

ILS 2012

Conference Program

Sunday, August 26, 2012

14:30 **Registration and welcome cocktail - Vachon building of the Faculty of Sciences and Engineering of Université Laval (1045, avenue de la Médecine)**

15:00 **Student competition: Salah E. Elmaghraby's Award I**

Location: VCH-2830
Chair:

15:00 **Potential of Routing Protocols for Freight in Open Logistics Networks: The Case of FMCG in France**

Sarraj, Rochdi, Mines ParisTech, rochdi.sarraj@mines-paristech.fr

15:25 **The Impact of Variable Operator Walking Distances on the Decision to Supply in Bulk or in Kits**

Limere, Veronique, Ghent University, veronique.limere@ugent.be

15:50 **A Game-Theoretical Model for Facility Location and Protection against Intentional Attacks**

Bricha, Naji, Université Laval, naji.bricha.1@ulaval.ca

16:15 **Break**

16:45 **Student competition: Salah E. Elmaghraby's Award II**

Location: VCH-2830
Chair:

16:45 **Inventory Management of Spare Parts in an Energy Company**

Guajardo, Mario, NHH Norwegian School of Economics and Business Administration, mario.guajardo@nhh.no

17:10 **Comparison of Single-Sourcing (with Order Splitting) and Dual-Sourcing in the Presence of Stochastic Processing Times**

Mukherjee, Niloy, Virginia Tech, niloym@vt.edu

17:35 **A Hybrid Approach to Large-Scale Short-Term Scheduling in Make-and-Pack Production**

Baumann, Philipp, University of Bern, philipp.baumann@pqm.unibe.ch

18:00 **Meeting**

Monday, August 27, 2012

07:30 Registration Vachon building of the Faculty of Sciences and Engineering of Université Laval (1045, avenue de la Médecine)

08:00 Official Welcome - Room VCH-2850

09:00 Keynote: Alain Martel, Honorary Chair

Location: VCH-2850

Chair: D'Amours, Sophie, *Université Laval*

Designing Supply Chain Networks for an Uncertain World

Martel, Alain, Université Laval, alain.martel@cirrelt.ca

This talk discusses Supply Chain Network (SCN) design problems under uncertainty, and it proposes a design methodology. Various aspects of the problem such as value creation, design decisions, resilience, responsiveness, and plausible futures are discussed. We review the nature of supply chain uncertainty sources, we analyze major disruptive events threatening SCNs, and we propose an approach to model multihazards. A generic formulation of the design problem under uncertainty is proposed, and complexity reduction avenues are examined. A solution approach based on scenario generation, SCN design generation and design evaluation and selection processes is also presented. We argue that the assessment of SCN robustness is a necessary condition to ensure sustainable value creation.

10:00 Break

10:30 REGULAR SESSION: SC Optimization and Network Design

Location: VCH-2830

Chair: Martel, Alain, *Université Laval*

10:30 Application of Job-shop Model for Supply Chain Optimization Considering Payment Delay between Members

Kemmoe, Sylvain, CRCGM, kemmoe@isima.fr

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In this paper, we discuss supply chain optimization considering financial exchange between different plants and different partners. The financial exchange is considered as the cash flow exchanges between suppliers, retailers, manufacturers and all the partners of the supply chain. We study the flow of money in a supply chain where each supply chain partner receives money from the downstream partners and makes payments to the upstream partners. The target is to obtain trade-off solutions during the operational supply chain planning. To model the problem we chose the Job Shop theoretical model where each machine represents a supply chain member and jobs represent the product batches. Each member of the supply chain has its own cash amount available and uses it to pay the upstream partners (suppliers and/or plant). We develop an integer linear programming model for the static case where the future receipts from distributors, and the payment terms and

amounts of all suppliers are known. The objective is to minimize the finish dates of all activities taking into account the financial constraints. The originality of our problem is the consideration of payment terms of different members of the supply chain. The proposed linear program is useful to obtain optimal solutions on small and medium industrial instances. The benefits of this work are shown through a small case study that illustrates the modeling approach and procedures necessary to implement a financial/supply chain scheduling methodology to aid the high level staff during planning and budgeting activities.

10:52 Tabu Search for Assembly/Disassembly Network Design

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This article develops a tabu search algorithm to solve an optimal design problem of assembly/disassembly manufacturing networks. The objective is to maximize production rate subject to a total cost constraint. Machines are chosen from a list of products available in the market and sizes of the buffers are chosen within a predetermined range. The buffers are characterized by their cost coefficients associated with the buffer size. The machines are characterized by their cost, failure rate, repair rate and processing time. To estimate assembly/disassembly network performance, a decomposition-type approximation is used. The optimal design problem is formulated as a combinatorial optimization one where the decision variables are buffers and types of machines. The design problem, solved in this study, has been previously analyzed using genetic algorithms and harmony search. The proposed tabu search takes advantage of the use of a bottleneck identification procedure. Comparisons show that the proposed tabu search out-performs genetic algorithms and harmony search solutions.

11:14 A CAT Metaheuristic for the Design of Activity-Based Supply Chain Networks under Uncertainty

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Martel, Alain, Université Laval, alain.martel@cirrelt.ca

An approach to design resilient and effective supply chain networks operating under uncertainty is presented. A generic stochastic programming model with recourse based on the supply chain activity graph, on structural deployment options and on second stage procurement, production and distribution decisions is first formulated. A Collaborating Agent Team (CAT) metaheuristic developed to solve large instances of this model is then proposed. Numerical results for a number of test problems are finally presented.

11:36 Suppliers' Coordination of Production and Delivery Decisions under Batch Size Constraints

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We consider the problem of coordinating production and delivery of a set of products ordered by a unique customer to different suppliers. Each supplier is producing the ordered quantity of one of the products. Each supplier is incurring an inventory cost per product item per unit of time from time 0 until the shipping time of the item, and a fixed delivery cost per loaded

truck. For economic reasons, the customer may accept to receive an ordered quantity split on many deliveries of small batches provided that each delivered quantity is greater than or equal to a minimum quantity threshold. Besides, delivered quantities must be less than or equal to a full truckload. The group of suppliers is considering mutualizing their deliveries. Deliveries mutualization supposes that the suppliers are synchronizing their deliveries, each of them contributing to all delivery batches. In this paper, we study this cooperative model and provide solution algorithms.

10:30 REGULAR SESSION: Production Scheduling and Sequencing I

Location: VCH-2840

Chair: Aggoune, Riad, *CRP Henri Tudor*

10:30 Scheduling on Three Identical Parallel Machines with a Single Operator and within the Free Changing Mode: A Geometrical Approach

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This paper addresses the problem of scheduling a set of jobs on three identical parallel machines within the supervision of a single operator in order to minimize the makespan. In our context, the presence of an operator is necessary to operate the machines through a subset of a given modus operandi: the working modes. A working mode models the way the operator divides up his interventions between the machines, and consequently the ratio of productivity induced on each machine. Within this model, the processing times become variable as they depend on the working mode being utilized. A schedule is thus a partition of the jobs on the machines with the corresponding sequences, a subset of working modes along with their duration, and the order of their utilization. Based on the geometrical approach, we present mathematical properties to characterize an optimal solution when the interventions of the operator can change at any time.

10:52 A Modified Shifting Bottleneck Procedure for Hoist Assignment and Sequencing in Surface Treatment Facilities

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In this paper, we consider hoist scheduling problems with one (or several) hoist(s) in a job shop environment. The objective is to minimize the makespan. This kind of problem exists in surface treatment facilities and is NP-complete even for the simple cyclic case. It is represented by a disjunctive graph, which contains not only processing nodes but also transportation nodes. Arcs with respectively positive and negative values are introduced to model lower and upper bounds on processing times. Once all disjunctions are arbitrated, a solution is found. A solution is said to be feasible if the associated graph contains no positive cycle. To solve this graph, two heuristics coupled with a modified shifting bottleneck procedure with repair are proposed. The shifting bottleneck procedure is used for finding feasible sequences on resources. A simple repair is applied if the proposed sequence is not

feasible. One heuristic is used to repair sequences of transportation tasks based on the original assignment. The other heuristic assigns and schedules transportation tasks. Various experiments on benchmarks show that our model and method are able to provide satisfying results.

11:14 Production Planning of a Two-machine Manufacturing System with Production Dependent Failure Rates

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A deteriorating production system consisting of two parallel machines with the production dependent failure rates of the machine is investigated in this paper. The machines produce one type of final products. The demand rate for the final commodity is constant and unmet demand is backlogged. The goal of the control problem is to find the production rates of both machines so as to minimize a long term average expected cost which penalizes both the presence of waiting customers and the inventory. In the proposed model, the production rate of the first machine (machine 1) is higher than the production rate of the second machine (machine 2). The failure rate of the machine 1 which is the main machine depends on its production rate. The failure rate of the second machine is constant. This paper proposes a stochastic dynamic programming formulation of the problem and derives the optimal production policies numerically. A numerical example is included and the sensitivity analyses of the optimal results with respect to the system parameters are also examined to illustrate the importance and effectiveness of the proposed methodology. In the near future, the proposed model will be extended to the reverse logistics.

11:36 An Integrated Approach for Lot Sizing and Detailed Scheduling in Job-shops

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Wolosewicz, Cathy, École des Mines de Saint-Étienne,

In this paper, an improved integrated approach for solving the production planning and scheduling problem for multi-item multi-resource systems is proposed. Detailed capacity constraints are considered in the lot sizing model, thus guaranteeing feasible solutions. We use a Lagrangian heuristic to generate an optimal production plan for a fixed sequence of operations. A procedure proposing production plans with relaxed capacity constraints is combined with a smoothing procedure which modifies these production plans to satisfy the capacity constraints. Then, a sequence improvement method is performed to feed the Lagrangian heuristic with different sequences. A Tabu search is used to guide the selection of sequences.

10:30 THEMATIC SESSION: SCM in Crisis Situations

Location: VCH-2860

Chair: Lamothe, Jacques, *École des Mines Albi Carmaux*

10:30 Designing a Humanitarian Supply Network: One Way to Deal with Demand Uncertainty

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An increasing number of humanitarian organisations have successfully opened regional warehouses. They are also thinking about or have already started to pre-position resources on a local level. Their choice for location, on both a regional and local level, may be helped by decision-support systems. Our proposition is to use Operations Research to help humanitarian organisations or any private company working under high levels of uncertainty regarding demand and supply to configure their logistics network so that for a given level of service in terms of agility, they improve their efficiency. We provide an analysis of humanitarian demand patterns enabling to estimate future demand. Then we propose an optimisation model to quantitatively analyse the impact of various strategic choices regarding supply strategy and level of service on operations efficiency. It allows us to provide some recommendations, aiming at helping humanitarian organisations to define their logistics strategy.

10:52 Towards a Collaborative and Agile Information Decision Support System for Transport Crisis Management

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This paper presents the first results of a French research project SIM-PeTra dealing with an agile Mediation Information Decision Support System in specific transport crisis context. The paper exposes the global architecture of such a system using an Event Driven Architecture approach coupled with a Service Oriented Architecture. This article describes briefly the functions of new services for this architecture. The paper explains also what are the futures topics for developing a Mediation Information System in Crisis Context.

11:14 Humanitarian Logistics and Disaster Relief Research: Trends, Applications, and Future Research Directions

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The increase in the number of people impacted by natural and man-made disasters has required more efforts of humanitarian organizations. In this context, research on disaster operations management and humanitarian logistics has grown in terms of publications and importance in recent years. This paper presents a literature survey of humanitarian logistics studies that aims to observe trends and ideas for future research directions. First, the reviews by Altay and Green (2006) and Natarajarathinam et al. (2009) are updated and detailed. In addition to the updated review and the classification criteria adopted by the previously-mentioned papers, other criteria are proposed in order to have more information about them. Two hundred one (201) that were published in the HL area are reviewed and listed in a companion website. The studies are classified according to criteria such as

research method, disaster type, decision level, and the database of publication. The conclusions point out to some literature gaps and research opportunities in the area of study.

11:36 Mitigating Disruptions Impacts Using Super Facilities

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Dealing with facility disruptions has increasingly attracted practitioners and researchers attention in the last decades due to recent events: weather deregulation, natural disasters, financial crisis, terrorist attacks, etc. Researchers often dealt with the strategic aspect of the problem while making facility location decisions in order to build a robust supply chain. In this paper we address the flexibility aspect and more precisely product configuration of the facilities. We consider the problem of allocating demand arising from a set of multiple products to a set of dedicated facilities. The facilities are subject to disruption and the demand is lost in this case. To mitigate disruption impacts, we consider the use of a super facility that can hold the demand of products when the dedicated facilities are under failure. The objective is to determine the optimal capacity of the super facility so as to minimize the sum of capacity investment, demand allocation and lost sales cost. In systems with identical products and identical facilities, we propose an algorithm that can be used to determine the optimal capacity of the super facility.

10:30 INDUSTRIAL SESSION: Quantified Creativity to Reduce Uncertainty (panel and discussion)

Location: VCH-2870

Chair: Vandaele, Nico, *Katholieke Universiteit Leuven*

10:30 The Essence of Comparing Apples and Pears within R&D Portfolio Management

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Decouttere, Catherine, Katholieke Universiteit Leuven,

Contemporary R&D portfolio management goes far beyond the technical and financial evaluation... More and more it has to take sustainability and other societal values into account. We develop an approach where sustainability is explored in a broad sense for evaluating R&D activities contained in a R&D portfolio. This assessment is the basis for a constrained ranking taking resources into account like budgets, people, time, etc. Some examples from industry will be shown.

11:00 Measuring the Qualia of an R&D Portfolio Management: Experiences from Industrial Practice

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Decouttere, Catherine, Katholieke Universiteit Leuven,

In order to be able to make the R&D portfolio assessment a success, there is a need to measure user and societal aspects in a reliable way. Based on the conclusions from an industrial review, we formulate the decision problem at hand and give a first hand of solution. It boils down to the necessity to incorporate qualia and values into the decision problem which reflects inherent conflicts between managers, engineers and creative intuitive minds. We illustrate with multiple examples from our industrial practice.

