

18th Cambridge International Manufacturing Symposium | 11-12 September 2014

Capturing value from global networks:

implications for manufacturing, supply chains and industrial policy

PROGRAMME & ABSTRACTS

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).

Organising Committee

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CHAIRMAN'S INTRODUCTION



The 18th Cambridge International Manufacturing Symposium, in its annual tradition of facilitating open dialogue between industry, academia and policy makers, will this year focus on the subject of **capturing value from global supply networks**. Within this broad topic, we introduce several new themes that will increasingly inform the design of these global networks. The symposium will examine for the first time the Re-shoring phenomenon that has been widely discussed in the management press, within a broader context where we continue to observe the globalisation of manufacturing operations. Keynotes will also discuss how IT enabled and e-commerce based supply chains are changing the role of information, providing insights on individual consumer behaviour. Novel business model examples are also presented where manufacturing supply chains are a key component in product

differentiation. Finally, we continue on a theme emerging from last year's Symposium conversation on the strategic implications of managing supply chain risk.

As per our usual format, we have some outstanding senior industrial speakers on the first day of our Symposium, representing exemplars of innovative manufacturing industries and those managing increasingly complex global supply chains. Senior executives from **Sanofi, Caterpillar, Grundfos, Tata (TCS), Lockheed Martin, Innocent Drinks and Unilever** will be sharing their thoughts on the future configurations of their international manufacturing supply networks as they develop and/or exploit changing technologies, and develop products delivered to new channels and emerging markets.

On day two we will be presenting insights from leading academics from around the globe on the analysis, design and operation of global value chains. This builds on our new report from the Centre for International Manufacturing on configuring global value networks, which captures some of our most recent research and practice experiences, and covers many of the themes we will address at the Symposium. Our keynote academic speakers this year are Professors Ellram and MacCarthy, who will share their research insights on international re-shoring trends & drivers, and on the future configuration of international manufacturing operations.

I am sure you will enjoy the engaging yet informal atmosphere of our rather unique academic-practitioner 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 2014 Cambridge International Manufacturing Symposium.

Dr Jagjit Singh Srani

Head of Centre for International Manufacturing

University of Cambridge Institute for Manufacturing

AGENDA | THURSDAY 11 SEPTEMBER

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| 09.00 | Registration and refreshments |
| 09.25 | Welcome and introduction: Dr Jagjit Singh Srail, Head, Centre for International Manufacturing, IfM, University of Cambridge |
| 09.30 | Life after the Patent Cliff
Peter McDonnell, Senior Technical Director, Sanofi-Genzyme |
| 10.15 | Refreshments |
| 10.45 | Global Network Considerations in a Distributed Business
Tim Flaherty, ACS Operations General Manager, Caterpillar |
| 11.30 | Manufacturing footprint for Grundfos Serbia including establishment of networks and supply chain
Knud Krægpøth, SVP Corporate Supply Chain, Grundfos |
| 12.15 | Lunch and networking |
| 13.30 | eCommerce - Changing Shopper Habits and the impact on international manufacturing
Dhivant Patel, Global e-Commerce, Supply Chain Manager, Unilever |
| 14.15 | Risk and resilience of global supply networks
Nigel Strutt - UK Director, Supply Chain Strategy, Lockheed Martin, UK |
| 15.00 | Refreshments |
| 15.30 | A Vision for Future Manufacturing Enterprises
Jeffrey Tew, Chief Scientist TCS, TATA |
| 16.15 | Squeezing improvements: innocent's outsourced supply chain journey
Stephen Spall, Group Operations Director, Innocent Drinks |
| 17.00 | Wrap up and close of session |
| 19.00 | Symposium Dinner at Peterhouse College |

AGENDA | FRIDAY 12 SEPTEMBER

08.00	Registration and refreshments
08.30	The Manufacturing Location Decision - where's the value now? Professor Lisa M. Ellram Co-editor-in-chief, Journal of Supply Chain Management; James Evans Rees Distinguished Professor of Supply Chain at the Farmer School of Business, Miami University
09.15	Supply Chain Evolution - An Emerging Science Professor Bart L MacCarthy European Editor, The International Journal of Production Economics; Professor of Operations Management, Nottingham University Business School
10.00	Refreshments
10.30	RESEARCH THEMES SESSION ONE Industrial Sustainability Internationalisation Network Structures Global Manufacturing & China - 1 Corporate Lean Partnerships: special track
12.00	Academic Panel discussion 'Publishing and Special Issue Opportunities for Research on New Supply Chains and Global Value Networks'
12.30	Lunch
13.15	RESEARCH THEMES SESSION TWO Off-shoring & Re-shoring Network Design & Strategy Sustainable Industrial Systems Global Manufacturing & China - 2 Logistics & Distributed Networks
14.45	Refreshments
15.00	RESEARCH THEMES SESSION THREE Production Management Performance Measures Medical Sector Studies Value Capture Supply Chain Evolution
16.30	Close

Industrial Sustainability (Chair: Mukesh Kumar)
The adaptation of supply chains to climate change Andre Kreie ¹ and Christine Rutherford ² , ¹ Kuehne Foundation, Switzerland, ² Heriot-Watt University, UK
Supply chain resilience for Oil & Gas industry infrastructure projects Ankan Mitra ¹ , Pep Borromeo ² , ¹ ABB Global Industries and Services Ltd, India ² ABB Ltd, UK
Environmental Sustainability in the UK and Indian Aerospace Industries: A comparative Study Mukesh Kumar, Akshay Ogale, Jag Srui, University of Cambridge, UK
Internationalisation (Chair: Afonso Fleury)
International manufacturing networks: how changes at strategic level impact their design and management Afonso Fleury ¹ , Yongjiang Shi ² , Silas Ferreira Junior ¹ , Jose H. D. Cordeiro ¹ , ¹ University of São Paulo, Brazil, ² University of Cambridge, UK
Home network positions and the impact on internationalization Du Jian ¹ , Chang Xiaoran ¹ , Xu Yue ² , ¹ School of Management, Zhejiang University, China, ² Hull University Business School, UK
Customer-driven Planning and Control of Global Production Networks – Balancing Standardisation and Regionalisation Tobias Arndt, Jan Hochdoerffer, Emanuel Moser, Steven Peters, Gisela Lanza Karlsruhe Institute of Technology (KIT), Institute of Production Science (wbk)
Network Structures (Chair: Petri Helo)
Order-decoupling point and global value network architectures Petri Helo, University of Vaasa, Finland
Identification of Autonomous Structures in Dynamic Manufacturing Networks using Clustering Approaches Till Becker and Daniel Weimer, BIBA, University of Bremen, Germany
Understanding Emergent Industrial Ecosystems in Health Care Mark A Phillips, University of Cambridge, UK
Global Manufacturing & China - 1 (Chair: Yongjiang Shi)
An Overview of Chinese Manufacturing Development in the last Ten Years: to celebrate the 10th GMC Symposium Xiaobo Wu ¹ , Yongjiang Shi ² , Peizhong Zhu ^{1,2} , ¹ Zhejiang University, China; ² University of Cambridge, UK
Are Chinese firms' outward foreign direct investments (OFDIs) a kind of herd behavior? Empirical evidence from an institutional isomorphic perspective Gangxiang Xu, Zhejiang University
The Motivations and Practices of MNCs' Overseas R&D Activities: A Comparative Analysis Quan Zhou ^{1,2} , Yongjiang Shi ¹ , Xiaobo Wu ² , ¹ University of Cambridge, UK, ² Zhejiang University, China
Corporate Lean Partnerships: special track (Chair: Torbjorn Netland)
Critical Factors in Designing of Lean and Green Equipment Zahra Mohammadi, Sasha Shahbazi and Martin Kurdve, Mälardalen University Sweden
Lean Operations Management and its Evolution –A Japanese Perspective Professor Hiroshi Katayama, Waseda University
Calibrating the expectation from corporate lean programs Torbjorn Netland, Norwegian University of Science and Technology

