Workshop on Supply Chains

Date: **17 and 18 December 2012 (Monday and Tuesday)**

Venue: **Singapore Management University**
                    Lee Kong Chian School of Business
                    Level 1, Seminar Room 1.1

Programme

Monday, 17 December 2012		
Time	**Venue**	**Event**
9.00am – 9.30am	**SR 1.1**	**Registration**
9.30am – 9.45am	**SR 1.1**	**Welcome address**
9.45am – 11.15am	**SR 1.1**	**Keynote Speaker** **Chung-Yee Lee** **Chair Professor, Department of Industrial Engineering and Logistics Management and Director, Logistics and Supply Chain Management Institute** **The Hong Kong University of Science and Technology** **Ocean Container Transport:** **Making Global Supply Chain Management Effective** **Abstract:** As supply chains become more global, and more operations are outsourcing and move offshore, ocean container transport now is a critical element of any such supply chain. In particular, due to the tightened security, increased congestion, slow steaming, and heightened pressure on energy usage and carbon emission, the immediate effect of transportation on supply chain has recently attracted much attention. In this talk, I will first review the main characteristics of current ocean container supply chains and discuss some major trends that affect the operation of these supply chains. I will then present a number of problems and related research questions that have been understudied in the literature and yet appear to be challenging for both container shipping service providers and

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		users. I will also suggest on how Operations Research/Management Science can play in such an emerging topic.
11.15am – 11.45am	Outside SR 1.1	**Coffee Break**
11.45am – 12.30pm	SR 1.1	**Paper I** **Onur Boyabatli** **Singapore Management University** **The Impact of Budget Constraints on Flexible versus Dedicated Technology Choice** **Abstract:** This paper studies the impact of financial constraints on a firm's choice of technology (flexible or dedicated) and capacity investment decisions. Specifically, we consider a two-product firm that decides on its technology choice and capacity level under demand uncertainty, and the production quantities after this uncertainty is resolved. The firm is budget-constrained both in the capacity investment and the production stages. Our analysis shows that ignoring financial constraints, as in the case of traditional modeling approaches, may lead to technology mis-specifications. Because the capital available to finance the production cost can be allocated between the two products in response to the demand realizations, the presence of financial constraints unlocks the *financial* pooling value with each technology. We identify the critical roles that the financial pooling value of the dedicated technology and the capacity intensity (the relative cost of capacity and production) of each technology play in the optimal technology choice under financial constraints. We show that, contrary to common intuition, adopting dedicated technology which has a lower investment cost than the flexible technology is not always the best response to the tightening of financial constraints. We find that, in general, the technology with the lower capacity intensity better combats the tightening of the capacity-stage budget whereas the technology with the higher capacity intensity better combats the tightening of the production-stage budget. In contrast to intuition also prevalent in the academic literature, we demonstrate that flexible technology may have value when the demands are perfectly positively correlated under financial constraints.
12.30pm – 1.15pm	SR 1.1	**Paper II** **Eddie Anderson** **The University of Sydney** **Competitive bidding with a reservation price and an execution price**

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		Abstract: We formulate a general model in which each supplier can offer a certain amount of capacity for reservation (at a reservation price) and at the same time specifies an execution price (that will be paid by the buyer only if the capacity is used. The buyer then decides which suppliers to select and pays the required reservation amounts. Then demand occurs according to a distribution that is common knowledge. Finally the buyer determines which of the reserved capacity to use (choosing that with a low execution price first). If demand exceeds the total amount of reserved capacity it is lost. In this scenario the buyer would like to have some capacity at low total cost (reservation plus execution) in order to meet demand that is almost certain to occur, but would also like to have some capacity at low reservation cost (even if the total cost is higher) in order to meet demand that is unlikely to occur. A similar model has been looked at by Martínez-de-Albéniz and Simchi-Levi (2009), but their model differs in having suppliers with an unlimited capacity at fixed reservation and execution prices. We look at two versions of this problem: A discrete version in which capacity comes in discrete blocks and a continuous version in which the prices are given as functions: thus, for example, to reserve a capacity x from supplier i has a cost $r_i(x)$. We show how the buyer's decision can be characterized and use this result in order to describe the optimal response by one supplier to the offers of the other suppliers. Finally we look at the properties of an equilibrium in the case where there are two suppliers and one buyer.
1.15pm – 2.30pm	**Near SR 2.8, Level 2**	Lunch
2.30pm – 3.15pm	**SR 1.1**	**Paper III** **Geoffrey Chua** **Nanyang Technological University** **On the Performance of Sparse Process Structures in Partial Postponement Production Systems** **Abstract:** Production postponement, the strategy to hold reserved production capacity that can be deployed based on actual demand signals, is often used to mitigate supply-demand mismatch risk. The effectiveness of this strategy depends crucially on the ease, or flexibility, in deploying the reserved capacity to meet product demands. Existing literature assumes