11:30 Open Debate and Reflections

10:30 **THEMATIC SESSION: Inter-Firm Collaborations for Logistics I**

Location: VCH-2880

Chair: Ballot, Eric, *Mines ParisTech*

10:30 **Supply Chain Members Paradoxical Strategies: A New Systemic View**

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Supply chains are organizational systems characterized by complex behavioral interactions upon which partners adopt bipolar strategies that join paradoxical and constructive actions to evolve in an uncertain environment. This enables them, on one hand, to converge towards common interests through the development of cooperative actions and strategies; and on the other hand, to deviate on their own interests by adopting competitive maneuvers. This dynamics generates an ago-antagonistic system where both of these two concepts, namely cooperation and competition, simultaneously drive the supply chain. In the present article, this system is investigated by using ago-antagonistic systems theory in order to have a new outlook of the supply chain approach.

10:52 **Collaboration in Transportation Management – Case Study for the Forest Industry**

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Transportation is characterized by tight competition and operating costs that increase day after day. For the forest industry, transportation is even more complex because forest products have specific transportation needs while their value has not really increased in the last few years. In this context, the concept of collaboration in transportation becomes an opportunity to better use capacity and improve profitability. Moreover, decision support systems (DSS) applied to transportation management are powerful tools that, combined with cost sharing methods, deliver great results. This paper explores some possibilities given by combining collaboration models to transportation management for the forest industry. In particular, real data from a union of forest owners and their transporters are used to test different scenarios so as to decrease the transportation cost. After simulating various ways of doing the transportation, we want to show that it is possible to better use the transportation capacity by greater collaborations between forest owners, customers, and transporters.

11:14 **Game Theoretic Contribution to Horizontal Cooperation in Logistics**

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Horizontal cooperation in logistics was proved globally advantageous, but we see only few realizations until now. The main obstacle to the successful implementation of horizontal cooperation is the absence of appropriate cooperation decision making model, consisting of

the detailed cooperation process, the optimization model, and the stable-and-fair gain sharing mechanism. In this paper, we propose a practical cooperation decision making model for the realization of horizontal logistics cooperation scheme. This model is a decision process integrating an optimization tool and a game-theoretic approach to find a feasible allocation rule, and stable coalitions related to coalition structures issue. We propose a weighted allocation rule that takes bargaining power, contribution and core stability into account, and generalize it in games with coalition structure. Then we investigate related stability issue under two different cooperation patterns. At the end, we present a case study of France retail supply network, which verifies the cooperation model we proposed.

11:36 An Improved Planning Coordination in a Decentralized 2-echelon Supply Chain

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This paper considers a two-echelon decentralized supply chain system with two actors, a logistician and a manufacturer. The problems of production, storage and transportation planning at tactical level using capacitated lot-sizing models are being studied and decentralized decision making is being considered. To achieve good economic performance, as in the centralized case, the two actors have to coordinate with each other to negotiate the quantities they exchange in the planning horizon. A coordination mechanism based on the negotiation process proposed by Jung et al. (2008) is being studied. Two major problems, imbalanced holding costs and storage capacity problems, which cause the decentralized planning under-performs the centralized one are identified. Hence, a modification on the original negotiation process is proposed in this paper to improve the efficiency relative to the storage capacity problem. The improved negotiation process is proved the converge ability, and computational results have clearly indicated economic benefits.

12:00 Lunch

13:30 Industrial Keynote: Anthony Valla

Location: VCH-2850

Chair: Botta-Genoulaz, Valérie, *INSA-Lyon*

13:30 A Complete Re-Design of Logistics to Support the Business Development

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Facing a strong development and difficulties with the performance of its logistics and the control the uncertainty of its demand, Valrhona launched an ambitious project to redesign its logistics. The company was able to successfully integrate the constraints of the food industry, a seasonal and highly capitalistic business model and implement a new way of functioning based on a complete modeling and analysis of the internal supply chain and its decision processes. This presentation is designed to share this metamorphosis where Valrhona transformed its approach and business model for its logistics. The presentation will show the global analysis approach used and the changes implemented in terms organization, information & material flows.

14:30 THEMATIC SESSION: Sustainable Logistics and Supply Chains I

Location: VCH-2830

Chair: Chaabane, Amin, *École de technologie supérieure*

14:30 Collaboration Mechanisms in Green Supply Chains: A Case in Pharmaceutical Industry

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Global market demands and governmental pressures are pushing corporations to tackle their social and environmental responsibilities and to address Environmental Management (EM) in their supply chains. Collaboration mechanism plays a critical role to maintain the flexibility and responsiveness of supply chains. The main goal of this work is to review the existing literature on Green Supply Chain management with a special focus on collaboration mechanisms for accelerating the integration of environmental aspects in supply chains. The idea is to investigate the existing literature on supply chain collaboration in order to find potential benefits and issues in adopting them as collaboration mechanisms among different stakeholders while attempting to have green and sustainable supply chains. A pharmaceutical company is considered as the case study. The motivations of the company in greening the supply chain, major processes and functions, in addition to main stakeholders in the company are also reviewed. Finally, we suggest green purchasing and reverse logistics as potential areas for collaboration in order to integrate environmental concerns and legislations in their supply chain.

14:52 The Impact of Technologies such as RFID on Sustainable Logistics

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Van Lier, T., VUB,

This paper studies the impact on sustainability of using RFID. The information technology, the domain of RFID, takes a major role in the business world. More and more companies rely on information to find opportunities and provide their consumers with new services. Information systems have transformed markets and created new business models: the information technology provides new value drivers for companies so as to benefit from the economies of scale as large companies while remaining small by responding quickly and innovatively.

15:14 Multi-Agent Service Delivery Tour Planning Using Model Checking

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Logistics planning may often involve service provision at multiple locations under plan specific constraints, ordering or sequencing especially in non-euclidean transit environments. In this respect, common approaches for vehicle routing fall short in adequately modeling and solving compound ad-hoc plan dependent constraints. In this paper, we address service

provisioning involving multi-agent tour planning to reach demand points as fast as possible, by starting from different initial nodes of shared irregular transport graphs (characterized by having distinct degrees on most of their adjacent vertices). The planning problem is subject to specific constraints that require to consider agent movement without concern of returning to the starting point(s). In this setting, our alternative approach finds competitive solutions by expressing such problems into transition systems and related goal state properties that can be subjected to symbolic model checking using automated formal verification tools such as NuSMV. The negation of the goal state property allows to generate a counter example during the assessment such that, if a counter example exists, then the route allocation planning problem finds a solution. To mitigate the state explosion problem, we employ bounded model checking that has the additional advantage of providing counter examples of minimal length which correspond to minimized agent tours under a cost bound.

15:36 Greening the Supply Chain: Operational Adjustment versus Technology Investment

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Greening a supply chain can be achieved by considering several options. However, companies lack of clear guidelines to assess and compare these options. In this paper, we propose to use multiobjective optimization to assess operational adjustment and technology investment options in terms of cost and carbon emissions. Our study is based on a multiobjective formulation of the economic order quantity model called the sustainable order quantity model. The results show that both options may be effective to lower the impacts of logistics operations. We also provide analytical conditions under which an option outperforms the other in a carbon tax context.

14:30 THEMATIC SESSION: Optimization of Production and Assembly Lines Design I

Location: VCH-2840

Chair: Amodeo, Lionel, *University of Technology of Troyes*

14:30 Linking Data-Driven Risk Analysis and Discrete Event Simulation for Supply Chain Strategic Decisions

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In today's manufacturing global environment, world-class companies are aiming to standardize their operations in which their product is built using the same assembly "formula" across all their sites. For this, companies are aiming towards a profitable partnership with their supply chain that provides flexibility and is fast to the market changes. Most risks associated with product industrialization are due to hidden supply chain costs that if business owners knew ahead of time, they could make better decisions when it comes to globalizing products. This paper attempts to show how discrete event simulation can help mitigate these 'hidden cost' during the product rationalization process and the optimal mix of actions to make decisions based on the true costs that are linked to the strategy.

14:52

Application of an Artificial Immune Algorithm to Solve a Robotic Assembly Lines Balancing Problem of Type E

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In this paper, an industrial application of an artificial immune algorithm for solving a robotic assembly line balancing is proposed in order to maximize the lines efficiency. The idea is to implement the developed method in a real case system to manage the functioning of pick and place robotic assembly lines which request a short execution time. For this reason, we are unable to apply an exact method that requires a large execution time. This is the main advantage of our method compared to exact methods. We aim to find the suitable assembling tasks and components of products in order to guide each robot in the process of gripping products. Numerical results show that the different algorithms perform efficiently for the tested instances in a reasonable computational time.

15:14

Optimizing Item Trips from a Production Line to Trucks

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This paper addresses the problems of minimizing the number of trips in order to load into trucks items coming from a production line. The transportation device used can only take at the same time a limited number of consecutive items going to the same destination. Although related to the games of Tetris, this problem is different to make a generalization of known complexity results. A dynamic programming algorithm is first presented to solve this problem. Although of exponential running time, the experimental results show that this algorithm outperforms by far the integer linear programming presented in Baptist et al. (2011). In the second step, we show that when discarding two constraints related to the capacity of the transportation device and the size of the window through which the items become visible in the production line, the problem is solved in polynomial time through a repeated application (though polynomially bounded) of the shortest path algorithm.

15:36

The Impact of Variable Operator Walking Distances on the Decision to Supply in Bulk or in Kits

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In the automotive industry, a high diversity of vehicles is assembled on mixed-model assembly lines. To allow for production, many different variant parts need to be supplied to these lines and stored at the border of line. Moreover, because parts are often large, the border of line can become enormous. This in turn leads to large walking distances and inefficient production. To free up some space at the line, kitting is introduced as an alternative materials supply method next to line stocking, i.e. feeding the line in bulk. This paper proposes a mathematical cost model which assigns all of the parts to one of both methods. The model explicitly takes into account variable operator walking distances at the line and in the kitting area. Results of the model are discussed and guidelines for logistics engineers are provided in the form of hypotheses.

14:30 THEMATIC SESSION: Robust Supply Chain Management I

Location: VCH-2860

Chair: Kazemi Zanjani, Masoumeh, *Concordia University*

14:30 **Monitoring of the Upstream Part of a Supply Chain Dedicated to the Customized Mass Production with a Revisited Version of MRP**

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SALI, Mustapha, Université Paris-Dauphine / Renault, mustapha.sali@renault.com

This article focuses on the monitoring of a supply chain dedicated to the mass production of strongly diversified products. Specifically, we are interested in the part of this chain that contributes to the production of a set of alter-native modules assembled on a work station of one or several assembly lines, whose production levels are stable. The MRP approach is adopted for the monitoring of this chain. The distance between the production units leads to a mix between production to stock and production to order. In this article, we establish the relations that allow us to define, in a steady state, the quantities to produce that address the requirements of the Master Production Schedule and that are partially or completely random to limit the stockout risk to a very low predetermined level. We will distinguish two cases by accounting for, or not accounting for, problems that are related to quality.

14:52 **A Scenario Generation Method and Robust Optimization for a Real-life Bulk Gas Distribution Problem**

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We address a 'rich' (i.e., with real-world features and constraints) inventory routing problem for bulk gas distribution under uncertainty. We consider that the uncertainty occurs on the supply side and consists of outages at the production plants. We propose a general methodology for generating realistic scenarios as well as efficient solutions to be used within a robust optimization framework. This methodology is applied to real data provided by Air Liquide company. We show that for a relatively small increase in cost, the robustness of routes and schedules for the bulk gas distribution with regard to possible plant outages is improved. Indeed, by using the robust planning the extra cost induced by plant outages can be reduced with only a slight increase in the distribution cost.

15:14 **A Literature Review on Robust Tactical Planning in the Divergent Supply Chain of Maintenance Industry**

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Nourelfath, Mustapha, Université Laval, Mustapha.Nourelfath@cirreil.ca

Tactical planning in a supply chain comprises the synchronized planning of procurement, production, distribution and sale activities to ensure that the customer demand is satisfied by the right products at the right time. The problem described in this article is focused on a real world divergent supply chain corresponding to an industry providing maintenance services to airlines. Due to the variety of elements included in the aircraft body and engine, starting from a single item demanded for maintenance by the customer, variety of maintenance services

might be required. As a consequence, in the service and maintenance industry we are dealing with a divergent-type supply chain facing with significant level of uncertainty in the nature and timing of the demand. We provide a general methodology to address the problem. We mainly review the methodologies for addressing supply chain tactical planning under uncertainty. Moreover, insights on the type of models that can be used for formulating the described tactical planning problem are also provided.

15:36 The Future of Vertical Lift and the Army Aeromedical Evacuation Platform

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The United States Army continues to evaluate capabilities associated with the Future of Vertical Lift (FVL) program – a futures program (with a time horizon of 25 years and beyond) intended to replace the current helicopter fleet. As part of the FVL study, a research team investigated required capabilities for future aeromedical evacuation platforms. Three results from the initial geographic analysis follow. 1. Given simplifying assumptions and constraints for a scenario where a future brigade is operating in a 300 kilometer square, the zero-risk aircraft ground speed required for the FVL platform is 350 nautical miles per hour (knots). 2. Given these same assumptions and constraints with the future brigade projecting power in a circle of radius 150km, the zero-risk ground speed required for the FVL platform is 260 knots. 3. Given uncertain casualty locations associated with future brigade stability and support operations, co-locating aeromedical evacuation assets and surgical elements mathematically optimizes the 60-minute set-covering problem. A discrete event simulation study loosely set in Afghanistan is also discussed.