Off-shoring & Re-shoring (Chair: Jag Srai)
Offshoring trends in the manufacturing process within the automotive industry Steve Simplay ¹ and Zaza Nadja Lee Hansen ² , ¹ Coventry University, UK ² Technical University of Denmark, Denmark
Re-shoring UK Manufacturing Activities, Supply Chain Management & Postponement Issues Hamid Moradlou and Chris Backhouse, Loughborough University, UK
Re-shoring & Offshoring trends: Managing Engineering Multinationals - A comparison of offshoring and outsourcing strategies in UK and German multinational corporations. Anthony Mitchell, University of Hertfordshire, UK
Network Design & Strategy (Chair: Harri Lorentz)
Configuring Large Scale Electrical Energy Supply Chains to Improve Sustainability: Implications for Supply Chain Design Dr. Laird Burns and Dr. Wes Colley, with Dr. Derald Morgan, University of Alabama in Huntsville
Supply chain adaptation through phases of product innovation life cycles Matthias Parlings ¹ and Katja Klingebiel ² , ¹ Fraunhofer Institute for Material Flow and Logistics, Germany, ² University of Applied Science and Arts Dortmund, Germany
Taxonomy of SME manufacturing strategies in a structurally changing economy Harri Lorentz ¹ , Olli-Pekka Hilmola ² and Jarmo Malmsten ¹ , ¹ University of Turku, Finland, ² Lappeenranta University of Technology, Finland
Sustainable Industrial Systems (Chair: Lloyd Fernando)
Greening manufacturing supply chains in Asia's emerging economies: A conceptual framework Ruoqi Geng ¹ , Afshin Mansouri ¹ and Emel Aktas ² , ¹ Brunel University London, UK, ² Cranfield University, UK
Systems thinking capability essential for transformation towards sustainable industrial system Fernando, L. and Evans, S., University of Cambridge, UK
Developing sustainability in global value chains: the role of production subsidiaries Ruggero Golini ¹ , Jury Gualandris ² and Matteo Kalchschmidt ¹ , ¹ Università degli Studi di Bergamo, Italy, ² University College Dublin, Ireland
Global Manufacturing & China - 2 (Chair: Yongjiang Shi)
Network Resources, Legitimacy and Competitive Advantages Zhiyan Wu ¹ and Yimei Hu ² , ¹ Zhejiang University, School of Management, China, ² Aalborg University, Department of Business and Management, Denmark
Nurturing business ecosystem to enable paradigm shift: case of emerging wireless telecommunications industry in China Yue Zhang ¹ , Yongjiang Shi ² and Jiang Yu ¹ , ¹ Chinese Academy of Sciences, University of Cambridge ²
Synergistic Innovation Modes and Innovation Performance Siyu Liu, School of Management, Zhejiang University, China
Logistics & Distributed Networks (Chair: Hermann Kuehnle)
Logistics innovation solutions for re-distributed manufacturing Laura Purvis ¹ , Robert Mason ¹ , Andrew Lahy ² and Mike Wilson ² , ¹ Cardiff Business School, Cardiff University, UK, ² Panalpina Ltd. UK
Smart Units in Distributed Manufacturing (DM) -Key Properties and Upcoming Abilities Hermann Kuehnle, Otto-von-Guericke-University Magdeburg, Germany
Service innovation in China: Development and implementation of a logistics platform solution Dmitrij Slepnirov ¹ and Jun Jin ² , ¹ Aalborg University, Denmark, ² Zhejiang University, China

Production Management (Chair: Mathias Knollmann)
Shifting Targets in Manufacturing Control: Development of a Methodology Considering Human Behavior to Avoid the Lead Time Syndrome of Manufacturing Control
Mathias Knollmann, Julia Bendul and Mengting He, Jacobs University Bremen, Germany
An Investigation of Production Changeover Time Reduction in Supply Chain Oriented Manufacturing Plant and Sustainability to Improve the Plant Performance
Khalid Mustafa and Kai Cheng, Brunel University
Lead-Time Hedging and Coordination in Prefab House Construction Supply Chain Management using Game Theory
Yue Zhai, George Q. Huang, The University of Hong Kong, China
Performance Measures (Chair: Till Becker)
Performance Evaluation of Visual Management Case for Effective Technology Transfer
Koichi Murata ¹ and Hiroshi Katayama ² , ¹ Nihon University, Japan, ² Waseda University, Japan
Performance and Time Based Robustness Measures for Dynamical and Multi-variant Manufacturing Systems
Till Becker ¹ and Mirja Meyer ² , ¹ BIBA, University of Bremen, ² Jacobs University Bremen
Medical Sector Studies (Chair: Mukesh Kumar)
Proposing a virtual operations network to support a business policy for the Medicinal and Aromatic Plants sector
Isabel Duarte de Almeida ¹ and J. M. Vilas-Boas da Silva ² , ¹ Universidade Lusíada, (CLISSIS-UL), Lisboa, Portugal, ² Instituto Universitário de Lisboa (ISCTE-IUL), BRU-UNIDE, Portugal
Towards a Theory of Industrial System: A Case study on Environmental Sustainability in the UK Medical Device Industry
Mukesh Kumar, Yuto Minakata, Jag Srai, University of Cambridge, UK
Value Capture (Chair: Tomás Harrington)
We do create and capture value, don't we? A conceptual model of purchasing contribution to business performance
Jury Gualandris ¹ , Legenvre Hervé ² and Matteo Kalchschmidt ³ , ¹ University College Dublin, Ireland, ² European Institute of Purchasing Management, France, ³ Università degli Studi di Bergamo
Foreign invested manufacturing company's components sourcing process in the context of China's processing trade
Mingu Kang ¹ , Ma Ga (Mark) Yang ² , Mark H. Haney ³ and Kihyun Park ³ , ¹ Zhejiang University, China, ² West Chester University of Pennsylvania, USA, ³ Robert Morris University, USA
An exploratory study assessing value chain reconfiguration opportunities in oncology
Tomás Harrington and Ismail Najim, University of Cambridge, UK
Supply Chain Evolution (Chair: Bart MacCarthy)
A Future Supply Chain Assessment Framework: a case study of Terpene-based Supply Chain
Mukesh Kumar, Wouter Bam, Jag Srai, University of Cambridge
Supply Chain Evolution - An Emerging Science
Professor Bart L MacCarthy, Nottingham University Business School



SPEAKER BIOGRAPHIES

**Peter McDonnell**

Senior Technical Director, Sanofi-Genzyme

PhD in synthetic organic chemistry (UEA). Chemical Development and Drug Discovery at Parke Davis from 1985-1994. Genzyme (Sanofi since 2011) 1994-present, running Development Group since 1998. Long term interest in continuous manufacturing, PAT and Life Cycle Management. Recently accepted a new position in Sanofi leading Global Innovation Strategy and External Partnering for the development functions.

**Tim Flaherty**

ACS Operations General Manager, Caterpillar

Tim received a Bachelor of Science in Accounting from the Pennsylvania State University and a Juris Doctor from the Chicago-Kent College of Law. He is also a graduate of the Advanced Management Program of the Harvard Business School.

Tim began his professional career practicing law for 13 years, focusing on commercial, employment and tort litigation. He joined Caterpillar in 2002, as the Manager of Corporate Labor Relations. Since 2005, he has progressed through general management within Cat's components division. He began as the North American Operations Manager for the Transmission Business Unit, progressed to the General Manager for the Implement and Steering Systems Business Unit, and is currently the General Manager of Operations for the Advance Components & Systems Division (ACSD). He manages 13 facilities in 6 countries and is also responsible for all Advance Planning and Supply Change activities for ACSD.

Tim is married and has two sons. His wife has now retired from her career in estate planning and wealth management. Their sons are both attending undergraduate school, majoring in business. Tim currently serves as a board member for the Special Olympics of Illinois.


