Research Statement

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Background

The background of my research involves 4 distinct areas:

a) Data & Decision Analytics
Many OR and OM problems usually assumed that data is readily available and the problems are all well defined. In my research, the focus is on presenting problems exactly the way problems occur in reality, where problems are ill-defined, fuzzy and even messy. Through analyzing the data available and studying the problem carefully, the decision analytics solution method then emerges through trial-and-error, and experience. Thus, the research work presents a clear integration of data and decision analytics, which produces results which are implementable in practice.

b) Supply Chain Coordination
Supply chain coordination encompasses research areas involving decision making at different levels of the supply chain. At the strategic level, the design of logistics network involves deciding where to locate hubs to consolidate supplies from multiple suppliers to be transported to multiple manufacturers, so as to minimize the total supply chain costs including fixed hub costs, transportation costs and inventory costs. At the tactical level, a centralized decision could involve coordinating the amount of supplies from different suppliers to different manufacturers, so as to minimize the overall supply chain costs. At the operational level, transportation decisions on different available routes across multiple time periods are made to coordinate shipping quantities from multiple suppliers to multiple manufacturers.

c) Spreadsheet Modeling
The ability to model open, unstructured business problems into spreadsheet models for detail analysis has become increasingly important in the fast-changing business environment. Spreadsheet modeling has shown to support quick decision making and its use is rampant in the business world. Effective modeling comes from years of experience and exposure to myriad of business problems, plus using effective modeling and analysis techniques and tools. With an effective spreadsheet model, businesses can explore the what-if questions and perform trade-off and sensitivity analysis.

d) Master Programme Design, Development and Delivery

Designing, developing and delivering a brand new master programme involves identifying the knowledge gap in the education scene, designing courses which will train the next generation of leaders in skills that are relevant to the industry, and ensuring the continuous growth of the programme, to benefit all stakeholders including the students, faculty members, our industry partners, and the Singapore economy. This massive task is coupled with many administrative items such as marketing and promotions, admissions, projects, internships and placement, and faculty search.

Research Areas

a) Data & Decision Analytics

This research involves close collaboration with industry partners to obtain operations related problems and data to solve and obtain implementable results. The work completed include airport terminal resource allocation, airport check-in process optimization, demand forecasting and inventory pooling for luxury watches, order distribution process improvement for FMCG goods. All the papers proposed solutions which were obtained from integrating data analytics approaches such as statistical distribution, statistical inference and regression analysis, and decision analytics solution methods including simulation, heuristic algorithm and optimization of mixed integer non-linear model.

b) Supply Chain Coordination

This research involves centralized decision making for supply chain coordination, using combinatorial auctions as a coordination mechanism. Leveraging on the tight links between combinatorial auction and Lagrangean Relaxation model, the Lagrangean multipliers are used as the dynamically adjusted parameter to balance supply and demand of supplied parts or shipping capacity, subjected to constraints. The proposed solution methodology is applied in freight consolidation & distribution (operational level), and supplies coordination (tactical level) problems. By harnessing the special characteristics of each problem, we aim to attain fast convergence for large problems, and thus the solutions are implementable in practice, as opposed to solution methods which take too long to solve for any practical use. This methodology can be applied in many domain areas involving coordination of multiple decisions.

c) Spreadsheet Modeling

Effective modeling and analysis skills can be imparted to students and instructors alike. Good teaching notes on business problems were developed including analysis of demand and sales data and distribution, forecasting of growth trends, and price revision with quantity discounts using Excel Solver.

A paper on emphasizing the importance of teaching spreadsheet modeling skills to students was prepared to create awareness and highlight the critical pedagogical insights. The textbook "Business Modeling with Spreadsheets: Problems, Principles, and Practice", 2nd Edition, which covers a myriad of business problems was published and used as the textbook for several business modeling courses in SMU.

d) Master Programme Design, Development and Delivery

2 tracks of the Master of IT in Business (MITB) programme were launched successfully. These 2 tracks have carved niche areas for SMU-SIS in terms of training new leaders in technology & operations in banking, as well as business analytics leaders in service sectors. From the initial concept, to detailed discussions with industry leaders, to detailed design of courses, to delivery of courses, and then continuous improvements, the master programme has grown and gained industry recognition.