14:30 THEMATIC SESSION: Inter-Firm Collaborations for Logistics II

Location: VCH-2880

Chair: Lehoux, Nadia, *Université Laval*

14:30 Stability Contracts between Retailers and Suppliers Using Quantity and Time Constraints

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In this paper, a relationship managed by contracts between a supplier and a retailer is considered. In these contracts, constraints on the order amount are usually emphasized. Additionally, it is proposed to use another type of constraint, based on the frequency of the orders. A contract can be split in two parts: the amount constraints, and the frequency constraints. These frequency constraints are called dynamic time windows, and they are formally defined as mathematical constraints in an integer linear program. Numerous tests are distributed into two experiments, which help to understand the model. Finally, it is shown that the two parts of a given contract (amount and frequency) are hugely linked. Being more constrained on a single part of a contract involves many effects on the second part of the contract. For example, if a single part of a contract is tightened, the second part of the contract can be tightened, in the same way, and without any cost increase.

15:00 Aligning Key Success Factors to ERP Implementation Strategy: Learning from a Case-Study

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These last years, we can observe that most of companies implemented an ERP system but many of them fail. Much of research that has been conducted in this field, focus on KSFs. We have noticed that confronting those KSFs to ERP implementation strategies seems quiet fecund. So provide in this article a brief overview of the literature dealing with key success factors related to an ERP implementation project to better cope with the field, then come out with a framework analyzing these KSFs depending on implementation strategies. Then we study a case of an ERP implementation project in a company operating in the automotive industry, with a quail-metric methodology, to better understand the reasons of ERP implementation projects success or failure.

15:30

The Relationship between Trust and Inventory Replenishment in Supplier-Customer Dyad: An Experimental Study

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Trust has been identified as a significant role-playing factor, which guards supply chains against high inventories and poor customer services. Previous research addressed trust in supply chain mostly with the aid of surveys, interviews and field data analysis. Using an extended version of the Beer distribution Game, this paper examines the impact of trust on inventory replenishment indicators in dyadic supply chain. To measure trust, a trust measurement mechanism is proposed. This trust measurement mechanism is based on questionnaires to be filled at regular time intervals by suppliers and customers during the experiment. Correlation analysis is preformed to assess the relationship between trust and inventory replenishment indicators. Results show that trust in supplier is negatively associated with average order quantity and time between orders for customers. Surprisingly, no significant correlation is found between trust in customer and inventory replenishment indicators for suppliers. However, both trust types seem to play a role in the supplier-customer dyad dynamics.

14:30

INDUSTRIAL SESSION: Supply Chain Management Competition

Location: PLT-2370

Chair:

Marier, Philippe, Université Laval, Philippe.Marier@forac.ulaval.ca

Come live the supply chain dynamics in this serious game adventure. The Wood Supply Game has some similarities to the worldwide known MIT's Beer Game, but with a pinch of salt making it a bit more challenging and a lot funnier to play. In this game, you will learn the major causes of supply chain inefficiencies, and more importantly, what you can do to avoid it. This is a friendly supply chain competition where we play to learn, not to win. Each participant will manage a business unit of a supply chain made up of seven interdependent enterprises. With one or two customers to satisfy and one supplying site, you will have to minimize the overall supply chain cost made up of inventories and backorders. The Wood Supply Game has been played over the Internet around the world by managers, CEO's and students of all degrees. Twice a year, an international Wood Supply Game competition take place with students from universities in the United States of America, Canada, South Africa

and Europe. Last year, the game won a prize for best E-Learning tool. So do not hesitate, it's your turn: come, play, learn.

16:00 Break

16:30 THEMATIC SESSION: Sustainable Logistics and Supply Chains II

Location: VCH-2830

Chair: Paquet, Marc, *École de technologie supérieure*

16:30 A Shared “Passengers & Goods” City Logistics System

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Many strategic planning models have been developed to help decision making in city logistics. Such models do not take into account, or very few, the flow of passengers because the considered unit does not have the same nature (a person is active and a good is passive). However, it seems fundamental to gather the goods and the passengers in one model when their respective transports interact with each other. In this context, we suggest assessing a shared passengers & goods city logistics system where the spare capacity of public transport is used to distribute goods toward the city core. We model the problem as a vehicle routing problem with transfers and give a mathematical formulation. Then we propose an Adaptive Large Neighborhood Search (ALNS) to solve it. This approach is evaluated on data sets generated following a field study in the city of La Rochelle in France.

16:52 Multi-criteria Decision Making for the Supply Chain Design: A Review with Emphasis on Sustainable Supply Chains

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This work presents a literature review on supply chain design (SCD) involving multiple criteria. A special emphasis is given to sustainable supply chains. Our purpose is to provide an overview on the existing works in the scientific literature. We are in particular interested in three questions: Which criteria are the most considered in supply chain design problems; especially in sustainable supply chain case? How are these criteria related to the supply chain characteristics? And, which multi-criteria decision making (MCDM) approaches and methods are used to solve such problems?

17:14 Tactical Planning of Procurement of a Supply Chain with Environmental Concern

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In this paper, we study the economic and environmental aspects of the tactical procurement planning of an industrial plant within a supply chain, corresponding to a real case of a European company. A procurement plan is obtained by solving an integer linear programming model. Two objectives are used: the first is to minimize the total cost including transportation, handling, and inventory holding cost, while the second is to minimize the CO2 emissions from transport taking into account the distance and the loads of the vehicles. Experimentations performed on the basis of real industrial data validate the approach and allow the analysis of tradeoffs between the two objectives.

17:36 Network Design Model for Intermodal Transport: The Case of the Hinterland of the Port of Cotonou

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Since 2006, the Millennium Challenge Account program subsidizes a project to improve the performance of the Port of Cotonou, through modernization of infrastructure and management systems, and strengthening institutional reforms. But the project mainly concerns the port, not the development of its hinterland. However, no port can develop without its links with its hinterland. That's why we analyse the issues relating to the hinterland transport network. Both rail and road transportation networks will be examined. We also investigate inland terminals in order to build up intermodal transportation which is almost non-operational. Thus, the objective of this paper is to determine the optimal number and locations of the terminals so that the total costs of the distribution network are minimized.

16:30 THEMATIC SESSION: Optimization of Production and Assembly Lines Design III

Location: VCH-2840

Chair: Baptiste, Pierre, *École Polytechnique de Montréal*

16:30 Comparison of Single-Sourcing (with Order Splitting) and Dual-sourcing in the Presence of Stochastic Processing Times

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Sarin, Subhash C., Professor, Virginia Tech, sarins@vt.edu

The strategy of ordering material for the production of a lot of identical, discrete items (products) from two vendors (called dual-sourcing) has been wellstudied in the literature. This strategy has been shown to result in a shorter lead time than that obtained by ordering material from either vendor alone. However, this strategy induces additional ordering cost. In this paper, we study an alternative strategy of sourcing the material from a single supplier but by permitting its delivery in two partial shipments (called single-sourcing with order splitting). Such a splitting of a lot into sublots has been studied in the deterministic scheduling area pertaining to economic lot sizing and lot streaming. However, in this paper, we study it in a stochastic environment by allowing processing times to be stochastic. Besides affording a lower ordering cost, we show that single-sourcing (with order splitting) incurs lower inventory and offers a better stockout risk behavior than that incurred and offered, respectively, by dual-sourcing.

16:52 A Strategic Capacity Allocation Model for Aligning Product Family Portfolios with Supply Chain Manufacturing Features

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Because of customization trend, firms must design products in order to regroup these into product families according to parts commonalities; this operation resulting in reduction of loss of capacity and in raw material wastes. However in order to be effective product family definition must be realized in a long term planning process considering supply chain features and inversely. In this paper, we propose a model allowing supply chain manager to measure impact of product family definition on demand satisfaction and supply chain design and operational costs. Confronting different scenarios, then it is possible to decide how define product family and how design supply chain. Among elements that we take account for, we can find resources constraints (minimum amount, purchase costs and transfer) but also capacity lost, capacity limitation, capabilities and inventory costs.

17:14 The Segmentation Method for Long Line Optimization

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In this paper, we present a segmentation method for long line optimization, in which we maximize profit (a function of production rate, buffer sizes, and average inventory). Instead of optimizing the original long line, the segmentation method divides it into several short lines, optimizes these short lines separately, and combines the optimal buffer distributions to find an approximately optimal buffer distribution of the original line. This method reduces the computer time for long line optimization dramatically. Both heuristic explanations and numerical experiments are provided to show the accuracy and speed of the method.

17:36 Performance Evaluation of Stochastic Production Systems : Discretization and Decomposition

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The performance evaluation of stochastic production systems is crucial to support managers decisions as well as challenging for researchers. In this paper, we propose a new methodology to analyze production systems with general assumptions: assembly/disassembly systems, general processing time distributions and finite storages spaces. The general distributions are first discretized by probability mass fitting, and the transformed system is then analytically modelled by decomposition. The system is decomposed into two station subsystems and the processing time distributions of the virtual stations are iteratively modified to approximate the impact of the rest of the network, adding estimations of the blocking and starving distributions. Decomposition allows to analyze large systems in a reasonable computational time (unlike exact models), and with good accuracy. Computational experiments show that the relative error is on the order of one percent, and less with buffer sizes larger than two. Moreover, as it allows a fine approximation of the blocking and starving time distributions, PMF seems to bring an improvement in the application of the decomposition technique.

16:30 THEMATIC SESSION: Robust Supply Chain Management II

Location: VCH-2860

Chair: Yoho, Keenan, *Naval Postgraduate School*

16:30

Agility Approach Design and Foundation: Case of Lumber Industry

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This paper develops an agility approach in the lumber industry. The industrial context and the business environment are explored. An integrated approach is based on four dimensions: conceptual, contextual, experimental and decisional. The first two dimensions give the specification components of the agility as a wide-range vision and are based on lumber industry specificities. The experimental framework aims to validate the components' correlation and the interaction between environment, performance and actions. The decisional dimension models the agility continuous improvement.

16:52

Comparison between Deterministic and Stochastic Production Planning Approaches in Sawmills via Simulation

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The goal of this paper is to compare the performance of stochastic and deterministic production planning approaches in sawmills on a rolling planning horizon. A series of designed experiments are proposed to identify significant factors influencing the performance of production planning process in sawmills. As it is not possible and not economically reasonable to interrupt the production line in sawmills to test different production planning models, Monte-Carlo simulation is used for implementation of different plans. By reviewing and analyzing the simulation and experimental results, our goal is to propose a decision framework for guiding the decision maker to select among deterministic and stochastic production planning models under different circumstances. Two influencing factors are identified based on the experimental results for a realistic scale case study and a decision framework is proposed based on the analysis of the results. The decision framework differs for each KPI. If the backorder has the priority for decision making, deterministic model has better performance in lower demand levels. On the other hand, for higher demand levels the stochastic model performs better than the deterministic model in terms of backorder cost. If the inventory is defined as the important KPI, the impact of interaction between length of planning horizon and demand level should be considered as the basis of decision making. For short planning horizons, deterministic model has superior performance in higher demand levels than the stochastic one. In contrary, for long planning horizons, the deterministic model can be the appropriate choice for lower demand levels and stochastic model has better performance for higher demand levels.

17:14

A Scenario Decomposition Algorithm for Stochastic Sawmill Production Planning with Set-up Constraints

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We study a real-world multi-period, multi-product production planning problem involving set-up constraints, with random yield and demand. The resulting large-scale multi-stage stochastic mixed-integer model cannot be solved by mixed-integer solvers of commercial optimization packages. The production planning model is a mixed-integer programming (MIP) model without any special structure. As a consequence, developing efficient decomposition and cutting plane algorithms to obtain a good solution in a reasonable amount of time is not straightforward. We propose a solution strategy based on the progressive hedging algorithm (PHA), which iteratively solves the scenarios separately. The proposed approach attempts to gradually steer the solutions of the sub-problems towards an implementable solution by adding some penalty terms in the objective function used when solving each scenario. The solution of this strategy is a local optimum and an upper bound for the optimal objective value of the multi-stage stochastic model. Computational experiments for a real world large-scale sawmill production planning model verify the effectiveness of the proposed solution strategy in finding quickly a good approximate solution.

17:36 Information Technology for Uncertainty Management in Supply Chain

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This manuscript explores the merge of modern database management technology, data modelling, and probability management for decision support for supply chain management. Data visibility and data integration are crucial concepts to a supply chain information system. These concepts together with adequate analysis tools provide decision makers what is necessary to manage the supply chain. This manuscript revisits information technology that has been proposed in the past, but that seems more feasible in the present. In particular, the use of simulations in concert with multidimensional databases, the analysis of the multidimensional cube, and their capabilities in support of uncertainty management in the enterprise with particular interest on supply chain management are explored.

16:30 THEMATIC SESSION: The Future Supply Chain: Beyond Out-of-the-Box Thinking + REGULAR SESSION: Facility Layout

Location: VCH-2880

Chair: Temponi, Cecilia, *Texas State University*

16:30 Online Government Services: The Benefits for Operations of Small and Medium-Sized Businesses in Québec

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Online government services enable businesses to broaden their operations and increase their productivity. The competitive advantage generated by these services is linked to recently developed products, know-how, and ability to meet customer needs. The purpose of this paper is to analyze the role of online government services in the development of small and medium-sized businesses (SMBs) in the context of the strong growth in online services that government bodies and institutions have made available to businesses. Specifically, this paper examines the extent to which the use of online government services affects SMB operations.

16:52

An Overview of DDSN and the Internal/External Customers

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The focus of this research is to develop a framework that organizes the literature in a structure that might facilitate better understanding and analysis of Demand Driven Supply Networks (DDSN) with a focus on the interactions and relationships that internal and external customers have on DDSN. We use archived literature to develop the proposed framework. The proposed DDSN framework is categorized into four broad categories: Concept development, Organization, Buyer/ Supplier Performance management, and Shared elements. Each broad category was conceptualized as a subcomponent with relevant issues. Each subcomponent has multidirectional interconnections. Our findings indicate that customers, both internal and external, have considerable influence in shaping the DDSN in an organization. Their collaboration and sharing of information becomes the drivers for the development of DDSN. Current underlying assumptions and claims in the literature about inter-relationships with the organization's customers ought to be re-evaluated and researched. Future research should emphasize metrics development and empirical studies.