Knud Krægpøth

SVP Corporate Supply Chain, Grundfos

During the last 10 years, Grundfos has extended its production setup extensively and established factories in 5+ countries around the world and more than doubled production capacity. Moreover, Grundfos has created a model for recommendation of the future footprint of the production and used it to transfer more than 20 product lines from one company (country) to another. Grundfos Serbia is the latest newcomer in Grundfos' manufacturing footprint.

Knud Krægpøth is Senior Vice President for Corporate Supply Chain being responsible for the development, implementation and management of demand planning, supply planning and distribution at Group level. This includes the design and development of the overall supply chain strategies. Knud has an educational background as engineer with a master in Technology Management. He joined Grundfos in 1991 and has held various positions in the production on both company and group level until he in 2008 became overall responsible for the Grundfos Supply Chain. Knud is married and has 2 children.


Dhivant Patel

Global e-Commerce Supply Chain Manager, Unilever

I grew up around Croydon, UK before escaping to Durham to read Natural Science and then International Studies. Before joining Unilever I worked in Quality for a pharmaceuticals company, Supply Chain coordination at NEC Mobile Networks, and as a Stock Analyst at Nestlé. Over the last six years have been in Unilever's supply chain function, primarily in Supply Chain Customer Services. My current role is in building industry leading supply chain capability for the fast growing eCommerce channel that is changing the way people shop our brands.



Nigel Strutt

*UK Director, Customer Relations & Supply Chain Strategy,
Lockheed Martin UK*

Nigel Joined Lockheed Martin in 1996. He brings with him over 35 years experience in the Aerospace and Defence business in a variety of increasingly senior positions. A mechanical and production engineer by training was augmented by periods within production, production planning, manufacturing control and project management. With significant periods of time being spent in procurement, SCM, materiel management and contract management disciplines.

Nigel has had leadership at a functional level within LMUK for Supply Chain Management (SCM) focused on strategy, policy coordination and governance along with delivery of performance improvement objectives since 2006.

Nigel also has the lead for strategic issues in support of Supply Chain Management within LMUK including aligning the supply network development, government national and specialist trade associations relationships.

Nigel was elected as Chairman of the UK ADPG (Aerospace and Defence Procurement Group) in July 2013 and he now chairs the UK's foremost group of CPO's (Chief Procurement Officers) on strategic and tactical SCM related challenges impacting common areas of interest.

He has leadership of the relationship with UK MOD aligned to Key Supplier Management (KSM).

Nigel is responsible for the provision of subject matter expertise in the management and execution of Lockheed Martin's industrial participation (offset) programmes in the UK along with guidance and coordination for export opportunities.

Prior to joining Lockheed Martin Nigel's last post was Commercial and Strategic Business Director for a medium sized Midlands based aerospace engineering company engaged in mechanical, avionic and engine components sub-systems

Nigel was appointed a Fellow for the Chartered Institute of Purchasing and Supply in Dec 2013.



Jeffrey Tew

Chief Scientist TCS, TATA

Jeffrey D. Tew is the Chief Scientist for the TCS Innovation Lab in Cincinnati, OH whose focus is leading and developing TCS's Supply Chain Research and Innovation activities globally.

Dr. Tew is an internationally known professional consultant, industrial researcher, and subject matter expert in Transportation and Supply Chain Management (SCM), global logistics, Green Supply Chain design (e.g., low energy and low environmental impact) and execution, and service parts management with over 25 years experience in industrial research in such areas as Transportation and Supply Chain Management, business development, operations management, technology implementation, and corporate strategy.

Throughout Dr. Tew's career, he has gained extensive experience in most aspects of Transportation and Supply Chain Management (e.g., strategy, operations, technology implementation, marketing and business development, consulting, etc.). Extensive experience in initiating and developing leading world-class research programs in transportation infrastructure and manufacturing supply chains in emerging markets (India and China) worldwide for the world's largest automotive manufacturer with special expertise in designing and implementing lean transportation systems and "green" transportation systems and service parts supply chain solutions.

Dr. Tew has a long history of effective interactions with several of the leading research universities in the world. Among his university interactions, Dr. Tew has served as Advisory Board Member and Visiting Professor of Transportation and Supply Chain Management for the Industrial Engineering Department at Tsing Hua University in Beijing, China and helped launch the department from its inception and coordinated its supply chain management curriculum; a Clinical Professor of Supply Chain Management at Michigan State University's Eli Broad School of Management; Clinical Professor of Supply Chain Management at Penn State's Smeal College of Business, and as Edinfield Visiting Scholar at Georgia Tech's ISYE Department.

**Stephen Spall**

Group Operations Director, Innocent Drinks

Stephen Spall is the Group Operations Director at Innocent Ltd. Steve has over 20 years' experience in developing and implementing supply-chain strategy. He was responsible for the design and implementation of a supply-chain strategy to support Tesco's UK growth from 800 to over 2500 stores during the early 2000s, along with their major expansion in clothing and non-food. He started his career as a consultant in Operations at Ernst and Young and has held senior operations positions at Centrica and with the retail group Kingfisher. He is an IfM alumnus and an Honorary Research Fellow at Cardiff Business School.



Professor Bart L MacCarthy

European Editor, The International Journal of Production Economics; Professor of Operations Management, Nottingham University Business School

Bart is Professor of Operations Management at Nottingham University Business School. After an early career in industry he undertook his PhD at the University of Bradford in the mid 1980s, followed by postdoctoral work in the Mathematics Institute at Oxford University. He has been a full professor at Nottingham since 2003. His research spans the analysis, modelling and management of operational systems in a wide range of sectors. He has researched and consulted with companies in different sectors including automotive, aerospace, engineering, textiles and clothing, consumer products, food and logistics. He has led major research projects on effective decision support in planning and scheduling, Mass Customization, supply chain management and order fulfilment. He was recently awarded major research funding to examine new modelling perspectives for the analysis of robustness and resilience in international manufacturing supply networks with a consortium of UK universities and companies.

He has published widely in the Operations Management and Management Science literature. He is European Editor for the International Journal of Production Economics (IJPE) and serves on the editorial board of a number of other academic journals including the International Journal of Operations and Production Management. He was President of the European Chapter of the Decision Sciences Institute (EDSI) from July 2011 until June 2012. He is a Fellow of the Institute of Mathematics and its applications (FIMA), the Institute of Operations Management (FIOM) and the Institution of Engineering and Technology (FIET).



Professor Lisa M. Ellram

Co-editor-in-chief, Journal of Supply Chain Management; James Evans Rees Distinguished Professor of Supply Chain at the Farmer School of Business, Miami University

Ph.D., C.P.M., CMA, Scor-S (ellramlm@miamioh.edu) is the Rees Distinguished Professor of Supply Chain Management in the Department of Marketing at the Farmer School of Business, Miami University in Oxford, OH, where she teaches logistics and supply chain management at the undergraduate and graduate level. Prior to that, she was the John Bebbling Professor of Supply Management at Arizona State University's W.P. Carey School of Business.

Her primary areas of research interest include sustainable purchasing, transportation and supply chain management; services purchasing and supply chain management; offshoring and outsourcing; and supply chain cost management. She has published in Journal of Supply Chain Management, Academy of Management Journal, Journal of Operations Management, California Management Review, MIT Sloan Management Review, Industrial Marketing Management, Journal of Services Management, Journal of Business Logistics and other managerial and academic outlets. She is the recipient of numerous research grants, including grants from CSCMP, ISM, CAPS Research and NSF. She currently serves as the Co-Editor in Chief for the Journal of Supply Chain Management, is a member of advisory board for numerous journals, including the Journal of Business Logistics.

She has co-authored five books, the most recent about environmental purchasing. She has served as the Director for the ATK Center for Strategic Supply Leadership, and been a member of the CAPS Research Board of Directors. She has taught in over 20 countries across the globe.