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		that the reserved capacity is "fully flexible," i.e. capable of being deployed to meet the demand of any item in a multi-product system. Little is known if reserved capacity is held at many different locations, with each location having only a limited range of flexibility on production options. This paper examines how effective the production postponement strategy is in this environment. When the amount of reserved capacity is small (i.e. postponement level near 0%), no amount of flexibility can reap significant benefits. When the reserved capacity is high (i.e. postponement level near 100%), it is well known that a sparse structure such as a 2-chain can perform nearly as well as a fully flexible structure. Hence, process flexibility has little impact on the effectiveness of production postponement strategy in these two extreme environments. Interestingly, in a balanced and symmetrical system, we prove that the performance of 2-chain, vis-a-viz the full flexibility structure, has a wider gap when postponement level (i.e. amount of reserved capacity) is moderate, and thus process flexibility structure matters and affects appreciably the performance of the production postponement strategy. Fortunately, adding a little flexibility, say turning a 2-chain into a 3-chain, the system can perform almost as well as a full flexibility structure for all postponement level. This is important as first stage production capacity can be allocated "as if" the reserve capacity is "fully flexible." Our analysis hinges on an exact analytical expression for the performance of d-chain, obtained from solving a related class of random walk problems. To the best of our knowledge, this is the first paper with analytical results on the performance of d-chain for $d > 2$.
3.15pm – 4.00pm	SR 1.1	**Paper IV** **Yangfang Zhou** **Singapore Management University** **Combining Operations Management and Engineering Models to Effectively Manage Electricity Storage** **Abstract:** Electricity storage has the potential to play an important role in many aspects of the global economy, such as enabling the use of electric cars and balancing electricity supply and demand on the power grid. However, in the literature, when these storage facilities are valued or managed, their physical characteristics and operating dynamics are often ignored. A natural question is whether it is important to model these dynamics, specifically whether modeling them might materially change the prescribed operating policy and the resulting valuation of a storage facility. We answer this

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		question using a representative setting, in which a battery is utilized to trade electricity in an energy arbitrage market. We model the problem of operating a battery in an electricity market as a finite-horizon Markov Decision Process. Using engineering models, we capture the dynamics of energy capacity degradation over time and efficiency variation at different charging/discharging rates, evaluating three types of batteries: lead acid, lithium-ion, and Aqueous Hybrid Ion—a new commercial battery technology. We calibrate the model for each battery to manufacturers' data and determine their values under an optimal operating policy using an existing financial engineering price model calibrated to price data from New York Independent System Operator. Our analysis shows that: (a) it is quite suboptimal to operate each battery as if it did not degrade, particularly for lead acid and lithium-ion; (b) reducing degradation and efficiency variation have complimentary effects—the value of reducing both together is greater than the sum of the value of reducing one individually; and (c) decreasing degradation may have a bigger effect than reducing efficiency variation.
4.00pm – 4.30pm	Outside SR 1.1	**Coffee Break**
4.30pm – 5.15pm	SR 1.1	**Paper V** Qing Li **The Hong Kong University of Science and Technology** **Multimodularity and Structural Properties of Stochastic Dynamic Programs** **Abstract:** We introduce the concept of multimodularity into the class of stochastic dynamic programs in which state and decision variables are economic substitutes. We discuss its properties and its relationships with supermodularity, convexity, and L#-convexity in real space. We show that multimodularity is preserved under minimization and multimodularity leads to monotone optimal policies with bounded sensitivity. We use clearance sales of perishable goods, transshipment under capacity constraints, and lost-sales inventory systems as examples to illustrate its applications in stochastic dynamic programs.
5.15pm – 6.00pm	SR 1.1	**Paper VI** Alex Angelus **Singapore Management University**