17:14

A Non-linear Threshold Accepting Algorithm for the Facility Layout Problem

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This paper proposes a simple but effective modification of the conventional threshold acceptance algorithm to solve the static and dynamic facility layout problems. The main difference between the proposed and the existing algorithms resides in the mechanism of accepting or rejecting the candidate solution from the neighbourhood. In the proposed variant, the acceptance rule is non-linear. This acceptance rule is inspired from the RC-filter which is a lowpass filter used in electronics to reduce the amplitude of signals with higher frequencies. We conduct a computational study to difficult instances taken from the literature. The results presented show that this algorithm performs very well compared to other methods proposed in the literature.

17:36

A Guideline for Occupational Health and Safety Considerations in Facilities Planning

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Facilities layout planning is fast becoming the compliance for the organizations. In the past two decades, researchers have developed simulation and mathematical programming models to estimate the performance measures of a production system. However, the considerations of occupational health and safety management have been overlooked. The objective of this work is to develop a comprehensive list of safety criteria which facility managers need to consider at the early stages of the plant design in order to improve occupational health and safety. These criteria, which are based on previous research as well as the safety guidelines and standards, provide a tool for anticipating hazardous situations and instructing the improvements to reduce the occupational accidents. Furthermore, a structured safety outline for facilities planning will prevent future potential layout modifications for safety reasons and consequently reduce costs.

**16:30 INDUSTRIAL SESSION: Supply Chain Management Competition
(cont'd)**

Location: PLT-2370

18:00 Commitees meeting

Tuesday, August 28, 2012

09:00 Keynote: Stanley B. Gershwin

Location: VCH-2850

Chair: Nourelfath, Mustapha, *Université Laval*

Qualitative Observations on Production Line Behavior – Intuitive and counter-Intuitive Explanations

Gershwin, Stanley B., Massachusetts Institute of Technology, Gershwin@mit.edu

The objective of this talk is to describe behavior observed in models of production lines and to propose intuitive explanations of that behavior. We explain how inventory is distributed along a line in terms of variability (and other factors). We show how optimal allocations of buffer space are also influenced by variability. We demonstrate examples that suggest that much of the behavior of long lines can be explained in terms of two-machine, one-buffer lines.

10:00 Break

10:30 THEMATIC SESSION: Reconfigurable Manufacturing Systems: Design and Operational Strategies

Location: VCH-2830

Chair: Kenné, Jean-Pierre, *École de technologie supérieure*

10:30 Ecodesign of New Products: A Methodological Comparison

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Along with the increase of environmental concern throughout the second half of the 20th century and the ecological awareness brought by it, the preoccupation with production, development and eventually disposal of products grew, not only among multinationals companies and governments, but also among gradually more informed consumers. This article analyses the interaction between traditional product development process and ecologically concerned product development methodologies evaluating possible opportunities and improvements from the combination of its best practices finally providing an optimized eco-development model.

10:52 Simultaneous Control of Production, Repair/Replacement and Preventive Maintenance of Deteriorating Manufacturing Systems

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This paper presents results of simultaneously control of production and a special case of integration of the preventive maintenance into the repair/replacement policy of a failure-prone system. The machine of the considered system exhibits increasing failure intensity and increasing repair times. The status of the system is deemed to degrade with production and repair activities. The machine manufactures one type of product, and when a breakdown occurs, either a repair or a replacement action is chosen. A replacement action renews the machine, while a repair action brings it to a degraded operational state, with the next repair time increasing as the number of repairs increases as well. To reduce the failure rate and subsequent repair times following a failure, there is an incentive to perform preventive maintenance on the machine before failure. The preventive maintenance action is considered in order to improve the reliability of the machine, thereby reducing the amount of disruptions caused by machine failures. The decision variables of the control problem are the production rate, the preventive maintenance rate and the repair/replacement switching policy upon machine failure. The objective of the study is to find the decision variables that minimize the overall cost, including repair, replacement, preventive maintenance, inventory holding and backlog costs, over an infinite planning horizon. The study considers the fact that machine repair activities depend on the repair history, and a Semi-Markov Decision Process (SMDP) is used to describe the dynamics of the system. The optimality conditions was developed using the stochastic dynamic programming approach, with a numerical example to illustrate the utility of the proposed approach, and a sensitivity analysis to confirm the structure of the control policy obtained.

11:14 Role of Configurator for Mass Customization Program in the Fashion Apparel Industry

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Mass customization offers the opportunity to meet, even surpass, customers' expectations; this being true whether one aims for pure mass customization (one individual-one garment) or merely a highly precise market segmentation. Yet to reach this objective, one needs to acquire and manage a knowledge base of consumers' needs and preferences. In the fashion & clothing industry, mass customization is not generally well understood or implemented due to difficulties related to measurements, pattern adaptation, and inflexible manufacturing processes. The objective of our research is to (1) identify the fundamental variables and data necessary to produce custom-made clothing, (2) to develop a configurator based on such data, and (3) to enable the efficient transmission of configurator generated information to computerized production systems. For producers to make the most of mass customization they need to better understand what can be done in terms of clothing personalization and mass customization. They also must formulate an appropriate strategy as to how they wish to approach mass customization in order to develop a competitive advantage.

11:36 Optimal Unlimited Free-Replacement Warranty Policy Using a Mixture of New and Reconditioned Components

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The total lifecycle of a given product or component is extended through the process of remanufacturing. This second life given to the reconditioned part is attractive for the manufacturer and consumer both from an economical and environmental perspective. These reconditioned products can be used as replacement parts in honouring warranties. This

paper considers the case where a mixture of new and reconditioned components are used to carry out replacements upon failure. A mathematical model is developed to determine the proportion of new and reconditioned components to be used. Numerical optimization is used to compute the optimal warranty and production parameters which maximize the total profit.

10:30 THEMATIC SESSION: Optimization of Production and Assembly Lines Design III

Location: VCH-2840

Chair: Giard, Vincent, *Université Paris-Dauphine*

10:30 A Framework for Comparison of CONWIP with G-MaxWIP and CWIPL Production Control Mechanisms

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Production control mechanisms are used to control WIP in a production line. The way in which performance is measured, and the methodology used to compare the performance of various production mechanisms, will influence the conclusions on the superiority of such mechanisms. We present a unified framework to compare the performance of three mechanisms: Constant Work in Process (CONWIP), Gated MaxWIP (G-MaxWIP), and Critical WIP Loops (CWIPL). We use a simulation model based on the Production Authorization Card (PAC) mechanism to estimate performance. Two measures are used to evaluate system performance: throughput, and average WIP in the line on or after the first machine. The goal is to simultaneously maximize throughput and minimize WIP. We develop optimal policy curves (or trade-off curves) to select highlight optimal policies for each mechanism, and use these curves to compare the performance of these different mechanisms. We show that G-MaxWIP does not always outperform CONWIP, and CWIPL does not outperform either G-MaxWIP or CONWIP.

10:52 An Algorithm to Optimize Packaging Sizes at CooperPharma Maroc

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In this paper, we study the problem of optimizing packaging sizes based on a real-life problem. We develop a (hierarchical) mathematical model that optimizes the packaging sizes by taking into consideration the packaging material cost and the picking cost. The picking cost results from the difference between the customer order size and an integer multiple of the box size. We solve the mathematical model for a range of different parameter settings and derive interesting managerial insights.

11:14 Solving Buffers Sizing Problems on Assembly Lines Using Multiobjective Genetic Algorithms

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This paper is focused on solving multiobjective buffers sizing problems on assembly lines. The multiobjective side is due to the fact that we are trying to optimize two criteria simultaneously: the minimization of the total buffers size and the maximization of the throughput rate of the line. Our contribution in this work is to propose a new multiobjective

metaheuristic based on coupling the Strength Pareto Evolutionary Algorithm (SPEA-II) with a fuzzy logic controller (FLC) to solve the problem. In fact, coupling this metaheuristic with FLC allows a dynamic and an improved setting of the two main genetic algorithms which are the crossover and the mutation probability. To prove the efficiency of this approach, named FLC-archive, we have carried out several experimental results to compare the numerical results with those obtained with another efficient approach that we have already developed. The latter is based on applying the Lorenz dominance relationship with an SPEA-II algorithm instead of the Pareto dominance relationship. The algorithm was named L-archive. Both FLC-archive and L-archive are compared to the classical SPEA-II algorithm.

11:36 **A Simulation-based Optimization Approach for an Integrated Production and Quality Control Model**

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This article presents an integrated production and quality control model for an unreliable and imperfect batch manufacturing system. The production is controlled by a hedging point policy, while, the quality control is performed by a lot-by-lot double acceptance sampling plan by attributes. The decision variables of this model are the production lot sizing and the hedging level. The purpose of this work is to develop and validate a simulation model to fairly represent the dynamic and stochastic aspects of the system under study. Then, a simulation optimization approach based on the response surface methodology is used to optimize the decision variables when the failure and repair times and the percentage of nonconforming items produced follow general probability distributions.

10:30 **THEMATIC SESSION: Project Planning and Control**

Location: VCH-2860

Chair: Elmaghraby, Salah, *North Carolina State University*

10:30 **A Comparison of Mixed-integer Programming and Constraint Programming and Constraint Programming Models for Scheduling Problem in Operating Theatres**

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The daily scheduling of an operating theatre is a highly constrained problem. Consequently, it is difficult to find the best solution, or even high quality solutions, in a reasonable time. We have compared two models that take into account many of the constraints on human and material resources encountered in real life. The performance of these two models, using mixed-integer and constraint programming respectively, were compared on a real-life case to determine which coped better with these constraints.

10:52 **Framework for E-Appointment Systems Design**

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The current situation in the service industries, public or private, demands efficiency and customer satisfaction in service delivery. These two demands intersect in scheduling of appointments. Despite the availability of computers and Internet access, wired or wireless, deployment of online services for scheduling appointments is found to be rare in the province of Quebec. Consumers and service organizations face many challenges in using Internet for scheduling appointments. These challenges are partially dealt with by software providers who offer commercial e-appointment solutions. This paper aims to investigate the design requirements of such solutions, based on a literature review. We present a review of the main characteristics of available commercial e-appointment solutions and propose a framework of the factors affecting the adoption of these systems in the service industry.

11:14 Sequencing Activities in a Project Network using Resource Complementarity Model

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The methodology of project management has been widespread in organizations of different functions and sizes. In this context, we address the issue of optimal resource allocation, and more specifically, the analysis of complementarity of resources (primary resource and supportive resource) in a project. We develop a conceptual system capable of determining the ideal timing, and the ideal mixture of resources allocated to the activities of a project, such that the project is completed on time, if not earlier, with minimal cost. In this paper we present new computational results of a Genetic Algorithm, based in a random keys alphabet to optimize the process to reach better results.

11:36 The Relevance of the "Alphorn of Uncertainty" to the Financial Management of Projects under Uncertainty

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We introduce the concept of the "alphorn of uncertainty" as a tool for project management when the durations and costs of the activities are random variables. We illustrate its applicability by two simple examples using mainly the Monte Carlo sampling approach. The examples demonstrate that the contractual agreement on payments to the project can seriously impact the profitability, or otherwise, of the project, which emphasizes the need for careful study of the bidding process on the project.

10:30 INDUSTRIAL SESSION: Tutorial: Lean Manufacturing and Services

Location: VCH-2870
Chair:

10:30 Lean Production and Lean Management

Forget, Pascal, Université du Québec à Trois-Rivières (UQTR)

In the last decades, more and more organizations looked at the concepts and techniques issued from the Lean Production approach. More recently, this approach has been applied to management activities and public sectors. The objective of this seminar is to offer to participants a synthesis of the underlining principles of Lean philosophy (also referred to as the Toyota Production System) and a brief look into the deployment of a typical Lean project.

With examples from production and management activities, participants will be able to judge the opportunity of Lean to increase efficiency in various organizations.

10:30 **REGULAR SESSION: Inventory and Routing**

Location: VCH-2880

Chair: de Kok, Ton, *Technische Universiteit Eindhoven*

10:30 **A GRASP with Variable Neighborhood Descent for the Pickup and Delivery Problem with Time Windows**

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Transportation is a dominating function in the logistic networks. Real link in the supply chain, the carrier has become a key player in the logistics whose performance strongly influences the performance of suppliers and customers. The pickup and delivery problem with time window (PDPTW) is a special class of transportation problems. The objective of the PDPTW is to satisfy at minimum cost a set of transport requests while respecting a set of constraints. This paper introduces a new Greedy Adaptive Search Procedure (GRASP) which embeds VND (Variable Neighborhood descent) for solving the PDPTW. Our approach is validated by using a set of benchmark instances from the literature.

10:52 **Distribution and Inventory Planning with Uncertain Demand**

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Distribution and inventory planning is an important planning exercise for many companies. In a general distribution network there may be several transportation modes and nodes representing mills, terminals and customers. Even though there are confirmed customer orders there are often uncertainties on the overall demand of products. The traditional approach to deal with uncertainty is to work with safety stock levels at terminals and/or distribution centers. In this paper, we introduce the use of robust optimization to handle the uncertainty of customer orders and to establish distribution and inventory plans. In the proposed approach, we can use historical information and practical considerations on the uncertainty. A case study from a large pulp producer is used to test the proposed approach against a traditional approach with safety stock. The analysis is based on simulations and it shows that the robust approach is more cost efficient.

11:14 **Flexibility and Consistency Issues in Static and Dynamic Inventory-Routing**

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Inventory-routing problems (IRPs) arise in vendor-managed inventory systems. They require jointly solving a vehicle routing problem and an inventory management problem. We introduce the concept of transshipments as a way to promote flexibility within the IRP.

Consistency leads to higher quality of service by regulating the frequency of the deliveries and the quantities delivered. Both concepts are later integrated within a dynamic environment, in which one can take better advantage of them. We propose matheuristics to solve several classes of IRPs with flexibility and consistency features.