AUTHOR ABSTRACTS

INDUSTRIAL SUSTAINABILITY

The Adaptation of Supply Networks to Climate Change

Andre Kreie¹ and Christine Rutherford²

¹Kuehne Foundation, Switzerland, ²Heriot-Watt University, UK

In the current era of turbulence, organisations and their supply networks seek for effective solutions in response to a changing environment. To retain competitive, the concept of adaptation to the likely impacts of such changes has therefore become a vital success factor for organisations and supply networks. This paper addresses the changing factor 'climate change' and investigates how the global and highly exposed coffee supply network prepares to the projected impacts. Using the case study methodology and interviewing multiple organisations from all different tiers along the coffee supply chain, a network learning process towards adaptation of the entire network to climate change is developed. We argue that network learning comprises a four-step learning cycle at organisational and inter-organisational level that scales-up from smaller pilot projects to the entire network. To facilitate the network learning process, we further conclude on four enabling principles that must be translated into practical mechanisms (management actions) which may vary from network to network.

Supply chain resilience for Oil & Gas industry infrastructure projects

Ankan Mitra¹ and Pep Borromeo²

¹ABB Global Industries and Services Limited, India, ²ABB Limited, UK

Oil & Gas industry infrastructure projects face the dual challenge of integrating the latest product solutions on offer, whilst ensuring their conformity to the stringent certifications required for the application. These multi-billion dollar infrastructure projects have decades of operational life expectancy with forward integration and upward gradation capability.

Leading organizations depend on the engineering expertise and trusted value chain of global integrated solution providers like ABB Group. This paper summarizes the key challenges of such projects and focuses on the three key elements by which supply chain resilience is achieved by ABB. The key elements include agile design and engineering, collaboration with suppliers and supply chain risk reviews all of which achieve the best solution created for both green-field and brown-field infrastructure projects.

The findings contribute to industry literature for the oil & gas industry to establish supply chain resilience for such complex infrastructure projects.

Environmental Sustainability in the UK and Indian Aerospace Industries: A comparative Study

Mukesh Kumar, Akshay Ogale, Jag Srai

University of Cambridge

Environmental protection has been and remains a prime driver in the development of air vehicles and new transport infrastructure. In addition to continuously improving fuel efficiency, the continued availability of liquid fuels, their cost impact on the aviation sector and their impact on the environment, has been addressed as part of an overall fuel strategy for all sectors (European Commission, 2011).

INTERNATIONALISATION

International manufacturing networks: how changes at strategic level impact their design and management

Afonso Fleury¹, Yongjiang Shi², Silas Ferreira Junior¹, Jose H. D. Cordeiro¹

¹ University of São Paulo, Brazil, ² University of Cambridge, UK

This paper focuses on the dynamic relationship between corporate strategy and international manufacturing networks. It argues that multinational companies will only be able to change its strategic positioning if the configuration of its international manufacturing networks provides organizational support for such change. The object of study are emerging country multinationals which, due to its late entry in international markets, provide a privileged field for the research. The study reveals that there is a co-evolution between strategy and network design. Additionally, it is proposed a systematic corporate strategic process for emerging country multinationals in order to define one or a set of missions that will guide the design and management of their international manufacturing networks.

Home network positions and the impact on internationalization

Du Jian¹, Chang Xiaoran¹, Xu Yue^{2*}

¹Zhejiang University, China, ²Hull University Business School, UK

In this study, we explore how firms' local network positions may impact the degree of their internationalization. The relationship between local network centrality and the degree of outward foreign direct investment is examined. An interactive effect between networks with local firms and foreign firms is considered in our examination. Based on a survey of 194 Chinese firms, our findings are in twofold. First, firms with a higher local network centrality tend to be more active in internationalisation. This effect is different for firms with intermediary positions in their local networks. Second, the relational embeddedness in foreign firms' networks is positively associated with the degree of internationalisation; this positive association is significant for firms with a higher local network centrality.

Customer-driven Planning and Control of Global Production Networks – Balancing Standardisation and Regionalisation

Tobias Arndt, Jan Hochdoerffer, Emanuel Moser, Steven Peters, Gisela Lanza
Karlsruhe Institute of Technology (KIT), Institute of Production Science (wbk)

An increasing and volatile demand in emerging economies challenges manufacturing companies to decide, whether the new markets can be satisfied with the existing product portfolio, or to which extent it has to be adapted to meet the regional market requirements. A three-step approach to enable globally operating companies to efficiently deliver innovative products adapted to regional requirements regarding product design and functionality is presented. In the first step a bottom-up process is formulated on how to design customer-oriented products for frugal innovation integrating the customer directly in the design process. In the second step a methodology to design production systems in accordance with the customised products including the customer in the order-fulfilment process is composed, while in the third step a multi-objective optimization approach is developed to strategically design production networks and to plan and control the designed networks on an operative level taking dynamic business environments into account.

NETWORK STRUCTURES

Order-decoupling point and global value network architectures

Petri Helo
University of Vaasa, Finland

Order decoupling point (ODP) decisions have been analysed in operations and supply chain context. Important parameters for decision making include (1) estimated production volume, (2) expected demand variability, (3) cost structure, and (4) lead-time to customer as well as delivery lead-time. By analysing these parameters companies define the right order-coupling point for each product variant. The decision defines lead-times and strategic inventory location. Life-cycle of a product changes optimal strategy. This paper analyses how product life-cycle from ramp-up to maturity and finally to ramp-down in terms of volume affects ODP and how global manufacturing organizations can evaluate order fulfilment strategies.

Identification of Autonomous Structures in Dynamic Manufacturing Networks using Clustering Approaches

Till Becker and Daniel Weimer
BIBA, University of Bremen, Germany

Recent developments in IT miniaturization, wireless technologies, and ubiquitous computing foster new manufacturing paradigms such as autonomously controlled production in decentralized structures. However, the newly created control methods need to operate on existing manufacturing structures. First approaches use clique percolation methods from complex network theory to discover possible autonomously acting clusters in static manufacturing systems. Due to the dynamic change in the structure of manufacturing systems over time, existing clique identification can be strongly biased by the selected size of the observation period of the manufacturing system. We propose a machine learning approach based on clustering, which is able to define autonomous structures in dynamically changing manufacturing systems. Our selected clustering approach is an unsupervised classification technique, which identifies inherent structures present in a manufacturing network based on the modularity of the network. In a first step, we use modularity as a feature that describes collaborative structures. In a second step, this feature is used for clustering coherent network structures with different time horizons to investigate the clustering in dynamically changing manufacturing environments. We apply the clustering approach in an experimental case study on real-world distributed manufacturing systems to illustrate the different results for different periods of the same manufacturing system.

Understanding Emergent Industrial Ecosystems in Health Care

Mark A Phillips
University of Cambridge, UK

Health care systems face major challenges to meet the ever-increasing care demands and control of costs. In response there is a drive to demonstrate greater value, emergence of outcome-based payments and patient centric solutions. These have the potential to change health delivery and drive a convergence of medical and other technologies delivered through new business models and value chains. Future value chains therefore face greater uncertainty and influence from organisations and institutions not traditionally part of the industrial ecosystem. Understanding the emerging ecosystem landscape and the new capabilities required for success is critical for business strategy and investment decision making. The focus of the research is to understand how organizations develop convergent technology products for the emerging health care industrial ecosystem, taking an integrative and modular approach to investigate the complexity of the health care industrial ecosystem, its business models and value networks.

GLOBAL MANUFACTURING & CHINA - 1

An Overview of Chinese Manufacturing Development in the last Ten Years: to celebrate the 10th GMC Symposium

Xiaobo Wu¹, Yongjiang Shi², Peizhong Zhu^{1,2}

¹Zhejiang University, China; ² University of Cambridge, UK

The global business environment has been changing fast in the last decade (2004-2013), during which China's manufacturing also gained dramatic growth. China has overtaken US as the world's largest manufacturer in 2010. However, we should confess that the consequential problems are getting more and more serious and noticeable, such as rising cost, transformation pressure, environmental pollution, excess capacity, etc. Actually, it is a totally new situation that China's manufacturing never faces and we are supposed to tackle it with an overall consideration to both the experience of developed countries or regions and the China's reality. China has stepped into a new era. In addition, GMC conference which is committed to studies on China's manufacturing will welcome its tenth anniversary in 2014. It is valuable for the conference to have an overview on the following three aspects: 1) what happened and is happening to China's manufacturing in the last decade including business environment, progresses, and troubles; 2) what has been discussed in the conference about China's manufacturing; 3) what should be discussed in the next conferences.

