MIT GLOBAL
SCALE NETWORK

2016 SCALE LATIN AMERICA

CONFERENCE

70 MEMORIAL DR., E51-345, CAMBRIDGE

MONDAY & TUESDAY, MARCH 21-22, 2016

ABSTRACTS
SUMMARIES
BY SESSION

Conference Program

Day 1 – Monday, March 21

Time	Event	Room
8:00	Registration	
8:30	*Welcome & Breakfast*	
9:10	*Keynote Speaker: Prof. Yossi Sheffi,* MIT Center for Transportation & Logistics *The Power of Resilience: How the Best Companies Manage the Unexpected*	
10:10	Break	
10:30	*Paper Presentations - Parallel Sessions*	
	Innovative Cases Studies in Logistics & SCM I.	E51 – 372
	Applied Operations Research I.	E51 – 376
	Urban Logistics I	E51 – 395
12:10	Break	
12:30	Lunch. *The MIT Graduate Certificate in Logistics & SCM - Informative Session*	
14:00	*Paper Presentations - Parallel Sessions*	
	Innovative Cases Studies in Logistics & SCM II	E51 – 372
	Applied Operations Research II.	E51 – 376
	Urban Logistics II	E51 – 395
15:40	Break	
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	Urban Logistics III	E51 – 395
	Student Paper Competition	E51 – 376
17:40	*Reception* – Samberg Conference Center, Building E52-7th Floor, Salon M	

Day 2 – Tuesday, March 22

8:00   Breakfast

8:30   *Paper Presentations - Parallel Sessions*
     Sustainability I . . . . E51 – 372
     General Topics on Logistics & SCM I . . . . E51 – 376

10:10   Break

10:30   *Paper Presentations - Parallel Sessions*
     Sustainability II . . . . E51 – 372
     General Topics on Logistics & SCM II . . . . E51 – 376

12:00   *Keynote Speaker: Prof. César Hidalgo,* MIT Media Lab
     Why Information Grows

13:00   Lunch

14:00   *Paper Presentations - Parallel Sessions*
     General Topics on Logistics & SCM III. . . . . E51 – 376
     International Trade & Logistics . . . . E51 – 372

15:40   Break

16:00   *Keynote Speaker: Prof. Carolina Osorio,* MIT Department of Civil & Environmental Engineering
     Large-scale urban transportation system design and operations in the era of connected, autonomous and real-time responsive vehicles and travelers.

17:00   *Student Competition Award Ceremony & Adjourn*

Index of summaries

Day 1 – Monday, March 21

10:30   Innovative Cases Studies in Logistics & SCM I   E51 – 372

Thematic area: Innovative Case Studies in Logistics & SCM

Financial Risk Measurement in a Model of Supply of Raw Materials

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Abstract

Companies must make decisions about where, when and how much raw material must buy. Decisions about raw material inventory levels should involve the expected cost and benefits of holding and managing raw material inventories. Moreover, other external risk factors can influence the decision. In this paper we present a raw materials supply model that considers uncertainty in factors such as raw material prices, demand and exchange rates.

In order to show the use of the methodology we developed, we present the case of a Colombian company in the aluminium industry. This company imports aluminium sheets from China. In this case we analyse the financial impact of the raw material supply contract proposed by the Chinese supplier. We use the Monte Carlo Method (MCM) to estimate the behaviour of the raw material supply model, considering different supply scenarios with uncertain variables, such as demand, prices and exchange rates. We calculate robust indicators such as Value at Risk (VaR), Conditional Value at Risk (CVaR) and Probability of Success for each scenario under study. Finally, we perform a sensitivity analysis with respect to sale price to validate the proposed models and solution approaches.

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Current position: Full Professor, Director of the School of Industrial Engineering

Thematic area: Innovative case study in Supply Chain Management

Demand Driven MRP Applied to the Retail Level and New Products Launching

Poveda, D.[1]

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Abstract

Demand Driven MRP, DDMRP, was conceived by its creators as an advanced, multi-echelon material and inventory planning and execution methodology, from the level of raw materials to distribution centers. This paper describes the application of DDMRP down to the retail level.

During the first implementation in Latin America of this frontier methodology, and the first in the world at the retail level, the knowledge required to make it operational in these environments was developed. The first retail implementation delivered outstanding results. During a period of 18 months, the company went through an essential change; shifting from a difficult financial situation to becoming "Best Supplier of the Year" for the largest retailer in Colombia. The company has publicly reported a 60% increase in sales during the period 2013-2015 with 40% less inventory in its retail chain with a significant increase in cash flow generation and shareholder value creation.