11:36 New Extensions of the Unidirectional Flow Path Design Problem

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The flow path design is the determination of each segment direction and the paths to be used for automated vehicles in production units. It is necessary to ensure that all pick up and delivery points can be reached from any other points. The organization of these roads directly influences the performance of a system, as the transport time and the number of necessary vehicles. That is why this problem is one of the most important issues in AGV (automated guided vehicles) systems design. This work deals with flow path design problem for a conventional unidirectional network. Some new extensions of the total travel distance minimization considering both loaded and empty travels is presented. This study is made in collaboration with ANDRA (National Agency for Radioactive Waste Management).

12:00 Lunch

13:30 Industrial Keynote: Dennis Pegden

Location: VCH-2850
Chair: Gaudreault, Jonathan, *Université Laval*

The Expanding Role of Simulation in an Uncertain World

Pegden, Dennis, Simio LLC,

Simulation modeling has become a critical technology for the 21st century. It is widely used by enterprises throughout the world to improve the design and operation of their systems. Simulation technology is in a state of rapid change. New advances in computing platforms, software design, and methodology are combining to make the simulation more powerful, easier to use, and useful for an expanding range of applications. This presentation will focus on the changes in simulation technology and discuss the impact of these changes on the role and importance of simulation modeling in the design and operation of complex systems. The presentation will provide a historical perspective on the important changes that have occurred over time, as well as a look forward into the future of simulation. The presentation will discuss both the traditional application of simulation to evaluate and compare system designs, as well as the new and expanding role in operational planning and scheduling.

14:30 THEMATIC SESSION: Sustainable Logistics and Supply Chains III

Location: VCH-2830
Chair: Yoshizaki, Hugo, *University of Sao Paulo*

14:30 A Bi-objective Two-stage Stochastic Programming Model for Inventory Routing Problem under Uncertainty with a Transshipment Option

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In this study we develop a bi-objective two-stage stochastic programming method to deal with Inventory Routing Problem (IRP) where a capacitated fleet distributes products from multiple suppliers to an assembly plant to meet the uncertain demand of each product over a two-period planning horizon. The shortage is not allowed. Nevertheless, due to the uncertain nature of the demand, the inevitable shortages are penalized in the objective function. In this many-to-one distribution network, a typical vehicle trip starts from a rental vehicle company and continues by visiting several suppliers to pick up or transship the products and it ends by delivering the pickups to the assembly plant and coming back to the rental company. The proposed model considers transshipment as a possible solution to enhance the performance of the supply chain and shows the impact of such solution on the uncertain environment. The first objective of the proposed model is aim to minimize expected value of the supply chain costs. And the second objective function attempts to minimize total quantity of the greenhouse gas (GHG) emission produced by the vehicles and scraped products. Finally by using a scenario-based approach a numerical example is solved to demonstrate the applicability of the proposed model.

14:52 **Coordination of Manufacturing, Remanufacturing and Returns Acceptance in a Hybrid Production-Inventory System**

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This paper studies the coordination of manufacturing, remanufacturing and returns acceptance in a hybrid system. We use a queueing control framework, where manufacturing and remanufacturing are modeled by single servers with exponentially distributed processing times. Customer demands and returned products arrive in the system according to independent Poisson processes. A returned product can be either rejected or accepted. When accepted, a return is placed in a remanufacturable inventory. New products and remanufactured products are placed in a serviceable inventory and customer demands can be satisfied by new products or remanufactured ones. For a cost structure including holding, backorder, manufacturing, admission and rejecting costs, we show that the optimal policy is characterized by two state-dependent base-stock thresholds and one state-dependent acceptance threshold. We also obtain monotonicity results for these switching curves. Then we adapt several heuristic policies from the literature to our model. Finally we carry out a numerical study to compare their performances to the ones of the optimal policy.

15:14 **Stochastic Inventory Control with Remanufacturing Under the Current Carbon Trading Schemes and Environmental Policies**

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The current environmental regulations and economic conditions have prompt the implementation of green supply chains and sustainable logistics systems. For many facilities, a limit on greenhouse gases (GHG) emissions is considered and they have mandatory targets in term of products recovery and reuse at the end-of-life. Thus, the developments of new managerial models which integrate environmental policies are necessary. Furthermore, inventories have proved their crucial role in supply chain. Hence, the purpose of this paper is

to develop a product recovery inventory model with the inclusion of emissions trading. The objective is to study the relationship between environmental policies and inventory control. The results provide insights on how to include an emissions trading scheme into an inventory model. Moreover, we prove the direct link between sustainability objective and inventory control policies through a stochastic inventory model.

15:36 A Survey on Return Policies Practices and their Variations

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This work studies the retailers' product return policies, taking into account the intrinsic characteristics of products and the industry in which the retailer operates. The paper presents a study of the variations in return policy terms and conditions. The present work highlights the interactions between the return policies and the various components that affect it. The study is performed on a wide range of return policies, in several industries, different countries and for different return causes. Identifying the causes of variations in return policies is useful for retailers as it helps them adopting a more suitable return policy. And thus maximizes their profit. This is possible by taking into account the customers' welfare and opportunistic behavior (borrowing).

14:30 THEMATIC SESSION: Optimization of Production and Assembly Lines Design IV

Location: VCH-2840
Chair: Thomas, André, *Université Henry Poincaré*

14:30 A Comparative Study of Simulation Models for the Production Control of Unreliable Manufacturing Systems

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This paper deals with the production control policy of an unreliable manufacturing system producing one part type, and subject to random failures and repairs. The applied production control policy is based on the so-called hedging point policy (HPP), which consists in building and maintaining a safety stock of product in order to fulfill the demand, and protect the production system against shortages during maintenance actions. The main objective of the study is to determine the most efficient option of the ARENA simulation software that simulates properly the production systems under consideration. To this end, four simulation models mimicking the dynamics and the stochastic behavior of the proposed manufacturing system were developed. Concepts of discrete and continuous simulation and modules from the ARENA flow process template, are applied to develop the models. The hedging point policy is used as input parameter of the simulation models, where we seek to determine the optimal production threshold that minimizes the inventory and backlog cost. Based on simulation results, the performance of the models is evaluated, in terms of accuracy and time economy. The obtained results shows that the continuous simulation model that uses C++ inserts outperforms the other models.

14:52 Improving Sawmill Agility through Log Classification

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Sawmill production is characterized by divergent processes and coproduction. In this context, it is difficult for a production manager to establish a production plan which meets customer demand. This is one of the reasons why the North American lumber industry produces with a mainly make-to-stock strategy. The aim of this research is to evaluate the impact that a better classification of the raw material (logs) would have on sawmill agility. Using a mathematical model to create production plans, we evaluate the performance of the mill to meet the demand in light of the knowledge it has of the raw material.

15:14

Combining Stochastic Modeling and Linear Programming to Improve Aggregate Production Planning

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Mathematical models for Aggregate Production Planning (APP) typically omit the dynamics of the underlying production system due to variable workload levels since they assume fixed capacity buffers and predetermined lead times. Pertinent approaches to overcome these drawbacks are either restrictive in their modeling capabilities or prohibitive in their computational effort. In this paper, we introduce an Aggregate Stochastic Queuing (ASQ) model to anticipate capacity buffers and lead time coefficients for the APP model. The ASQ model allows for flexible modeling of the underlying production system and the corresponding optimization algorithm is computationally very well tractable. The APP and the ASQ model are integrated into a hierarchical framework and are solved iteratively. A numerical example is used to highlight the benefits of this novel approach.

15:36

Stochastic Scheduling with Abandonments

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In this paper, we address the problem of dynamically scheduling jobs with abandonments. Processing times and release dates are arbitrarily distributed while patience times are exponentially distributed. The objective is to minimize holding costs and abandonment costs, either in the class of static list scheduling policies or in the class of dynamic policies with preemption. We first show an equivalence between holding costs and abandonment costs. When processing times are exponentially distributed and all jobs are available at time 0, we provide conditions under which a strict priority rule is optimal in the class of static list scheduling policies. Then we extend this result to the class of dynamic scheduling policy with preemption and arbitrary stochastic release dates.

14:30

THEMATIC SESSION: Hospital Supply Chain I

Location: VCH-2860

Chair: Di Martinelly, Christine, *Universidad Andres Bello*

14:30

Impact Assessment of the Integration of Nurses Timetable on the OR Planning and Scheduling

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The objective of the paper is to better understand the link between the management of OR and nurses and to investigate the trade-off between open OR, nurses and overtime work. The approach was to model the OR scheduling while considering availabilities of surgeons and anesthesiologists and to integrate in the model elements to model or not nurses scheduling. Different scenarios were tested in order to test how our suggestion performs in comparison with some traditional approaches: OR scheduling with no constraint on nurses, teams of 2 nurses allotted to an OR, or minimization of the number of nurses. Our idea is to introduce some flexibility by asking nurses to work in teams starting at different time.

14:52

The Optimal Allocation of Server Time Slots over Different Classes of Patients

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We present a model for assigning server time slots to different classes of patients. The objective is to minimize the total expected weighted waiting time of a patient (where different patient classes may be assigned different weights). A bulk service queueing model is used to obtain the expected waiting time of a patient of a particular class, given a feasible allocation of service time slots. Using the output of the bulk service queueing models as the input of an optimization procedure, the optimal allocation scheme may be identified. For problems with a large number of patient classes and/or a large number of feasible allocation schemes, a step-wise heuristic is developed. A common example of such a system is the allocation of operating room time slots over different medical disciplines in a hospital.

15:14

Evaluation of Appointment Scheduling Rules: A Multi-performance Measures Approach

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Appointment scheduling rules are used to determine during which service session and at what time a customer is to receive service. Many different appointment scheduling rules have been devised and are being used in practice (e.g. in healthcare, legal services, administration and many other service and manufacturing industries). Which appointment scheduling rule is best however, is still an open question. In order to answer this question, we develop an analytical model to assess the performance (w.r.t. customer waiting time, server idle time and server overtime) of appointment scheduling rules in a wide variety of settings. More specifically, the model takes into account: (1) customer unpunctuality; (2) no-shows; (3) service interruptions; (4) delay of the service process. In addition, no restriction are imposed on the distributions used to capture the basic processes (i.e. the model is not limited to the use of exponential distributions). The model builds on matrix analytical methods and adopts an efficient algorithm (in terms of computational and memory requirements) to assess the performance of 314 appointment scheduling rules. Data envelopment analysis is used to compare the results of these appointment scheduling rules.

15:36 A Case Study on the Use of Operations Reserach to Evaluate Changes in a Blood Supply Chain

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Canadian Blood Services is a not-for-profit, charitable organization whose mission is to manage the supply of blood and blood products in Canada. For the past several years, the organization has been implementing a strategy to standardize processes and workflows through the amalgamation of production and testing centres. In this case study we describe how simulation and other operational research techniques were successfully used to evaluate the impact on customer service associated with the centralization of production centres in Atlantic Canada. The case study describes the problem, outlines the study methods, and provides a brief summary of results.

14:30 REGULAR SESSION: Inventory Theory and Management

Location: VCH-2880

Chair: Botta-Genoulaz, Valérie, *INSA-Lyon*

14:30 Inventory Management of Spare Parts in an Energy Company

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We address a problem of inventory management of spare parts in the context of a large energy company, producer of oil and gas. Spare parts are critical for assuring operational conditions in offshore platforms. About 200,000 different items are held in several inventory plants. The inventory system implemented at the company corresponds to a min-max system. The control parameters are decided based mainly on the expert judgment of the planners. Also, though the inventory plants can in practice be supplied from each other, the inventory planning is performed separately by the plant planners. This is because of different ownership structures where the studied company has the operative responsibility. The company is pursuing a system in which all planners conform to the same inventory management approach and evaluation, as well as being more cost efficient. Our work focuses on supporting this goal. We apply methods to decide the inventory control parameters for this system under a service level constraint. The methodology we use distinguishes unit-size and lot-size demand cases. We perform computational experiments to find control parameters for a sample of items. After the control parameters are found, we use them to explore the impact of risk pooling among the plants and inaccuracy arising from duplicate item codes.

14:52 Impact of Fuel Price on Economic Order Quantity (EOQ)

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This paper provides an overview of the impact of oil price on Economic Order Quantity (EOQ) in supply chains. It presents trends in the global energy mix, and discusses alternate sources of energy, fuel options in meeting future energy demands, a brief discussion on the limitations of some of the alternate energy sources and dependence on fossil fuels in cargo

transportation. It talks about the trend of oil prices based on data since 1990, oil production/consumption and estimated oil prices in the future. It further examines the impact of changes in oil prices on EOQ and develops a model for calculating EOQ that includes these changes. The model is used to present three cases that show the impact of increases in oil price on EOQ and concludes with a discussion of its effect on organizations in managing the global supply chains in the future.

15:14 Approximation Algorithms for Deterministic Continuous-review Inventory Lot-sizing Problems with Time-varying Parameters

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This work deals with the continuous-review lot-sizing inventory problem with time-varying parameters. We adapt a cost balancing technique developed for the periodic-review version of our problem to the continuous-review framework. We prove that the solution obtained costs at most twice the cost of an optimal solution. Then we study the numerical complexity of the algorithm and generalize the policy to several important extensions while preserving its performance guarantee of two. Finally, we propose a modified version of our algorithm for the basic model with slightly restricted settings that improves the worst-case bound.

15:36 Inventory Inaccuracies in the Internet Retailing: A Comparison Study between the Additive and the Multiplicative Error Settings

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The standard literature on inventory modeling is rarely differentiating between the inventory records and the physical inventory. In the recent years, some empirical studies – mainly developed around the deployment of a new identification technology such as RFID - highlighted that errors and inventory perturbations may occur in the inventory system. Such errors result in a gap between what the information system shows and what is actually available for sales and used to satisfy the demand. The impact of such errors is particularly important in a wholesaling / e-retailing context where customer' demands are remotely satisfied based on the inventory record shown in the information system. These errors could be presented by an additive or multiplicative structure. In this paper we provide an analytical study about the multiplicative error setting in the internet retailing and we compare its performance with the additive error setting.