Are Chinese firms' outward foreign direct investments (OFDIs) a kind of herd behavior? Empirical evidence from an institutional isomorphic perspective

Gangxiang Xu

Zhejiang University

In this study, we examine the legitimacy rationale behind the choice of outward foreign direct investment among Chinese firms from an institutional isomorphic perspective. We suggest that, when under a strong pressure to conform at the regional and industrial levels of the Chinese institutional environment, Chinese firms are more likely to adopt OFDI behavior in exchange for legitimacy. We also examine the joint effect between the state ownership of a Chinese firm and the pressures from the firms in the same industry and region on the Chinese firm's OFDI behavior. We test our hypotheses on a sample of 122 firms in 7 industries during 2008-2012, and we find that Chinese firms are more likely to adopt OFDI behavior when more and more firms in the same region or industry go abroad for investment. However, we find no support for the interaction effect between the state ownership and the pressures from the firms in the same industry and region.

The Motivations and Practices of MNCs' Overseas R&D Activities: A Comparative Analysis

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There was a strong movement for multinational corporations (MNCs) from developed countries to establish a transnational configuration of R&D in other developed countries in the 80s and 90s, and in emerging countries such as China and India in the new millennium. These trends have been well documented in the R&D internationalisation literature. That said, MNCs from emerging countries such as China, are trying to move up the value chain, and one important route to do this is by focusing on R&D. R&D operations from emerging countries are expanding their geographic reach to developed countries. In spite of this growing trend, academic research in this field has not kept pace. To what extent are opportunities and challenges of managing R&D different in these countries from those in the west? This paper tries to tackle this question by incorporating the existing literature and practices of international R&D, and compare and contrast it with the current practice of overseas R&D activities by MNCs from emerging countries. A comparative framework is developed to serve this purpose. Drawing on the analysis we suggest that MNCs from emerging countries should learn from the experience of their western counterparts, but more importantly, the unique challenges and capabilities should be considered in managing their international R&D strategies and decisions.

CORPORATE LEAN PARTNERSHIPS

Critical Factors in Designing of Lean and Green Equipment

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Designing production equipment considering lean and related sustainability requirements may be a major factor in achieving productiveness through lean implementation. The objective of the study is to investigate the impact of lean production requirements on equipment design and how the lean requirements affects early design phases and global footprint. Data collection method includes literature review and in depth interviews with equipment users. The results provide support to importance of considering green and lean requirements in designing of production equipment by introducing important lean design factors for production equipment. These factors are designing simple equipment, error-proofing, being portable and flexible, supporting one piece flow, supporting short setup time, easy and reliable maintenance, supporting the operator interface with machine, safety of the operator, supporting production processes and layouts, energy efficiency, easy to operate, minimum cost, visualization, straight flows, teamwork, standardization, quality assurance, using previous experiences, easy to clean, and easy to control.

Lean Operations Management and its Evolution –A Japanese Perspective

Hiroshi Katayama, Waseda University, Japan

Over 20 years has passed already since the concept and methodology of lean management came on the stage of world manufacturing scene through the book entitled “The Machine That Changed The World” written by Womack, J. P., Jones, D. T. and Roos, D. in 1990. The authors of this book analysed the substance of Japanese manufacturing operations, then extracted essential features as well as elements, most of which western countries have not been aware of in the past. Typical representative cases are Toyota Production System (TPS), Total Productive Maintenance and Management (TPM) etc. Then, this way of manufacturing was introduced and implemented among world leading industrial countries followed by its extension. These years, rapid business globalisation for a background, it is in progress to transfer this approach to offshore factories, to other business functions within the company such as product development, facility-engineering, sales, procurement-supply divisions, and furthermore, expected to transfer to other industries such as transportation, medical, civil services etc. Recognizing the situation, this paper, focusing on some extent of generalised operations, introduces the origin of its sense of value, its way of thinking, approach and methodology followed by discussion on the possible direction for its evolution.

Calibrating the Expectation from Corporate Learning Programs

Torjorn Netland, Norwegian University of Science and Technology

Considering all the evidence in literature and industry, there is little doubt that corporate lean programmes has the potential to significantly improve the performance of manufacturing firms. Many multinationals have therefore recently launched their own lean programmes. Typical examples include the Audi Production System, Boeing Production System, Bosch Production System, Caterpillar Production System, Rolls Royce Production System and Scania Production System. However, how the expected improvement manifests itself during the implementation process is less clear. Using an in-depth case study of the Volvo Production System, this paper investigates how the performance of a plant change as it continues to implement a corporate lean program. The answer has important implications for how managers can successfully implement lean in a plant. Not knowing it can lead managers to set erroneous targets, have unreasonable expectations, and, worse, take improper actions.

OFF-SHORING & RE-SHORING

Offshoring trends in the manufacturing process within the automotive industry

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This paper investigates offshoring trends in the automotive industry. The research approach consisted of combining empirical findings from case companies with latest research from the field. Empirical data was collected through case studies from 15 automotive organisations based in Europe consisting of original equipment manufacturers and engineering service providers.

The findings indicated some offshoring trends in the automotive industry. Offshoring in this industry is moving from a manufacturing focus to incorporate large parts of the process, including high-level product development engineering activities. This development has created several challenges. These challenges arose as organisations are not considering how offshoring activities could be integrated with an increasingly global supply chain for the manufacturing of the final product.

The paper contributes to manufacturing theory with a focus on offshoring in the automotive industry and provides practitioners with information on a cutting-edge trend to the industry

Re-shoring UK Manufacturing Activities, Supply Chain Management & Postponement Issues

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As a result of globalization and dynamic business environment, manufacturing sectors are obliged to co-operate within more complicated and longer supply chains. Therefore since the mid-20th century, offshoring trend for manufacturing facilities has gained significant popularity to reduce cost. However over the past years, the evidence shows that offshoring strategies may not continue to be beneficial for the organization's manufacturing activities. Companies have begun to establish a better understanding of the total risk/benefit-balance and base their decisions on strategic supply chain issue rather than simply relying on cost analysis. Consequently it is evident that there are tendencies on reversing the off-shoring strategy and re-shoring manufacturing activities. Despite the significance of this phenomenon, the supply chain literature has not received sufficient attention by the academic community. This study aims to identify the supply chain criteria, which influence the manufacturing decision-making process and investigate the applicability of postponement in repatriated manufacturing activities.

Re-shoring & Offshoring trends: Managing Engineering Multinationals - A comparison of offshoring and outsourcing strategies in UK and German multinational corporations.

Anthony Mitchell

University of Hertfordshire, UK

UK and German headquartered engineering multinational corporations (MNCs) are compared with a focus on their outsourcing and offshoring initiatives. A novel conceptual framework is developed that uses differing varieties of capitalism (VoC) to compare and contrast a series of criteria. Underlying theory is taken from the resource based view (RBV) of the firm and global production networks (GPNs). The findings from a comparative case study were that in the UK, lower labour costs and reorganising the value chain were key reasons to outsource and offshore. The UK business was less risk adverse and seemed more flexible and agile in its sourcing policies. The German organisation was less inclined to outsource preferring to retain control of a wholly owned offshore business unit. A further difference was that management in Germany were reluctant to progress radical initiatives with the works council. There was little evidence of re-shoring.