In addition, an innovative model for launching new collections in the apparel industry was developed. This model maximizes the availability and sales of high movers, while minimizes required inventories, increases speed-to-market, reduces the number of items sold with large discounts and minimizes the costs associated to the supply chain. The model can be applied in any other industrial sector.

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Thematic area: Innovative Case Studies in Logistics & SCM

Purchasing management improvement for Quimica AG – Peru local manufacturing line

E. Buse[1], M. Chong[1], C. Cucho[1], K. Lozada[1], C. Ubarnes[1]

1: Universidad del Pacífico, Av. Salaverry 2020, Jesús María, Lima, Perú

Abstract

Our project focuses on providing solutions to the three major problems that were found at the procurement department in QUIMICA AG: the processes are not formalized nor do they have control indicators, there are errors in the articles and suppliers master data and there is no suppliers' management. These problems complicate the supply chain management, thus reducing the possibility of generating savings from purchases, and increasing risk in the supply chain as a whole.

In order to obtain a general analysis of the supply chain, we applied the methodology used by Oliver Wight consulting firm through "The Oliver Wight ABCD Checklist for Operational Excellence", reaching the lowest score the purchasing department, after this a diagnosis was made in purchasing management where were found high operating load, errors in the master data and excess of transactional activities. From this diagnosis four improvement projects were proposed: redesign of procurement management, improvement in data quality, strategic sourcing and change management.

Among the key findings are: there are several opportunities for improvement in procurement processes and is possible to demonstrate that it is likely to obtain a 5% savings. In the interviews that we had with executives who manage companies in Peru and Latin America they told us that the methodology that is used in our project could be applied in the purchase management of their companies too.

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Thematic area: Innovative Cases Studies in Logistics & SCM

Innovation and Collaborative Strategies Applied to the Supply Chain of a Peruvian Agro-Industrial Company

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1: Universidad del Pacífico, Lima, Perú.

Abstract

The discovery of agriculture was the first big step toward a civilized life and it has been transformed by the generation of knowledge and appropriate technology over time. Currently, we discuss about bio production, genetic modification of fields, robotics, and food traceability.

Peru, where the agriculture sector generates the second highest foreign exchange reserves, is also an example of the emerging countries that are currently experiencing a transition from traditional processes to new technologies. An appropriate supply chain management will be essential for achieving this transition and shortening the gap that separates it from the First World.

VIDA, the company we have studied over the last two years, is the top producer and distributor of strawberries for the main retail channels in Peru. VIDA, a medium-sized company created in 2000 in Lima, is engaged in sowing, collecting and trading top quality strawberries for domestic and international markets.

The study sought to resolve the impact of high operating costs, generated by a complete cold chain, worsening during low production season. The structure of the research led us to analyze the international and domestic (Peruvian) markets, to subsequently explore the supply chain and the importance of VIDA's cold chain. The on-site research enabled innovation strategies, and us to apply collaborative results of which have affected VIDA's supply chain. We enclose these conclusions in this study.

The methodology used in the research aimed at promoting interaction within the company's functional areas and supplier-customer collaboration, favoring innovation and collaborative strategies at all levels.

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Thematic area: Innovative Case Studies in Logistics & SCM

Towards online traceability in upcoming markets for sustainable seafood

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1:Marine Stewardship Council (MSC), 1 Snow Hill, London, UK.

Abstract

The Marine Stewardship Council (MSC) is a global certification scheme for sustainable fishing and seafood traceability. The traceability standard requires strict separation of certified and non-certified seafood and the implementation of strong processes and a management system to ensure this happening. Third party auditing takes place and MSC has an extensive program to monitor the effectiveness of the traceability program.

The monitoring program exists of a combination of tools and activities that include DNA testing, record tracebacks, supply chain reconciliations, audit report review and compliance audits (repeating the audits to verify the results). Because much of this work is manual, MSC is testing the potential use of online traceability and verification tools. As part of this, MSC has piloted a system called MOTS (MSC Online Transaction solution) which verifies certified volumes of seafood as they travel through the supply chain. In 2014 and 2015 the tool was tested in one region with advanced digital systems and a long history with the MSC (Western Europe) and one region that is more dependent on paper based traceability systems and more recently started working with the MSC (China). The experiences of both pilots differed both in terms of the outcome on increased integrity of the supply chain and experienced benefits of the system, as well as the user experience.