14:30 INDUSTRIAL SESSION: Tutorial - Simulation with SIMIO

Location: PLT-2370
Chair:

Simulation with SIMIO - An Introduction

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This hands-on tutorial offers participants the opportunity to learn and explore the latest in 3D simulation environments, Simio, by building a few simple models. During this course, attendees will learn how to create a model of a system, enter real world processing times,

customize its animation, and analyze results. The activity will take place in a computer lab, allowing participants to work with the most recent version of the software.

16:00 Break

16:30 THEMATIC SESSION: Sustainable Logistics and Supply Chains IV

Location: VCH-2830

Chair: Campagne, Jean-Pierre, *INSA*

16:30 A Conceptual Framework for Location, Sizing and Operation of Urban Distribution Centers with Sustainable Performance Metrics

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Most European cities describe a series of common characteristics that influence mobility and commercial activities and impose a series of restrictions in flows of freight deliveries in urban areas. In order to reduce both traffic congestion and pollution levels, several initiatives have been implemented around the world. One of them concerns the use of urban distribution centers near to the city center in order to consolidate freight. This paper considers the problem of locating distribution centers in urban areas and proposes a methodology based on mixed integer linear programming to find their optimal location. The models are validated using real-life data from the city of Saint-Etienne, France. Proposed models may virtually be applied to any city subject to proper data collection and pre-treatment.

16:52 Sustainable Supply Chains and Responsiveness: Trade-offs in Supply Chain Planning

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The most of greenhouse gases (GHG) emissions are attributed to supply chain activities. Thus, a comprehensive supply chain planning models are essential to maintain the supply chain performance (cost-effectiveness) under environmental policies. These models should capture the trade-offs arising through the interaction between different supply chain processes such as material acquisition, manufacturing, transport, distribution, and recycling. Therefore, we propose a model for strategic supply chain planning that takes into account carbon trading and includes decision on supply chain responsiveness under different environmental regulations: Caps on supply chain carbon footprints and recovery rate of products at the end-of-life.

17:14 Assessment of Trucks Emissions and Impact of Eco-driving in Delivery Tours

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Eco driving is often cited as a good practice to reduce fuel consumption by 10% to 20% and thus contributes to reduce CO2 emissions. As among other sectors, freight transportation by truck is one of the major contributors to CO2 emissions with 14% of the grand total in France. However, assessing its potential in actual operations is not easy and to our best knowledge has never been done before. In this research, done in collaboration with a logistics services

provider operating its own fleet, we defined a measurement protocol and tested several incentives to motivate truck drivers in order to reduce fuel consumption. By reporting the eco driving strategy implemented in 3 different operational areas, this research has enabled us to understand the benefits of the actions to reach emissions reduction up to 4,2%. To complement other researches that aim to bring a theoretical analysis of the relationship between the consumption and its impacting factors, this research is anchored in practice. This has enabled us to understand the need to evaluate the driving behaviour depending on the characteristics of the tour and the area. And help us to conceive a sustainable system of incentives for drivers.

17:36

A Decision-Support Tool for Evaluating the Technical and Economic Potential of Integrating Bioenergy Production within Pulp and Paper Mills

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To overcome declining markets and low-cost competition, Canadian pulp and paper (P&P) mills are considering the diversification of their product platform. Investing in bioenergy is emerging as a promising way to boost the sector. In this paper, we present a mathematical approach to evaluate the profitability of bioenergy investments, in the case of a P&P mill, while assessing technical and economical associated risks. The mill, so called integrated forest biorefinery (IFBR), could produce a set of high value bioproducts from biomass generated in the mill or supplied from outside. The P&P activity generates residues, such as black liquor and paper sludge, which could be used to produce bioenergy. The P&P activity should, then, be well managed, assuming the possibility to not produce pulp and paper for one or several periods. The objective is to develop a real decision-support tool for investors and stakeholders, within the forest sector, aiming to optimise the value creation network of the IFBR and to maximise the profitability of future investments in bioenergy, while optimising the existing P&P activity.

16:30

REGULAR SESSION: Maintenance

Location: VCH-2840

Chair: Riane, Fouad, *Louvain School of Management*

16:30

A Profit Assessment Model for Equipment Sold under Warranty and Subject to Random Generation of Environmental Damage

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One of the major interests of the green supply chain management is the concept of green productivity, which is focused on environment, quality, and profitability. To face these challenges, manufacturers and consumers need to establish efficient maintenance policies for their products in order to meet environmental legislations requirements. This paper develops a model to determine the profit generated by a service contract for a certain type of equipment sold with a warranty and which can randomly shift to a polluting state releasing hazardous substances or over consuming energy causing direct or indirect damage to the environment. Such undesirable state can only be known through inspection. The customer and the manufacturer agree that during the warranty period, the manufacturer inspects the equipment according to a specified schedule and supports the costs incurred for equipment

inspections and replacement if pollution is detected. After the expiration of the warranty, inspections and replacements are performed by the manufacturer and billed to the customer. Moreover, penalties related to pollution are always supported by the manufacturer. An analytical model taking into account the commitments of both parties is developed. An algorithm is also presented to generate the inspection instants given the costs structure and the probability distribution associated with the time to shift to the polluting state. With the advent of increasing environmental concerns and business models arguing for technological implication of suppliers towards their customers, the proposed decision model may be relevant and very useful.

17:00

Joint Redundancy and Imperfect Preventive Maintenance Optimization

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This paper presents two algorithms based on Harmony Search algorithm (HS) and Genetic algorithm (GA) to solve a joint redundancy and imperfect preventive maintenance planning optimization problem for series-parallel multi-state degraded systems. Non identical multi-state components can be used in parallel to improve the system availability by providing redundancy in subsystems. Multiple component choices are available on the market for each subsystem. The status of each component is considered to degrade with use. The objective is to determine jointly the minimal-cost series-parallel system structure and the appropriate preventive maintenance actions, subject to a availability constraint. System availability is defined as the ability to satisfy consumer demand that is represented as a piecewise cumulative load curve. A procedure is used, based on Markov processes and universal moment generating function, to evaluate the multi-state system availability and the cost function. The two algorithms are compared through two numerical examples.

17:30

An Integrated Model for Production, Maintenance and Quality

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In this paper, three main aspects are integrated in the same model: production, maintenance, and quality. We are given a set of products that must be produced in lots on a production system during a specified finite planning horizon. The objective is to determine an integrated lot-sizing and preventive maintenance strategy of the system that will minimize the sum of preventive maintenance costs, inspection costs, production costs, setup costs, inventory holding costs, backorder costs, and the costs of producing nonconforming items, while satisfying the demand for all products over the entire horizon. We model the production system as a multi-state system with multi-state and s-independent components. Each component represents a machine for which the status is considered to degrade with use, and these degradations may lead to the production of nonconforming products. In addition, a machine can fail randomly from any operational state and can be repaired. This repair action brings the machine to its previous operational state without affecting its failure rate (i.e. minimal repair). The used preventive maintenance policy suggests also that planned preventive maintenance can be performed on each machine. During each period, machines are inspected, and imperfect preventive maintenance activities are performed to reduce the ages of the machines, proportional to the preventive maintenance level. A machine is stopped either when the inspection reveals that it is producing nonconforming products, or at the end of the current period. Once stopped, a machine is restored to the as good as new conditions to be ready for the next production period. An evaluation method is proposed to calculate the production rates of conforming and nonconforming items. We finally discuss the

assumptions under which the model can reformulated to be solved by comparing the results of several multi-period multi-product capacitated lotsizing problems.

16:30 THEMATIC SESSION: Hospital Supply Chain II

Location: VCH-2860

Chair: Creemers, Stefan, *IESEG School of Management*

16:30 A SARIMA Modeling Tool Applied for Forecasting Platelet Bags

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This paper describes a systematic approach for automatic identification of parametric models of time-series with forecasting purposes. A general Seasonal Autoregressive Integrated Moving Average (SARIMA) model based on Box & Jenkins procedure is considered in this study. This automatic approach helps the user to identify the degree of non-stationary and seasonal differences in order to fit a complex original series into a stationary series and, as well as to identify orders and parameters of this general SARIMA model. In this study, mathematical models identified from this automatic approach are used to forecast quantities of platelets bags that are need to be distributed from a blood center to the blood bank of hospitals. An example illustrates such an application.

17:00 A Solution Algorithm to Surgery Scheduling and Surgeons Assignment in a Public Hospital

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The purpose of this study was to solve the weekly surgery scheduling and the surgeon assignment problem in a public hospital that treats indigent patients. The study was divided into two parts: first, surgeries were scheduled with support from a multi-knapsack mathematical model; then, surgeons were assigned, using a search method based on chronological backtracking heuristic. The computer implementation used ILOG libraries in C++ language, obtaining surgery scheduling in minimal time. When we compare the results our algorithm to the current manual procedure, our algorithm has 17.53% more surgeries in some cases. Additionally, the new tool resulted in a homogeneous assignment of surgery among surgeons with the same specialty.

17:30 Patient Scheduling for Multiple Services of Cancer Supportive Care

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Year by year, the number of cancer patient evolves worldwide. Trends are confirmed in terms of decreasing cancer mortality and increasing gains in life expectancy after cancer. Therefore we are confronted now with the new challenge of the construction of coordinated, customized care process to each patient during and after cancer treatment. The main

objective of this research work is to identify better admission criteria that drive optimized efficiency in cancer supportive care services and bring more convenience to the patients. A new decision support tool has been proposed through linear and nonlinear programming to optimize patient recruitment and services coordination for cancer supportive care with minimal impact on the existing organization. Furthermore, an event-driven mechanism is developed to drive the mathematical models, in order to improve the agility of this tool. Numerical examples show that the application of our mathematical model results in significant improvement in admitted list, compared with current scheduling process, especially for a complex case.

16:30 **REGULAR SESSION: Shipment**

Location: VCH-2880

Chair: Dejax, Pierre, *École des Mines de Nantes*

16:30 **Automatic Cargo Load Planning: Special Shipments**

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The aircraft loading problem is a real-world combinatorial optimisation problem highly constrained. Indeed, loading the aircraft so the gross weight is less than the maximum allowable is not enough. This weight must be distributed to keep the centre of gravity within specified limits. Moreover, an aircraft has usually several cargo compartments with specific contours and structural limitations such as floor loading, combined load limits and cumulative load limitations. Finally, some shipments are particularly restrictive to transport, like dangerous goods, live animals and perishable goods. This paper is concerned with the incorporation of these latter constraints in a mixed integer linear program for the problem of loading a set of Unit Loading Devices and bulk into an aircraft. Experimental results show that our method achieves optimal solutions within only few seconds.

17:00 **Three Dimensional Bin Packing Problem Applied to Air Cargo**

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Deciding whether a set of three dimensional boxes can be packed into a container is a NP-hard problem. Mathematical models have been developed, however, only few studies take into account constraints encountered in real-world applications such as the stability or the fragility of the cargo. Moreover, despite the importance of this issue in air transport, the literature is almost silent on constraints related to the distribution of the weight inside a container. This paper is concerned with the formulation of the three dimensional palletization which includes the main constraints met in the air cargo industry.

17:30 **Container Safety Storage on a Port Terminal**

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A container terminal is a complex and dynamic system. Many operations occur within the storage area: containers import, containers export and containers shifting. All these operations require the respect of many rules and even laws in order to guarantee the port safety and to prevent risks, especially for the hazardous material storage. This paper proposes an hybrid architecture, using a Multi-Agent System and a Cellular Automaton, to handle the hazardous container storage problem. It is an optimization problem since the aim is to improve the container terminal configuration, that is, the way hazardous containers are dispatched through the terminal. Simple optimization heuristic methods were tested on a terminal with four hazardous container types. We consider then containers as agents, in order to use a Multi-Agent System for the decision aid software, and a Cellular Automaton for modelling the terminal itself. This approach will improve the naive methods first implemented, and should apply to the actual data and constraints of container terminal management.

20:00

Gala dinner - Château Frontenac

Wednesday, August 29, 2012

09:00 Keynote Ton de Kok

Location: VCH-2850

Chair: Riane, Fouad, *Louvain School of Management*

Supply Chain Planning Concepts in a Stochastic World

de Kok, Ton, Eindhoven University of Technology, A.G.d.Kok@tue.nl

With the implementation of ERP systems a wealth of information is available about the actual performance of business and transformation processes. It is easy to obtain empirical distributions of e.g. forecast errors, processing times, setup times, as well as to identify trends in demand and learning curves in times to perform operational activities. With this information we can develop models that support supply chain design and operational planning of supply chains. With the same information we can validate the models developed, too. Applying the validated models for design and planning requires a careful assessment of the possible differences between the (likely) future behaviour of business and transformation processes and the behaviour of these processes observed in the past. In most cases process intelligence must be incorporated in the model instances to be applied. The objective of this presentation is two-fold. Firstly, we present a high-level methodology for the design of decision support of supply chain design and operational planning of supply chains. Secondly, we present some results of projects where this methodology has been applied. In particular we share experiences with validating models. We end our presentation with a reflection on our experiences with implementation of the concepts developed according to the proposed methodology.

10:00 Break

10:30 THEMATIC SESSION: Human and Planning

Location: VCH-2830

Chair: Tchernev, Nikolay, *Université d'Auvergne*

10:30 Time-window Optimization of the Home Health Care Services Districting Problem

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Home Health Care (HHC) which represents an alternative to the traditional hospitalization aims at maintaining or improving the clinical, psychological and social welfare of patients while containing operations costs. In this work, we are interested in the districting problem within the context of HHC service providers. This problem consists in grouping basic units into larger clusters, i.e. "districts", so that these districts are "good" according to relevant criteria. The aim of the model developed in the paper is to guarantee the compactness of the districts as well as the continuity of care while balancing at best the workload of the different districts through the districting horizon in order to reach the objectives of quality and costs.