NETWORK DESIGN & STRATEGY

Configuring Large Scale Electrical Energy Supply Chains to Improve Sustainability: Implications for Supply Chain Design

Dr. Laird Burns and Dr. Wes Colley, with Dr. Derald Morgan
University of Alabama in Huntsville

Electrical energy supply chains have evolved slowly. Much of recent development has been in advancements toward large scale development of alternative energy production technologies to improve supply-side capacity and reduce pollution from existing production technologies (Mateus & Oliveira, 2009; Snyder & Kaiser, 2009; Türkay & Telli, 2011). Less improvement has occurred in demand-side management (DSM) of electrical energy systems, where electrical generators work to smooth demand and reduce generation capacity needs necessary to manage high peak demands (Aalami, Moghaddam, & Yousefi, 2010). In this study we demonstrate field results from an advancement in demand-side information technology coupled with advanced customer segmentation and customer analytics which allows producers and distributors to reduce peak electricity demand and lower total system costs while maintaining consumer satisfaction and reducing total plant emissions.

Supply chain adaptation through phases of product innovation life cycles

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An innovative product's life cycle affects dynamics of supply chains significantly, necessitating a defined SCM strategy for each life cycle phase. Furthermore, the adaption of the supply chain strategy and structure must be executed quickly, as innovation life cycle phases are often short and phase transitions can occur abruptly. In order to ensure supply chain effectiveness throughout an innovation's life cycle, efficient performance measurement is of high importance. The findings of this paper support metric-driven models for SCM, and the application of a prioritisation of the SCOR performance attributes. During each phase of the product innovation life cycle, the performance attributes need to be prioritised to a different extent in response to changing market environments. The framework provides guidance for setting up boundaries for KPI systems by relating supply chain strategies to SCOR performance attributes.

Taxonomy of SME manufacturing strategies in a structurally changing economy

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This research seeks to further test the classic manufacturing strategy taxonomy by Miller and Roth (1994). Cluster analysis is conducted on a data set collected from a sample of Finnish manufacturing SMEs, in a context where the country is undergoing a phase of structural change in terms of its industrial base. The results suggest a four cluster solution, with some similarities with the classic three cluster solution; however, significant differences are observed as well, suggesting perhaps a distinct taxonomy for SMEs. Taking into consideration the context of the research, with much policy emphasis placed on manufacturing SMEs as the backbone of developed economies, locked in competition with emerging economies, the findings also suggest a lack of servitization capabilities in particular and other distinctive manufacturing capabilities in general, among the Finnish manufacturing SMEs, on average.

SUSTAINABLE INDUSTRIAL SYSTEMS

Greening manufacturing supply chains in Asia's emerging economies: A conceptual framework

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In recent decades, rapid industrial modernisation and economic growth have brought substantial environmental problems for the Asian emerging economies; particularly China, Taiwan, India, Malaysia, Indonesia, Thailand and South Korea. As a result, the manufacturing sector in these countries has suffered negative environmental impact such as air pollution, waste and water pollution. Green supply chain management (GSCM) aims at reducing environmental impact while achieving economic, operational, social and environmental benefits. Based on a systematic literature review, this study has developed a conceptual framework and propositions for greening manufacturing supply chains in Asia's emerging economies. This study has identified areas for future research to raise the understanding of issues surrounding implementation of GSCM in this region. Moreover, the outcomes of this study are likely to guide manufacturing companies in other countries with comparable level of economic development to enhance sustainability of their operations and to green their supply chain.

Systems thinking capability essential for transformation towards sustainable industrial system

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Organisations are exploring new sustainable business models to prepare for a fundamentally different operating environment, due to the emergence of increasingly complex problems, combined with growing concerns for the environment. Organisations currently lack understanding of possible futures and where to focus efforts to inform planning. There is a need to develop the know-how to enable changes across the whole industrial system and to identify system-wide opportunities. The paper explores the research question; What is the role of systems thinking in designing a sustainable industrial system? The paper reports the results of exploratory case studies observed through document analysis and interviews. Evidence from the case studies illustrate organisations that are able to work across the firm boundaries are found to be able to deliver radical innovation. Organisations that are willing to experiment by working with unusual partners and widen the system boundaries are found to be able to create new forms of value.

Developing sustainability in global value chains: the role of production subsidiaries

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This paper explores the effect for a plant of being part of multinational network on the development of sustainable management (SM) initiatives. In particular, we hypothesize that a plant will adopt SM to a larger extent when the level of autonomy, internal and supplier integration are higher. We test such hypotheses by means of the 2014 preliminary release of the International Manufacturing Strategy Survey (IMSS). The results show that autonomy does not play a relevant role. On the other side internal and supplier integration have a positive effect on SM. All together, the results, even if preliminary, provide an interesting contribution for both research and practice.

GLOBAL MANUFACTURING & CHINA - 2

Network Resources, Legitimacy and Competitive Advantages

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This paper addresses a major gap in current research on open innovation: how do large manufacturing firms implement open innovation? We combine network and organization perspectives in a model of technology sourcing portfolio management that explains how organizations implement open innovation. The model is grounded in observations, interviews, informal conversations, and archived data gathered during ethnography of Haier Group, a Manufacturing firm in China. This firm exploits its network position within a global R&D networks to gain intellectual capital in various industries. It acts as an innovation platform by introducing technology where they are not familiar and, in the process, develops new products that are original combinations of existing knowledge from disparate innovation sources. Haier exploits its access to a broad range of technology sourcing portfolios for acquiring and storing this knowledge in its technology base and retrieving that knowledge to boost radical innovation. The paper also discusses the mechanisms in the organization of open innovation and how organizations build open innovation ecosystem that overcomes organizational inertia.

Nurturing business ecosystem to enable paradigm shift: case of emerging wireless telecommunications industry in China

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This paper aims to unveil the paradigm shift of China's wireless telecommunications industry from industrial catching-up paradigm to beyond catching-up paradigm through the co-evolution of key elements within business ecosystem. By conducting in-depth case study and draw roadmap of China's indigenous 3G/4G standard, the authors identify the key elements in business ecosystem as technology, institution, ecosystem configuration and ecosystem capability. The co-evolution of these elements is comprehensively analyzed. Then this paper discusses the paradigm shift of China's wireless telecommunications industry from the perspectives of technology accumulation mode, domestic standard's evolution path and the way of involving in business ecosystem. Through analyzing the paradigm shift of China's wireless telecommunications industry, the authors hope to provide guidance to emerging countries' industrial development beyond catching-up.

Synergistic Innovation Modes and Innovation Performance

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In the context of open innovation, synergistic innovation has been the indispensable choice for small and medium enterprise. Based on a survey to 427 Chinese manufacturing SMEs from Yangtze River Delta, this paper empirically explores the relationships between different synergistic innovation modes and innovation performance of SME using the technique of structural equation modeling (SEM), and the mechanism how synergistic innovation modes influence the innovation performance is explored. The study finds that there are significant positive relationships between synergistic innovation modes (Strategic alliances mode, Patent collaboration mode, R&D outsourcing mode and Factors exchange mode) and innovation performance of SMEs, of which synergistic effect mediator the relationship between synergistic innovation modes and innovation performance.

LOGISTICS & DISTRIBUTED NETWORKS

Logistics innovation solutions for re-distributed manufacturing

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Increasingly, both academics and practitioners have been reporting on the drive towards what has been termed “re-distributed manufacturing”, a move away from centralized to distributed production and from global (offshored) to more local (near-shored) manufacturing.. This is associated with various changes in transport and labour costs, availability of materials and energy, the need for sustainability, increasing demand for customised products and services, the availability and cost of small-scale equipment, easier access to information and ever shorter product life cycles. These changes are, in turn, leading to the development of new business models and supply chains (SCs). The purpose of our paper is to explore why and how global logistics companies are developing innovative business models that allow them to better support their customers in their journey of re-distributing their manufacturing around the world. An in-depth longitudinal case study is presented. The case company is one of the World’s largest 3rd party logistics providers, employing over 16,000 people and operating in over 80 countries. The findings highlight how, through decoupling various manufacturing and logistics processes, the company was able to improve customer service, increase productivity and free up capacity while positioning themselves as a key innovator in the industry

Smart Units in Distributed Manufacturing (DM) -Key Properties and Upcoming Abilities

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Rapid developments in ICT totally reshape manufacturing as machines, objects and equipment on the shopfloors will be smart and online. Interactions between virtualisations and models of manufacturing units will appear exactly as interactions with the units itself. These virtualisations may be driven by providers with novel ICT services on demand that might jeopardise even well established business models. Context aware equipment, autonomous orders, scalable machine capacity or networkable manufacturing unit will be the terminology to get familiar with in manufacturing and manufacturing management. Such newly appearing smart abilities with impact on network behaviour, collaboration procedures and human resource development will make distributed manufacturing a preferred model to produce.

