacturing footprint strategy. This one-day open course will help attendees to reconfigure their company's international footprint of manufacturing activities to deliver real business impact.

CIM SYMPOSIUM 2019

26 - 27 SEPTEMBER 2019, MØLLER CENTRE, CAMBRIDGE

The annual Cambridge International Manufacturing Symposium provides the chance to hear from world-leading business figures and thinkers on the challenges facing modern manufacturing. It is a unique event that brings together senior industrialists and leading academics to share approaches and experiences in this strategic domain. The Symposium includes keynote speakers from the world's leading companies and universities, mixed with informal networking opportunities. It aims to create a growing community of international manufacturing enthusiasts and to inspire 'thought leadership' in this exciting field.

For further details or to book your place please visit www.ifm.eng.cam.ac.uk

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