10:52 A Time-perspective on the Scheduler's Job

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Time is the most critical resource at the disposal of schedulers. Hence, an adequate management of time from the schedulers may impact positively on the scheduler's productivity and responsiveness to uncertain scheduling environments. This paper presents a field study of how schedulers make use of their time and makes explicit what time-management decisions and behaviors are available to a scheduler. Based on observations of the field study, we propose a framework to classify and specify key characteristics of common tasks to the scheduling job in terms of their impact on the workflow and workload of a scheduler. We then discuss how such a framework may be used to assess alternative time-management decisions of a scheduler.

11:14 Finish what you Start: Determinants of Self-interruption

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In white collar work such as the work in planning and scheduling functions, the execution of tasks is fragmented, where tasks are often abandoned without completion to be resumed later. Often such resume is due to self-interruption of tasks. Using a field study we find evidence that the probability of self-interruption is significantly related to the number of outstanding tasks that have been started but not completed. Implications of this empirical finding to the operations management field are discussed.

11:36 Modelling Human Impact on Performance

de Kok, Ton, Eindhoven University of Technology, A.G.d.Kok@tue.nl

In this paper we discuss an inventory control problem where manufacturing lead times can be shortened in case short-term stockouts are foreseen. This problem occurs in many practical situations where multiple items are produced in a production department using common capacity and customer lead time for the items is positive. In that case the common capacity provides the flexibility of scheduling in production orders of items for which a stockout occurs within the customer lead time, while scheduling out production orders for items that have sufficient stock available to satisfy short-term demand. The exact reschedule-in and -out mechanisms are based on mental models of human planners and modelled as a black box. Using this blackbox model, we derive expressions for the probability of a stockout and the fill rate in case such replanning is allowed. We validate the heuristic analysis of the model by comparing model results with results from a case study. We discuss the importance of measuring the frequency of replanning for the application of the model.

10:30 THEMATIC SESSION: Strategic and Operational Carrier Selection in Transportation Auctions

Location: VCH-2840

Chair: Nourelfath, Mustapha, *Université Laval*

10:30 Strategic Logistics Service Provider Selection Influenced by Relationships, Cost and Market Dynamics - A Multi-Factorial Case Study

Tambo, Torben, Aarhus University, torbento@hih.au.dk

Selection of logistics service providers (LSPs) is regarded critical and complex. Relationships tend to last for many years and have a critical role in the architecting of supply chains. Occasionally, relationships between buyer and LSP come to a crossroad of termination, extension or change; attrition of relationships can be caused by poor quality, changed market conditions, changed management, changed operational conditions on either side, and moves from competitors. This study uses a case-based methodology to provide an in-depth account of business motivations in relationship development in LSP selection. The study presents a tendering process as a fulcrum of „non-conformant“ behaviour and unexpected outcome. Major findings are that contract-bound services and cost structures seem to drift into less transparent and informal patterns of interactions over time; this is wearing on the business relationship. Extreme fluctuations in the market – not sufficiently rapidly recognised by the LSPs – also put wear on relationship. In the case where relationships are too stressed, everything comes into play; newcomers might have good chances even if both parties should expect history to repeat itself. This paper could contribute to deepened understanding of both sides in either utilising the unexpected or to struggle harder for conflict resolution in relationships. Further implications are the presented processes as a background for volatility in global supply chains and radical changes in logistics services.

10:52 A Heuristic Approach for Bid Construction in Combinatorial Auctions for the Procurement of TL Transportation Services

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This paper proposes a heuristic approach for constructing combinatorial bids in transportation procurement auctions. We consider a context where a single shipper submits a number of transportation contracts to a set of participating carriers. Each carrier will analyse these new contracts and try to insert them in its existing transportation network in order to increase its profits. We propose to formulate this bid construction problem (BCP) with a particular graph using super nodes in which only profitable nodes need to be visited. The output of the heuristic is a combinatorial bid, i.e., a package of new contracts and an associated interval of ask prices that the carrier would gain by submitting. Preliminary computing results are promising.

11:14 A 2-stage Robust Formulation for the Winner Determination Problem in Combinatorial Transportation Auctions under Uncertain Demands

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Combinatorial auctions are widely used for the procurement of transportation services. In such auctions, shippers act as auctioneers who need to outsource a number of transportation services on given lanes (i.e., origin-destination pairs) to some external carriers. Carriers, the bidders of the auction, compete by submitting bids on packages of

shippers' requests. After receiving all carriers' bids, the shipper solves the well-known winner determination problem (WDP) in order to determine winning bids that satisfy its transportation needs while minimizing its total transportation cost. This paper deals with a variant of the WDP in the context where shipment volumes on lanes are not known with certainty. The paper investigates a robust optimization methodology to handle this uncertainty. Based on the bi-level characteristic of the problem, a simplified 2-stage robust formulation is proposed and solved using a constraint generation algorithm. Preliminary experimental results are promising to solve large size instances.

11:36 Conceptual Framework for Strategic and Operational Decision Making for Carriers Selection

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This paper addresses the carrier's selection problem at both the strategic and the operational levels. A conceptual framework is proposed to handle both levels. The strategic selection uses a combinatorial auction mechanism in which carriers compete by submitting package bids on shippers' requests. A MIP model is used to determine winning carriers with which the shipper will engage on a long period. At the operational level, an LP model is proposed to select carriers with the objective of minimizing inventory, backorder and transportation costs. This model is governed by some information available from the strategic level and uses other information available at the operational level. Some preliminary results are presented and show the usefulness of the proposed framework.

10:30 THEMATIC SESSION: Innovations in APS (Advanced Planning and Scheduling) Systems

Location: VCH-2860
Chair: Venkatadri, Uday, *Dalhousie University*

10:30 A Hybrid Approach to Large-Scale Short-Term Scheduling in Make-and-Pack Production

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We investigate short-term scheduling of industrial make-and-pack production processes. The planning problem consists of minimizing the production makespan while meeting given end-product demands. A large number of operations, sequence-dependent changeover times, multi-purpose storage units with finite capacities, batch splitting, quarantine times, partial equipment connectivity, and material transfer times render the problem a challenging task. Known MILP formulations for such production processes can solve only small and medium-sized problem instances in reasonable CPU times. In this paper, we present a hybrid heuristic approach to tackle large-scale instances. Under this approach, the set of batches is divided into several subsets according to a priority rule. The subsets are then scheduled iteratively using a MILP model. We enhance the performance of the heuristic by eliminating redundant constraints and variables after each iteration. The applicability of the proposed heuristic is demonstrated by means of a real-world production process.

10:52

Perspectives on Interactive Metaheuristics

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This paper investigates interactive metaheuristics as a way to support the integration of metaheuristics in real applications. The study focuses on the use of metaheuristics in optimization-based decision support systems. In spite of the fact that metaheuristics have been proven to be successful as real problem solvers in a variety of application areas, several limitations restrain the use of metaheuristics in such decision support systems. These obstacles to a practical use of metaheuristics may be overcome by taking advantage of human expertise during the solving process. In this context, this paper investigates interactive metaheuristics. In this original approach of metaheuristics, the interaction with the user aims at guiding the search process, enriching the problem model, involving and informing the user on the decisions taken by the optimization process. In this paper, we first try to identify the main obstacles to a practical use of metaheuristics in optimization-based decision support systems. Then, we present an interactive approach of metaheuristics and propose a conceptual framework to analyze existing interactive approaches.

11:14

Interactive Planning System for Forest Road Construction

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In this paper, we propose an interactive decision support system for forest road construction planning. This approach is based on an interactive heuristic approach, within which the user contributes in a cooperative manner to the optimization process. The objective is to exploit the problem-domain expertise of the user in order to generate more realistic solutions that integrate aspects not captured by the heuristic objective function. This paper presents the user interface, the interaction mechanisms and the heuristic developed to support the cooperation between the computer and the user. We present experimental results based on real problem instances. A comparison shows clear advantages for using the proposed interactive approach over a pure manual approach.

11:36

A Three-step Approach for Operating Room Planning and Sequencing under Uncertainty

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A stochastic three-step approach is proposed for operating room planning and sequencing. Two types of uncertainties related to operating room activities are taken into account: (1) uncertainty related to surgery case duration and (2) uncertainty related to the daily arrival of emergency surgery cases. After constructing operating room plan and fixing off-line and on-line sequencing rules, simulation is used to evaluate the performance of the operating rooms. The obtained results highlight the importance of using a stochastic approach for operating room planning. Indeed, regardless the used sequencing/resequencing rules, operating room schedules obtained by the stochastic approach are more robust than the ones obtained by a deterministic approach. Besides, the utilization cost of operating rooms is reduced when a stochastic approach is used.

10:30 INDUSTRIAL SESSION: Strategic Management of Inventory at the Enterprise Level I

Location: VCH-2870

Chair: Rappold, James A., *Supply Chain Sciences, Inc.*

10:30 Error Reduction in an (r,Q) Normal Demand Inventory System

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In practice inventory models are still very often based upon normal distribution although more accurate representations exist. For the performance measures such as average inventory, average backorders, ready rate, fill rate and orderline service level further simplifications are also applied without knowing the risks linked to it. We analyze the maximum and average errors on these performance measures when a Poisson or compound Poisson leadtime demand is approximated with a normal distribution. Conditions are defined to allow the use of simplified equations and corrections are made. The modifications are very simple allowing a quick implementation in practice and existing models.

10:52 Predictions for Future Order Statistics under Parametric Uncertainty with Applications to Inventory Control Problems

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A large number of problems in production planning and scheduling, location, transportation, finance, and engineering design require that decisions be made in the presence of uncertainty. Most models, which are used for solving these problems, are developed under the assumptions that the parameter values of the models are known with certainty. When these models are applied to solve real-world problems, the parameters are estimated and then treated as if they were the true values. The risk associated with using estimates rather than the true parameters is called estimation risk and is often ignored. In this paper, we consider statistical prediction problems which are invariant with respect to a certain group of transformations. If a given decision problem admits a sufficient statistic, it is well known that the class of invariant rules based on the sufficient statistic is essentially complete (under some assumptions) in the class of all invariant rules. If, in this case, there exists an optimal invariant rule among invariant rules based on sufficient statistic, it is optimal among all invariant rules. The primary purpose of this paper is to introduce the idea of cumulative customer demand in inventory control problems to deal with the order statistics from the underlying distribution. This idea allows one to use the invariant embedding technique to improve statistical decisions for inventory control problems under parametric uncertainty. We discuss the statistical decisions for the exponential distribution.

11:14 Sales and Operations Planning as an Integrating Enabler for a Joint-Venture

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Sales and operations planning (S&OP) is a process used to meet strategic goals through the reconciliation of tactical supply and demand plans (monthly or quarterly targets) with operational execution (daily, weekly production and inventory control and allocation). However, the S&OP process has organizational benefits that extend beyond functional integration. We introduce a case of a joint business venture between two North American firms and describe how S&OP was a necessary condition of the joint venture success and how it contributed to long-term cohesion of the business at all levels. We discuss the competitive and operational forces that shaped the decision to pursue S&OP and describe the process of implementation as well as the key functions, capabilities, roles and metrics used to ensure the success of the business. The success of the joint venture hinged upon an S&OP process that was characterized by strong, effective leadership, shared performance metrics, an integrated information technology (IT) system that allows real-time access to shared data, a disciplined business process that establishes an analysis and decision cadence, and a decision support tool that allows management to make decisions and execute them quickly utilizing all operational and strategic information in the business environment. We contribute to the sparse but growing academic literature on S&OP by providing a case of how a joint venture used the S&OP process to integrate the business functions of two organizations to achieve operational and financial success.

11:36 A Stochastic Inventory Model for the Stock versus Non-Stock Decision

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The most fundamental decision in inventory management is whether or not to stock a particular item. Despite its importance, the preponderance of the literature on inventory systems is concerned with how much to order and when to order which assume the stocking decision has been made. In this research we examine an inventory stocking decision model that is based upon an item's demand history. In this model every item must earn its way into the catalogue of stocked items by receiving a given number of demands over a specified time period and will likewise be de-stocked and taken out of the catalogue (or burned) if it receives fewer than a given number of demands over a specified time period. We show the stability of such a policy and discuss implications for its use by firms that compete on product assortment.

10:30 THEMATIC SESSION : Physical Internet Initiative

Location: VCH-2880

Chair: Montreuil, Benoît, *Université Laval*

10:30 The Impact of Standardized Physical Internet Containers on Shipping Volume

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One of the key aspects of the Physical Internet (PI) is the use of standardized, modular containers that enable the coordination of shipments across the supply chain. However, a key open question is how will limiting the choice of containers impact the amount of volume that is shipped? We present a mathematical model to determine that impact and report our results for data sets that are based on data from a computer peripherals manufacturing company.

10:52

Potential of Routing Protocols for Freight in Open Logistics Networks: The Case of FMCG in France

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Logistics networks intensely use means of transport and storage facilities to deliver goods all around the world. However they are still poorly interconnected and this fragmentation is responsible for a lack of consolidation and thus efficiency. To cope with challenging emissions targets, an improvement by an order of magnitude in supply networks is sought. This is the purpose of the Physical Internet. If from a logical point of view, this concept should improve efficiency by merging flows, no demonstration of its potential has yet been carried out based on real-world flows. To reach this goal, we used flows from the Fast Moving Consumer Goods sector (FMCG) in France and a model of interconnected logistics networks to simulate their routing. Unlike vehicle routing problems, flow routing is a new re-search field. Routing is therefore proposed based on a combination of knapsack algorithm to fill transportation means and of shortest path to minimize travelled distances. Various routing protocols and scenarios were tested and encouraging results were measured according to sustainability indicators such as CO2 emissions, energy used, cost, lead-time, delivery time, and so forth. As this is a first work in the field of routing flows, the simulation model also suggests potential improvements.