Service innovation in China: Development and implementation of a logistics platform solution

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Purpose – The aim of this paper is to advance our understanding of service innovation in China and to identify the major drivers and impediments for manufacturing companies pushing into services in China.

Design/methodology/approach – By employing an in-depth longitudinal case of a Chinese company, the paper investigates how a traditional manufacturing company developed and implemented a ‘road-port’ logistics concept in the local context. We draw on the resource-based and institution-based view as well as theories of innovation.

Findings – The ‘road-port’ platform concept has a potential to transform the industry by increasing transparency and connectedness between track owners and third-party logistics (3PL) companies. We find that the service concept helped the company to diversify as well as enhanced its growth and competitive advantages in a very competitive environment of the second and third tier Chinese cities. Both internal and external factors played a significant role in influencing the development and implementation of service innovation in the case. The paper details and discusses the factors that affect service innovation in China.

Research Limitations – The study is exposed to the limitations associated with the use of qualitative methodology based on a single case and geographic delimitation. Rather than providing definite answers, the findings of this study should be seen as propositions which open avenues for future research on the subject.

Implications – The findings may be useful in informing our expectations about the push of many Chinese manufacturing companies into services. The paper provides insights into the development and diffusion of service innovation in many fast transforming industrial companies in China. Lessons for other developing countries can also be drawn from the study.

Originality/value – The paper addresses the topic of service innovation in China, which has so far received a limited attention in the management literature. By presenting an in-depth case study, the paper highlights main factors and dilemmas underpinning how Chinese companies are seeking to create a foundation for growth and development based on innovation.

PRODUCTION MANAGEMENT

Shifting Targets in Manufacturing Control: Development of a Methodology Considering Human Behavior to Avoid the Lead Time Syndrome of Manufacturing Control

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While research has developed a wealth of knowledge with regard to approaches in Production Planning and Control, it often overlooks the fundamental issue of human expectations by assuming “perfect rationality and knowledge” of decision makers. Compared to the vast number of studies on the optimization of manufacturing processes, human decisions and the process of decision-making were rarely subject of these studies. In practice, planners often misinterpret system states or KPI's: If, e.g., planned lead times are adjusted in order to improve the logistic performance, the resulting due date reliability might decrease, which is known as the ‘Lead Time Syndrome’ of manufacturing control (LTS). Preliminary research has shown the topicality of the LTS in today's manufacturing systems and provided a mathematical and simulation based investigation of underlying coherences. However, LTS research did not focus on planners' decision-making process, which is accompanied by cognitive biases. Thus, the aim of this paper is to determine requirements of a LTS-avoiding methodology that aims to prevent human mistakes by overreaction or misinterpretation and to derive an initial concept of a visualization-tool.

An Investigation of Production Changeover Time Reduction in Supply Chain Oriented Manufacturing Plant and Sustainability to Improve the Plant Performance

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The supply chains for manufacturing systems have become more complex with increasing customer requirements on a global scale. The situation becomes more complex in the context of market demands, which change daily or weekly, and the corresponding responsive changes across production lines, i.e. product changeover (setup time/ start-up time). Such a situation often results in wastage of resources: for instance, time consumption, wastage of materials and other resources, and the reconfiguration of the production line, for example.

The ability to implement rapid changeover on a product line in switching from one product to another is the keys to increasing production line flexibility. Thus far, most of the research on short changeover has focused on conventional methods, such as the use of Single Minute Exchange Dies (SMED), internal and external activities, and time-dependent activities. This paper proposes a unified model for changeover time reduction using conventional and new methods with a sustainable design in order to reduce product changeover complexity. Through the proposed model, sustainability is taken into account by including resource utilisation, energy consumption and waste generation, etc. The proposed approach will not only improve machine utilisation but will also result in improved flexibility and reductions in wastage throughout the whole production facility.

Lead-Time Hedging and Coordination in Prefab House Construction Supply Chain Management using Game Theory

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Prefabs are used increasingly to simplify the building process on-site. And timely delivery of prefabs attracts extensive attention, for tardiness delivery is enormous nowadays. In order to solve this problem, the construction site manager prefers to inform the prefab manufacturer an earlier due date. This strategy is called “lead-time hedging”. However, this strategy adds much pressure to the prefab manufacturing department, for their production time is shortened. Thus, the conflict generates. To solve this conflict, an “additional money” is involved and a Stackelberg game where the prefab manufacturer acts as a leader and the construction site department serves as a follower is studied in this paper. Also, a cost sharing contract is discussed to balance the profit for each department. We find out that the coordination scheme reduces the lead-time hedging amount without sacrifices each department's profit. Also, other insights are obtained from comparative analysis and numerical studies.

PERFORMANCE MEASURES

Performance Evaluation of Visual Management Case for Effective Technology Transfer

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A visual management (VM) is now well known as one fashion and important management concept for smooth global supply chain management. A key target of VM is to harmonize communication among persons who have something to do with. For example, in case of a production sector, VM supports to resolve various burdens such as a quick detection of an abnormal situation, maintenance of a safety environment, a prevention of an operation miss and a knowledge sharing. However, a development of VM cases has been unrestrained. The situation is considered not good and it will be necessary to construct strategic enhancement system of VM. Based on the above recognition, as the initial step of the realization of the system, this paper discusses a quantification of a performance of VM cases.

Performance and Time Based Robustness Measures for Dynamical and Multi-variant Manufacturing Systems

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In the face of emerging manufacturing complexity, manufacturing systems are increasingly susceptible to fluctuations and disruptions. Thus robustness, “the ability of a system to maintain specified features when subject to assemblages of perturbations either internal or external” (Jen, 2005), is recently regarded as a desirable characteristic to achieve in manufacturing systems, similar to flexibility or adaptability. Rendering the performance of a manufacturing system (e.g., throughput time, delivery reliability) robust to fluctuations and disruptions is regarded as beneficial as it ensures a constant output.

In the context of manufacturing systems research, different approaches and measures exist to render manufacturing systems robust, usually concerning specific, classical manufacturing problems, such as robust planning and scheduling (Kouvelis et al., 2000), or robustness of product quality. However, these approaches are usually not concerned with the overall robustness of the manufacturing system performance, but rather with the robustness of certain target values, i.e. product quality robustness or schedule robustness. In addition to that, there are only few definitions that take into account that a robustness measure should include a time component, i.e. a clear definition for which time span a measure needs to stay on which level in order for the system to be called robust.

In a previous paper, we have suggested to assess the robustness of a manufacturing system by modeling the manufacturing systems as a dynamically changing network of material flow (Becker et al., 2013). We defined manufacturing system robustness as the ratio of operations feasible under disruptions of a specific machine to total operations usually conducted in the system. The time component has only implicitly been included by the choice of the size of the time span for robustness assessment.

In this paper, we first present an overview of robustness concepts and measures in different research fields and in the context of manufacturing systems. We then proceed to suggest a measure to adequately quantify the robustness of manufacturing system performance. Due to the two-dimensional characteristic of robustness, namely the degree of maintaining performance and the time span allowed until recovery, we enhance our previously developed measure by an explicit time component. We explain the parameterization of our method and illustrate its applicability using a simulated flow-shop scenario.