Time	Venue	Event
		Optimal Policies for Capacitated Multiechelon Systems under High Utilization **Abstract:** We consider an infinite-horizon, multiechelon inventory problem with stochastic demand and processing capacity constraints at each stage. When the smallest capacity in the system is at the lowest echelon, we show that, under high utilization, there exists an optimal policy which, in the spirit of Clark and Scarf (1960), preserves additive convexity of the objective function, thus rendering the problem amenable to solution. We identify the structure of the optimal policy, which has the form of an ordered, multi-tiered echelon basestock policy, whose novel feature is that the optimal inventory decision at each stage is determined (only) by echelon inventories upstream of that stage, in a piecewise linear manner.
6.00pm – 6.30pm	LKCSB Stairs	**Group Photo and Break**
6.30pm	**Sun Japanese Dining @ CHIJMES**	**Workshop Dinner**

Tuesday, 18 December 2012

Time	Venue	Event
9.00m – 9.45am	SR 1.1	**Paper VII** **Dmytro Matsypura** **The University of Sydney** **Incremental Network Design with Maximum Flows** **Abstract:** Network infrastructure upgrades are a common phenomenon and typically occur over time due to various constraints. We introduce a class of incremental network design problems and focus on one of its variants: incremental network design with maximum flows. We consider the complexity of the problem, we analyse the performance of natural heuristics, we derive approximation algorithms, and we study integer program formulations.
9.45am – 10.30am		**Paper VIII** **Chen Wang** **Singapore Management University**

Time	Venue	Event
		Inventory management based on target-oriented robust optimisation **Abstract:** A target-oriented robust optimization method is proposed in this paper to solve a multi-period inventory management problem subject to inventory and ordering capacity constraints. Under our approach, only support sets of product demands are required. A solution of our model guarantees, as much as possible, fulfilment of a pre-specified target cost. By tuning this target cost, the solution can achieve a balance between its cost and its associated risk. Simulation studies based on data from a service-part distributor suggest that, if demand distributions are only partially known, our approach significantly outperforms the results of dynamic programs.
10.30am – 10.45am	Outside SR 1.1	**Coffee Break**
10.45am – 11.30am	SR 1.1	**Paper IX** Tong Wang National University of Singapore **Demand Estimation and Ordering under Censoring: Stock-out timing is (almost) all you need** **Abstract:** Retailers facing uncertain demand can use observed sales to update demand estimates. However, such learn- ing is limited by the amount of inventory carried; when demand exceeds inventory (i.e., a stock-out event occurs), a retailer in general cannot observe actual demand. We propose the use of sales transaction timing observations in a Bayesian fashion to learn about demand, and analyze this learning method for a multiperiod newsvendor setting. We find that, as previously shown with the use of only stock-out event observations, the optimal order quantity with sales transaction timing is greater than the optimal order quantity with full demand observation. We prove this result using a novel methodology from the statistics literature on comparison of experiments. While the optimal over-ordering with timing observation tends to be less than that with only stock-out event observations in most cases, we do observe cases where the opposite is true. Such cases correspond to high demand uncertainty and low margins, where marginal learning from using stock-out timing is significantly higher than using only stock-out event. In an extensive numerical study we find that, on average and with respect to uncensored demand observations, the use of timing observations eliminates 74.8% of the loss in expected profit from using only stock-out event observations. We illustrate that, for Poisson and Normal demand with unknown mean, the proposed learning method is tractable as well as intuitively appealing:

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		the information contained in transaction timing is fully captured by a single number—the timing of stock-out.
11.30am – 12.15pm	**SR 1.1**	**Paper X** **Masoud Talebian** **The University of Newcastle** **Markdown Management at Sports Unlimited** **Abstract:** Sports Unlimited, a sporting goods retailer, has hired a consulting team to help revise its markdown policy in order to increase store revenues. This case describes the challenges that the retailer faces in designing its markdown policy and focuses specifically on the timing of markdowns.
12.15pm – 1.30pm	**Near SR 2.8, Level 2**	**Lunch**
1.30pm – 2.15pm	**SR 1.1**	**Paper XI** **Tava Olsen** **The University of Auckland** **Reducing Length of Stay in Hospital Emergency Rooms through Process Redesign** **Abstract:** Emergency department (ED) overcrowding, while common around the world, negatively impacts operational performance and, at the limit, leads to an increased risk of mortality. Adverse outcomes linked to crowding stem from long wait times, which not only increase the time elapsed before treating a patient's medical condition but also increase the risk of infection from others in the waiting room. In this work, we evaluate the impact of point-of-care testing (POCT) on long ED wait times. POCT is the analysis of patient specimens at or near the location of patient care rather than in a centralized laboratory. By converting a test ordinarily processed in the central lab to the point-of-care, POCT may mitigate the negative effects of crowding by reducing the time required to diagnose and treat a patient (service time). Specifically, POCT can reduce service time delays due to congestion in the central lab and from transporting specimens to and from the central lab. Faster service enables faster turns and thus lower wait times. For this study, we retrospectively analyze the POCT natural experiment created when an urban, tertiary US hospital ED with annual census of 55,000 patients chose to co-locate the diagnostic device for a candidate blood test in the Department. We apply queueing theory to analyze ED patient flow. This allows us to model the impact of POCT on

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		waiting time and service time. We then use propensity score matching and difference-in-differences to econometrically test the hypotheses derived from the analytical model.
2.15pm – 3.00pm	SR 1.1	**Paper XII** **Pascale Crama** **Singapore Management University** **Licensing Contracts: Control Rights and Options** **Abstract:** In many high tech industries, but particularly in the pharmaceutical industry, research and development (R&D) collaborations have become very common. R&D collaboration, however, can be challenging to manage because of the high degree of technical and market uncertainty as well as the difficulty in measuring research effort. We investigate how the contracts between the innovating parties structure the R&D collaboration. We jointly optimize the payment terms and launch control rights or buy out (buy back) options, to offer the correct incentives to the innovator and the marketer. We find that the nature of the impact of the research effort matters as milestone payments are not always effective in encouraging research effort. We observe a counterintuitive result that the innovator may prefer to grant the launch control right to the marketer. This can occur for two reasons. First, when innovators possess a cost advantage for the marketing of niche products and the product outcome is highly uncertain, it naturally leads to the optimal allocation of niche and blockbuster products to the innovator and marketer respectively. Second, it can improve the effectiveness of milestone contracts by creating a credible threat that the marketer will not launch marginally profitable products and creating a strong incentive to invest in research. Buy out options are effective when the less profitable product is valuable enough to be launched by the marketer. The option enables the innovator to create a revenue stream that is directly proportional to the product outcome while limited the distortion effect of royalties.
3.00pm – 3.30pm	Outside SR 1.1	**Coffee Break and Close**

Administrative Information

1. **Workshop Venue**

    The Workshop on Supply Chains will be held at the Singapore Management University, Lee Kong Chian School of Business, Seminar Room 1.1 located at Level 1.

    Address:
    Singapore Management University (SMU)
    Lee Kong Chian School of Business
    50 Stamford Road
    Singapore 178899
    Website: http://business.smu.edu.sg/

2. **Temporary Wireless LAN**

    Wireless internet access is available for your use during the workshop. You may obtain the details at the time of registration.

3. **Meals**

    Coffee breaks and lunches will be provided for all registered participants outside the Seminar Room 1.1 at Level 1 and near Seminar Room 2.8 at Level 2 respectively. Workshop dinner will be at the Sun Japanese Dining restaurant located at CHIJMES. No transportation will be provided as the restaurant is within walking distance from the workshop venue.

    Address:
    Sun Japanese Dining @ CHIJMES
    30 Victoria Street #02-01
    Singapore 187996

4. **Contact**

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5. Map