The lessons learned through the pilots are very important for the future development of the MSC monitoring program and for the management of further expansion of the MSC program into other lower developed regions such as wider SE Asia, Africa and Latin America.
With the commitment to serve sustainable seafood the Rio Olympic Games 2016, in addition to general growth MSC is expecting in Latin America, the experiences from the MOTS pilots will help to form the program development and monitoring activities for this region.

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10:30   Applied Operations Research I   E51 – 376

Thematic area: Applied Operations Research

Improvement of the inventory planning in Caynarachi Company

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1: Universidad del Pacifico, Av. Salaverry 2020, Distrito Jesus Maria, Lima, Peru

Abstract

Caynarachi is an agro industrial enterprise dedicated to production of sauces and canned vegetables for export to Europe, USA, Japan and South America.

The company will achieve its strategic goals with the help of this work: increase sales and improve its profit margins. Their strategies to achieve these are to improve the level of service through the measurement of the perfect order as well as reduce operating costs generated by the deviations between sales forecasts and real sales, thereby it is obtained the better inventory planning.

Implementing a new demand management process can be obtained annual savings of up 3MM$. The new model improves the current MAPE (Mean absolute percentage error) from 82% reducing it to 50%. The process improvement in the management of suppling inventory will reduce to 1.5 MM$ of purchases a year through a new method for purchasing planning accord the service level agreement
Finally, it is considered that the integration of both solutions would increase the company´s competitive advantage into its sector and global level.

The theoretical basis used is the measurement of the perfect order according to Dr. Edwad Frazelle, evaluation of cost drivers Dr. Chopra and the choice of method for measuring sales forecast MAPE

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Thematic area: Applied Operations Research

Hybrid Heuristic Method to Solve a Two-Stage Capacitated Facility Location Problem

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2: Dep. of Transport Engineering, Federal University of Rio de Janeiro, Rio de Janeiro-RJ, Brazil.

Abstract

This paper proposes a hybrid heuristic method combining a Clustering Search (CS) metaheuristic with an exact algorithm to solve a Two-Stage Capacitated Facility Location Problem (TSCFLP). The TSCFLP consists of defining the optimal locations of plants and depots and the product flow from plants to depots (first stage) and from depots to customers (second stage). The problem deals commonly with cargo transportation in which products must be transported from a set of plants to meet customers' demands passing out by intermediate depots. The main decisions to be made are related to define which plants and depots to open from a given set of potential locations, which customer to assign to each one of the opened depots, and the amount of product flow from the plants to the depots and from the depots to the customers. The objective is to minimize the operation costs satisfying demand and capacity constraints. Computational results demonstrates that our method was able to found good and fast solutions when comparing it directly with a commercial solver and a Genetic Algorithm reported in a recent paper found in the literature. Thus, our hybrid method combining CS with an exact algorithm can be considered as a new alternative to solve the TSCFLP.

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Thematic area: Applied Operations Research

A linear programming model to planning sugar cane crops to supply biofuels plants.

Jimmy Carvajal[1]

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Abstract

In this paper, we propose a new methodology to operation planning and risk assessment in the implementation biofuels project in Colombia, the main objective is synchronizing agribusiness and industrial schedule to evaluate risk schedule delayed and low productivity of agricultural fields, subject to environmental, operational and productive resources constraints. In the problem formulation section, shows the different effects on the project value proposition, when the risks occur, and how enterprise try to solve this problem with some strategies and their performance. Next, in the methodology section, it present the strategy framework based on linear programming, that looking for the risk impact reduction on future profit flow at the project. In the experimental section, it is shown some advantages about the methodology used , in addition is mentioned about the many application about this modelling, this instance been used to calculate the quantity of machines requested at agricultural operations, the fuels and amount of maintenance needed. At final, it show some conclusions about the benefits of applying of linear programming to improve the operations planning, executing and control in agro-industrial activities in the growing biofuels business in Colombia and the future research lines and possible stakeholders in the adoption of this methodology.

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A two-stage location-routing problem considering compatibility vehicle-product and among products applied in Bogota

Thematic area: Urban Logistics

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Abstract

This research presents a set of mixed-integer linear programming (MILP) models. The goal of these models is to define the last-mile distribution of goods in a squared kilometer from Bogota considering compatibility constraints and to minimize the costs. The data gathering is based in the Megacity Logistics Lab procedure to acquire data from different types of stores, urban plot, traffic flow, deliveries and interruptions.