11:14

Simulating Physical Internet Enabled Distribution Webs

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What if instead of packing products in pallets and boxes of different size, shapes and materials, they are packed in smart, standardized, and modular containers? What if these containers are the only unit loads dealt with by transportation systems and logistics facilities? What if the storage and distribution facilities, regardless of which company they belong to, are open to receive, handle, and store containers from any other company? The Physical Internet suggests that if such a context exists, it enables a Logistics Web that will contribute to address the problem of the economic, environmental, and social inefficiency and unsustainability resulting from the way physical entities are currently moved, handled, stored, supplied, realized and used across the world. In this paper, we report on research aiming to enable the exploration of the potential of such a Logistics Web through simulation based investigation. The research is anchored around a collaborative French-Canada-Switzerland project aiming to assess the potential of altering the French distribution system for fast-moving consumer goods from its current state towards a Physical Internet enabled France-wide open logistics web. This web is notably comprised of an open mobility web and an open distribution web. Specifically, we focus on the design challenges associated with architecting and developing a large-scale agent-based simulator enabling the French Logistics Web experiment.

11:36

Modeling Scenario-based Distribution Network Design in a Physical Internet-enabled Open Logistics Web

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This paper aims to propose a rigorous assessment, through an optimization-based approach, of the economic performance potential offered by the recently introduced Physical Internet regarding the design of distribution networks. The paper describes the existing distribution network design context through the characterization of current closed and collaborative distribution systems. It also depicts the open and global Distribution Web, a key constituent of the Logistics Web to be enabled by the Physical Internet. The paper characterizes and models future business environment with a set of scenarios taking into account various evolutionary paths of the world economic, environmental and societal future. Subsequently, it formally introduces a scenario-based distribution network design model, in a two-stage setting, to decide on the set of distribution facilities to open and their mission. First, a generic form of the model is provided and then, it is adapted to the closed, collaborative and open web contexts.

12:00 Lunch

13:30 Industrial Keynote: Serge Alexandre

Location: VCH-2850

Chair: Lehoux, Nadia, *Université Laval*

Efficiency & Flawless Execution in the Supply Chain

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In today's global economy, the Aerospace Industry is facing every day major logistics challenges. Three years ago, anticipating the new economy, Pratt & Whitney Canada (P&WC) has strategically re-aligned its logistics to move material and to service its customers. By rethinking the different networks, by adding new technologies and by developing partnerships with Third Party Logistics, P&WC is currently well positioned for the future, in order to propose new and innovative business models to its customer base. This presentation is designed to share this journey where P&WC developed a unique and dynamic business model for its logistics. The audience will appreciate the benefits of the logistic best practices implemented, in terms of material flow execution from Suppliers to P&WC and from P&WC to its Customers.

14:30 INDUSTRIAL SESSION: Strategic Management of Inventory at the Enterprise Level II

Location: VCH-2870

Chair: Forget, Pascal, *Université du Québec à Trois-Rivières*

14:30 Heerema Reel Transport Challenge: Simulation to Deal with Increased Complexity

Sturm, Noortje, Heerema Marine Contractors, Netherland,

HMC is investing in a new vessel the Aegir for installing complex deep water infrastructure and pipeline projects (completed mid 2013). This will be the first reel-lay vessel for HMC. Reel-lay is a method for installing rigid subsea pipelines. Long pipe segments are welded onshore and then spooled onto a large vertical pipe reel in one length. Where competitors have their reel fixed on the vessel, HMC decided to implement a concept of shuttling reels

between the installation vessel and the pipe production yard. The Aegir stays in the field and can install pipelines continuously, while competing vessels have to sail to the yard to refill the reel in critical project time. The aim is to be more competitive. By shuttling reels the project logistics become more complex, because an extra non-critical product flow is introduced. This puts an effort in making the reel supply cost-efficient and robust. Robust as different risks/uncertainties can influence the result: weather downtime, breakdown and/or rework. The risks vary per project: different materials, region, etc. By using simulation the aim is to search for both a cost-efficient as a robust concept with respect to potential risks/uncertainties. Scenario simulation and sensitivity analysis support to understand the robustness and boundaries in order to reduce the choice options. Now HMC is at a point on where simulation could support in project preparations, in which multiple departments are involved. User friendliness and presentation of the results becomes more and more important. This is a challenge we would like to discuss.

15:30 **Deploying a Risk-Based Planning and Scheduling (RPS) Solution for Lockheed Martin Aeronautics**

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Despite recent media reports, the production rate of the F-35 Lightning II aircraft is increasing. Over a period of 4 years, the yearly number of aircraft produced will have increased 6 fold. In order to plan its production activities and better control its costs, Lockheed Martin is deploying a Risk Based Planning and Scheduling solution. This presentation will provide insight into the complexity of producing a modern day fighter, its planning challenges, the production system's vulnerability to randomness and the need for a risk focused planning environment. This will be followed by a description of the new system's Simio based architecture, the system's deployment history and finally its benefits.

14:30 **THEMATIC SESSION: SME Networks Management**

Location: VCH-2830

Chair: Frayret, Jean-Marc, *École Polytechnique de Montréal*

14:30 **Impact of National and Organizational Cultures: From SMEs to a Large Group... The Case of Carrefour in Romania**

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Though the international expansion of retailer takes many strategic variables into account, it seldom examines the impact of the cultural variable on the process. Here a qualitative approach has been used. It is based on the discourse of 33 key actors in the Romanian retail industry and one French firm: Carrefour. The case of Carrefour in Romania highlights the importance of first entering a market with an SME structure favouring a more relational culture before then deploying a more standardized business model. This research, which has been carried out in an emerging country, aims to understand the intercultural process used by the retailer. The inclusion of a new variable (culture) to obtain our results enriches the cycle of internationalization via the creation of an analytical grid which includes both the strategic and includes cultural variables used by the retailer.

15:00 **An Approach for the Valorization of Competitive Intelligence Practices in SME Supply Chains**

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At the interface between supply chain management and business intelligence for SMEs, the focus of this paper is twofold: (i) it seeks, firstly, to show how to develop a strategic approach and qualitative-type "business intelligence" in SME' Supply Chain; (ii) it also aims to show how the processes of competitive intelligence can be embedded in SME's supply chains and create value for everyone involved, or at least avoid leakage of strategic knowledge and know-how; The issues associated with business intelligence as they relate to SME's supply chains are therefore detailed. An extension of PREVA (for PROcess EVALuation approach (Comelli et al., 2008) to qualitative "business intelligence" type processes is proposed. In the third part, we present the implementation of this approach in a case study focused on the supply chain of an SME based in the French area of Thiers, operating in the cutlery sector.

15:30 **Personal Networks Management and Competitive Intelligence in French SMEs**

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Little empirical research has been conducted on competitive intelligence in French SMEs. The influence of SMEs' top decision makers' personal networks on competitive intelligence practices' development remains to be explored. This paper aims at studying and measuring this influence. To do so, a literature review of both competitive intelligence and social capital fields led us to construct a conceptual model based on four hypotheses. Data from 193 questionnaires are analysed through a PLS regression. These questionnaires were filled out by French SME high-tech dedicated to information, telecom and audio-visual technologies. The results provide support for the four hypotheses. The results showed that personal networks of decision makers influence positively the development level of competitive intelligence practices in high-tech French SMEs.

14:30 **THEMATIC SESSION: Military Logistics Applications**

Location: VCH-2840

Chair: Klibi, Walid, *Université Laval*

14:30 **A Comparison of Decision Support Technologies for Operational Logistics**

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This paper provides a preliminary analysis and comparison of selected information technologies and soft-ware systems characterized with functionalities useful to decision making in military operational logistics. Both, military and commercial systems have been considered, and the relevant functionalities have been divided in two categories: information

access and integration, and decision support. The results of the quantitative comparison study involving few advanced systems have been presented.

14:52 Scheduling of Humanitarian Relief Operations Using Military Logistics Capabilities

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We develop a scheduling methodology of humanitarian reliefs distribution using military tactical logistics. We address some issues related to storage and distribution of heterogeneous commodities in a theatre of operations using a combination of heterogeneous transportation assets. The scheduling problem is modeled as a multi-objective Integer Linear Programming (ILP), and solved using a large scale optimization techniques, namely Column Generation (CG). We extend the classical capacitated vehicle routing problem with time window to allow multiple time windows for delivery of multiple classes of commodities. The performances of the CG-based algorithm in deriving the integer solution and the added value of the multiple time slots delivery are analyzed using different hypothetical data inputs.

15:14 On the Selection of an Operational Support Hub in the European Region for the Canadian Forces

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The Canadian Forces (CF) is establishing a network of permanent and temporary operational support hubs at strategic locations around the globe to improve its ability to deploy and sustain forces overseas. This paper addresses the problem of determining the optimal location of such a hub in the European region from a list of candidates. The candidate locations were evaluated against a set of criteria by military subject matter experts. The weights of the criteria were provided on an ordinal scale. The volume of the weight-space associated to each of the possible rankings of the candidate locations was determined, and was then expressed as a probability measure. The expected rank of each location was calculated using this measure. The underlying assumption is that all weight vectors respecting the criteria ordinal ranking are equally possible. Significant differences were found in the suitability of the various candidate locations. Full results were communicated to the CF.

14:30 THEMATIC SESSION: Managing Disruptions in Sustainable Supply Chains

Location: VCH-2860

Chair: Montoya-Torres, Jairo, *Universidad de La Sabana*

14:30 Towards a Conceptual Framework for Studying the Impact of Major Disruptions on Sustainability in Supply Chains

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This paper presents a conceptual framework for studying the impact of major disruptions on sustainability in supply chains. It draws from two main bodies of literature: one concerned with disruption management in supply chains, the other with sustainability issues. The conceptual framework considers the impact of the characteristics (type, frequency and severity) of major disruptions together with the characteristics of the individual organisations and of their supply chain on sustainability in supply chains, in terms of economic, environmental and social dimensions.

15:00 **Demand-driven Wood Remanufacturing Industry: Proposing a Planning Model and Evaluating Re-planning Policies in a Real-scale Application**

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Managing uncertainty is one of the main challenges within the forest supply chain. Uncertainty arises from internal or external sources. Due to these uncertainties managers are not able to handle disturbances adequately by deterministic or predictive plans, because such plans are often generated in advance, and should have an ongoing reactive and adaptive process. Therefore, dynamic planning with the ability to respond quickly to real-time events is of great importance for the successful implementation of real-world systems. This paper studies a real wood remanufacturing unit that experiences disruptions due to uncertain demands during the planning horizon. In this unit managers are obliged to review the production plans daily, because of arrival of new orders. In order to handle uncertain demands, a complete re-planning approach by periodic policy is proposed and investigated through simulation experiments in a real-case application, to evaluate the impact of choosing appropriate re-planning frequencies for the rolling horizon, in terms of three performance measures; back order level, estimated value of production, and inventory holding level.

15:30 **A Game-Theoretical Model for Facility Location and Protection against Intentional Attacks**

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The article presents an optimization modeling approach for allocating protection resources among a system of facilities so that the disruptive effects of possible intentional attacks to the system. This article considers the uncapacitated fixed charge location problem (UFLP) to deal with defence resource allocation. The vulnerability of each facility is determined by an attacker-defender contest success function. The article considers a two-period min-max game where the defender invests in the first period, and the attacker moves in the second period. This means that the defender selects a strategy in the first period that minimizes the maximum loss that the attacker may cause in the second period. The loss incurred by the defender is evaluated of the increasing in transportation cost, and the cost necessary to restore the disabled facility.

14:30 **THEMATIC SESSION: Value Chain Management in Natural Resources**

Location: VCH-2880

Chair: Rönnqvist, Mikael, *Université Laval*

14:30

Defining the Integrator-Supplier Concept for the Forest Supply Chain

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This paper seeks to map out and define the concept of Integrator-Supplier (IS), a mean towards integrative planning in the context of public forests management. Basically, the IS is an intermediary that opens the planning process to a broader variety of stakeholders including the government, the forest industry, regional and local organizations, recreational and tourism companies, and first nations. It is believe to enable a lean approach to conducting forest operations. The paper first presents a perspective about intermediation, coordination and collaboration in value chain. A methodology is then proposed to restructure the forest value chain using intermediaries when socioeconomic and environmental constraints are brought to the forefront and productivity should be redefined. The proposed methodology is illustrated using a case study in the province of Quebec, eastern Canada, a jurisdiction preparing for a major overhaul of its forest policies. Potential scenarios for which different actors in the supply chain assume the strategic role of IS are described. Our analysis indicates that the IS concept offers opportunities to improve the efficiency of the timber supply chain. It is proposed that the government entrusts to an IS the responsibilities of reconciling and executing tactical and operational plans.

15:00

Integrating Optimization and Simulation for Supply Chain Tactical Planning in the Forest Products Industry

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This paper addresses a tactical planning problem in a supply chain network in the forest products industry. We present a mathematical model that aims at integrating data coming from simulation tools (FPInterface and Optitek) with an optimization model (LogiOpt). This mathematical model aims at planning at the same time harvesting, transportation and production operations.

15:30

The Complexity in the French Wood Supply Chain Reduction: A Traceability Perspective

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The Supply Chain (SC) represents a complex and dynamic open system characterized by a dissipative structure and a positive entropy (Wang, 2008). To better understand the SC dynamic behavior, we present in this paper a conceptual framework to explain how the SC complexity can decrease the operational performance and the value-added creation. A review of the literature found that the SC positive entropy is a source of its inherent unnecessary uncertainty and its underperformance. Indeed, the non-linear interactions between the SC actors and their incapacity to share relevant information, represent a source of several entropic behavior. To achieve our research objective, and after presenting literature review of the complexity in the SC, we show that the incapacity to share relevant

information and the ineffective traceability information management, can represent a amplification source of the SC positive entropy. After this, we highlight how can a traceability system and automatic in-formation sharing process can reduce the Wood SC information dissipation and ameliorate the wood allocation. Then, we use empirical results from an European project "Indisputable Key", to highlight how RFID traceability system, can create a "negative entropy" in the Wood SC, and improve the wood allocation by quickly allowing companies to access to relevant wood information. The forest-wood sector is a low economical margin sector, any wood allocation improvement would be a source of value added and a competitive lever for companies.