MEDICAL SECTOR STUDIES

Proposing a virtual operations network to support a business policy for the Medicinal and Aromatic Plants sector

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This research found out a more robust conceptual basis behind three missing links concerning the requirement for a virtual operations network to support a business policy for the Medicinal and Aromatic Plants (MAP) sector. Industry was pictured from secondary data gathered from a 12 experts panel. The factors to configure a collaborative network, e.g. relationships and structure, enabled the operationalisation of a previously defined social platform. Requirements for information infrastructure, co-ordination and DSS were also expressed. Moreover, the role of enterprise knowledge to the formation of collaborative ventures helped the modelling of the social-momentum of the platform. Finally, it is argued (i) for the confirmation of a significant Operations Management contribution to defining a MAP policy and, (ii) for the outlining of a collaborative network representing an advance to the usually ambiguous prescriptions of virtual operations. An interview guide to run an empirical test could be generated as further work.

Towards a Theory of Industrial System: a case study on environmental sustainability in the UK medical device industry

Mukesh Kumar, Yuto Minakata, Jag Srai

University of Cambridge, UK

The purpose of this paper is to first develop an industrial system analytical framework from operational management perspective, then to test it through exploring the influence of environmental sustainability on an industrial system by analysing its dynamics. It was believed that this framework developed from a theory of industrial systems could provide new insights on approaching industrial scale challenges such as this one. This research involved the development of an industrial system framework and mapping approach, extending established structure and infrastructure definitions of the previous manufacturing systems to an industrial system level. The resulting framework was tested on the selected UK Medical Technology Sector Industrial System in a form of multiple case studies in different segments. Environmental activities in the chosen sector were collected and contrasted with literature to analyse its dynamics with the industrial system.

The industrial system framework provided new insights into the structural and infrastructural components of an industrial system. Analysis of the dynamics between environmental sustainability and an industrial system showed that external stakeholders generally have an indirect impact on the overall industrial system structure. In contrast, industrial actors were found to have direct and specific structural impact to a certain part of the value/supply chain, depending on the nature of the product-based systems.

Furthermore, specific environmental challenges for the UK Medical Technology Sector Industrial System were highlighted as its significant Small and Medium Enterprise proportion that does not have a high focus on this issue and high environmental regulatory barriers. This shows a need for a more effective infrastructure, incentivising industrial actors to adopt green methods as well as to share its knowledge through collaborations with its industrial system.

This research makes contextual/business environmental elements of operational management into more dominant elements of an operational system, leading to a theory of industrial system. The developed framework can be utilised by both external stakeholders and industrial actors in order to align its strategy with a certain industrial scale challenge.

Although multiple product-based industrial systems have been investigated, some aspects could not be verified. Furthermore, testing the developed framework is suggested for other types of industrial systems for a further verification of this approach and to expand on the theory of industrial system.

VALUE CAPTURE

We do create and capture value, don't we? A conceptual model of purchasing contribution to business performance.

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A relevant question is holding court in academia: how does purchasing contribute to a company capability to create and capture value? This paper seeks to make two contributions. First, building on ambidexterity literature, we investigate how the purchasing function can simultaneously explore and exploit opportunities (i.e., purchasing ambidexterity), facilitating innovation while maintaining efficiency. Second, insights emerge from prior research and anecdotal evidence about the means by which purchasing ambidexterity can help the company to create and capture value. Two main outcomes of purchasing ambidexterity emerge which mediate the relationship with business performance: innovation and purchasing efficacy. This studies proposes a conceptual model and a set of propositions that future research can empirically validate. Finally, future research directions and managerial implications are discussed.

Foreign invested manufacturing company's components sourcing process in the context of China's processing trade

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Processing trade activities in China significantly depend on foreign invested manufacturing companies (FIMC). Based on a case study of the component procurement process of a foreign electronics company engaged in processing trade in China, this study identifies three stages of the components sourcing process: (1) simple assembly stage, (2) component localization stage, and (3) supply chain integration stage. In addition, the case study suggests that the type of processing trade evolves from processing with supplied materials (PSMs) to processing with imported materials (PIMs) as the sourcing process proceeds through the three stages and the internal and external environments change.

An exploratory study assessing value chain reconfiguration opportunities in oncology

Tomás Harrington and Ismail Najim, University of Cambridge, UK

The widespread adoption of e.g. continuous manufacturing in pharmaceutical industrial practice is not solely dependent upon the technical requirements of each process step. For such technologies to become more generally accepted the business case and impact on current industry value chain configuration(s) needs to be better understood. Current reconfiguration studies in this area have largely focused on a series of pharmaceutical candidates that are manufactured in large volume (e.g. ACT and Metformin production in the order of 100-1000 tonnes/annum respectively).

Accelerated growth of the oncology market within the pharmaceutical sector has been widely reported in the literature e.g. Oncology drugs went from 10% sales of the top 100 best-selling drugs in 1998 to 18% by 2009. In addition, the IMS Institute for Healthcare (2012) forecasts \$74-84 billion of spending by 2017 - making oncology the leading therapeutic area. It is also argued that oncology may better exhibit characteristics of what may be the future of the pharmaceutical industry (e.g. niche, personalised, targeted for specific sub-populations, high prices/costs, lower volumes) and, hence, inform opportunities and benefits for e.g. continuous operations and the wider pharmaceutical sector.

An analytical framework, previously developed, enables the systematic assessment of a series of candidates that are representative of the wider oncology market e.g. including low volume, niche, patented drugs with high QALYs (quality-adjusted life years) through to higher volume generics with a history of shortages. A series of emerging product-process archetypes in oncology – classified as 'New Niche', 'Old Niche' and 'Established Generics' - are presented in this working paper and a range future scenarios and models for value chain reconfiguration are explored.

SUPPLY CHAIN EVOLUTION

PA Future Supply Chain Assessment Framework: a case study of Terpene-based supply chain

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The aim of this research is to adapt existing supply chain analysis techniques to the analysis of compound class defined supply chains in order to explore the key factors that influence the commercial viability of renewable chemicals feedstocks (RCFs). By categorising the analysis perspectives used in supply chain literature it can be identified that supply chain analysis has traditionally been applied to product or company defined supply chains. More recent publications have presented examples of source, industry, technology and by-product defined supply chain analyses. However, a clear gap exists in the analysis of compound class defined supply chains. Furthermore, the field of RCFs is receiving an increasing amount of attention due to the potential of RCFs to replace petrochemicals. In particular, terpenes present an example of a RCF supply chain that allows for the study of a compound class defined supply chain. Therefore, an existing supply chain analysis methodology was adapted to the analysis of compound class defined supply chains. The methodology was further extended to include the consideration of environmental and economic factors. The resulting methodology was applied to terpene based RCFs as a case study. This allowed the identification of the key factors that affect the viability of terpene RCF supply chains. This terpene viability framework was extended to support the viability assessment of RCF solutions. The primary changes that were required to the existing supply chain analysis methodology related to the focus, scope and order of data collection and analysis. The primary challenge to application was the complexity at the market side of the supply chain that appears to be inherent in compound class defined supply chains.

Supply Chain Evolution - An Emerging Science

Professor Bart L MacCarthy
Nottingham University Business School, UK

Supply chains are not static – they evolve in terms of size, shape and configuration and in terms of how they are coordinated and managed. New supply chains may emerge for many reasons, e.g. in response to a technological breakthrough, the emergence of a new market niche or a new geographical market. Supply chains also decline and die when demand is no longer sufficient to drive the chain. Although the supply chain management literature does address supply chain strategies and their dynamics over time, and to some degree addresses changing supply chain configurations, less attention has been given to supply chain birth and supply chain evolution from emergence to growth and maturity - what we term here as the supply chain lifecycle (SLC). Examples are given of supply chains that are mature and relatively unchanging, those that are emerging, and those that are in transition or subject to disruption. A range of sectors is discussed including steel, clothing, electronics, aerospace and the auto-industry. The major factors influencing a supply chain over its lifecycle are discussed including technology, economics, regulation and policy, markets and sourcing, and supply chain strategy and re-engineering. A number of propositions are presented on factors affecting the 'complexion' of a supply chain over its lifecycle. It is argued that a new science is needed to investigate and understand the supply chain lifecycle. This needs to exploit a wide discipline base to better understand the patterns of supply chain emergence from birth to maturity and decline.

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