Selected Publications and Outputs

1. "Identification of Demand through Statistical Distribution Modeling for Improved Demand" by Murphy CHOY and Michelle LF CHEONG, 2012. Forthcoming, *Business Intelligence Journal.*

2. "A Sentiment Analysis of Singapore Presidential Election 2011 using Twitter data with Census Correction" by Murphy CHOY, Michelle LF CHEONG, Nang Laik MA and Ping Shung KOO, 2012. Forthcoming, *Social Science Computer Review.*

3. "Uncovering Insights through Data Analytics for an Airport Operation to Improve Profitability" by Nang Laik MA, Michelle LF CHEONG and Murphy CHOY, July 2012. Forthcoming, *SRII, Service Research and Innovation Institute Conference*, San Jose, USA.

4. "Multi-Party Multi-Period Supply Chain Coordination", by Thin Yin LEONG and Lee Fong, Michelle CHEONG, 2010. Forthcoming, *International Journal of Industrial and Systems Engineering (IJISE)*, in its special issue on "Integrated Manufacturing and Service Systems".

5. "Logistics Network Design with Supplier Consolidation Hubs and Multiple Shipment Options", by Michelle LF CHEONG, R. BHATNAGAR, and S.C. GRAVES, 02/2007, Vol. 3, Special Issue, 1,*Journal of Industrial and Management Optimization*, AIMS, 51 – 69.

6. "Logistics Network Design with Price Discount", by Lee Fong, Michelle CHEONG, R. BHATNAGAR, and S.C. GRAVES, 2005*, MSOM Conference 2005*, Chicago, USA.

7. "Business Modelling with Spreadsheets: Problems, Principles, and Practice", by Thin Yin LEONG and Lee Fong, Michelle CHEONG, Second Edition, 2012. *McGraw-Hill*, Singapore.

8. "Spreadsheet Modeling of Hotel Room Sales and Demand Distribution Estimation", by Thin Yin LEONG and Michelle LF CHEONG, 2009, Vol. 7, 1, *Decision Sciences Journal of Innovative Education*, Decision Sciences Institute, 89-97, United States of America.

10. "Spreadsheet Modeling of Equipment Acquisition Plan", by Thin Yin LEONG and Lee Fong, Michelle CHEONG, 2008, Vol. 6, 2*, Decision Sciences Journal of Innovative Education*, Decision Sciences Institute, 365-373, United States Of America.

12. "Teaching Business Modeling using Spreadsheets", by Thin Yin LEONG and Michelle LF CHEONG, 2008, Vol. 9, 1*, INFORMS Transactions on Education*, 20 to 34, United States of America.

13. "Essential Spreadsheet Modeling Course for Business Students", by Thin Yin LEONG and Lee Fong, Michelle CHEONG, *OR/MS Today*, 08/2009, United States of America.

Working Papers

1. “Minimization of retail ordering risk through aggregation of regional demands” by Murphy CHOY and Michelle LF CHEONG, 2012.

2. “Data Analysis of Retailer Orders to Improve Order Distribution” by Michelle LF CHEONG, Murphy CHOY and Nang Laik MA, 2012.

3. “Data Analysis and Monte Carlo Simulation of Airport Check-In Process” by Nang Laik MA, Michelle LF CHEONG and Murphy CHOY, 2012.

4. “Price Revision with Quantity Discounts using Solver in a Spreadsheet”, by Thin Yin LEONG and Lee Fong, Michelle CHEONG, 2010.

5. "Multi-Route Multi-Period Freight Consolidation", by Thin Yin LEONG and Michelle LF CHEONG, 2008.

6. "Logistics Network Design with Differentiated Delivery Lead Time: A Chemical Industry Case Study", by Michelle LF CHEONG, R. BHATNAGAR, and S.C. GRAVES, 2005.