One approach proposes a two-stage procedure where the first stage emulates the compatibility model to decide which products will be transported by the available fleet. With this output, the second stage is developed taking into account the location-routing problem (LRP) model that decides the best location of the urban consolidation centers and the vehicle routing to serve the clients in a squared kilometer.

In other approach develops a LRP model including the compatibility among products and products – vehicles. This integral model is solved using some exact methods such as branch and price algorithm and is analyzed providing lower bounds via Lagrangian relaxation and subgradient algorithms.

As a result, the location of the urban distribution center, routes and product-vehicle assignments are acquired considering a set of scenarios. In general, this proposal is meaningful for decision makers addressing urban last-mile operations that integrate supply chain activities and flows in tactical and operational levels to maximize efficiency keeping low costs.

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Solving strategic and tactical location and routing problem throught an heuristic approach

Thematic area: Applied Operations Research

Solving strategic and tactical location and routing problem throught an heuristic approach

T. Pavez[1], R. Giesen[1], P. Rocha e Oliveira[2], N. Julio[3], P. Mandujano[3], and J. C. Ferrer[4]

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4: Department of Industrial and Systems Engineering, Pontificia Universidad Católica de Chile Vicuña Mackenna 4860, Santiago, Chile

Abstract

We present different heuristic approaches to solve the strategic School Location and Size Problem (SLSP) and the tactical School Bus Routing and Shift Programming Problem (SBRSP) (Mandujano *et al,* 2012). The main goal is to obtain an efficient solution approach in order to avoid using optimization software that can be very expensive, not just computationally, but also economically.

In the SLSP we decide which schools should remain open, how many classrooms should have each one, how many shifts should they have, and which students should attend which school based on their geo-location, in order to minimize the total cost. The cost includes administration cost per school type, operational cost per classroom, an approximation of the transportation cost, construction cost, and an overcapacity cost. The latter aims to maintain the number of students per classroom at a desired average. The SBRSP takes as an input the solution given by the SLSP and provides for each school the number of classrooms allocated for each grade, along with the shift assigned to each student attending that specific school. This is based on minimizing total transportation cost.

We developed a heuristic for the SLSP following a Greedy Randomized Adaptive Search Procedure (GRASP), obtaining reductions on execution time of up to 95% compared to the optimization software. In the case of the SBRSP, a set of algorithms was tested, such as k-Means, Clarke & Wright algorithm, and a heuristic based on a Minimum Spanning Tree (MST) to solve the Traveling Salesperson Problem (TSP).

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10:30   Urban Logistics I   E51 – 395

Thematic area: Urban Logistics

Rebalancing Operations in Mexico City's Bike-Sharing System

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Abstract

Bike-Sharing systems (BSS) allow people to take and later return a bicycle at one of many stations scattered around the city. Users naturally imbalance the system by creating demands in a highly asymmetric pattern. In order for BSS to meet the fluctuating demand for bicycles and available docks, inventory-rebalancing operations among stations are crucial. This creates an important optimization challenge.

In Mexico City's BSS (ECOBICI), 21% of users complain about bicycle or locker shortage during rush hour. This paper provides a framework for analyzing usage patterns (through data mining and clustering) and for modeling the system (through simulation techniques) to determine the optimal number of bicycles that should be available in each station.

We analyze the usage pattern of ECOBICI based on 26 million data entries covering the 2010-2015 period. We test for several parameters in the analysis, such as intra-weekday variations and seasonality. We identify those stations that are the most congested at both morning and evening rush hours (the main candidates for rebalancing operations), from which we select a sample of 22 stations with unique characteristics as the focus of our rebalancing approach.

We model this subset of stations in *SIMIO* simulation software using the key parameters determined by the above analysis. We generate alternative scenarios to assess the system's service level according ECOBICI's requirements. We then apply optimization techniques to determine the optimal number of bicycles that should be placed at each station during the rush-hour period to enable the system to comply with ECOBICI's operational requirement.

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Thematic area: Urban Logistics

Multipurpose transfer station design for Municipal Solid Waste based on reverse Cross Docking

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1: School of Industrial Engineering, Universidad del Valle, Campus Melendez, Cali, Colombia

Abstract

In Latin American and Caribbean countries, Municipal Solid Waste Management (MSWM) has become a serious problem, especially in urban regions. Although certain countries have a regulatory framework for MSWM, few have appropriate infrastructure and human resources required to enforce the regulations, especially those related to recycling and final disposal. An important step in this management is use transfer stations (TS) because solid wastes are passed from collection trucks to higher capacity trucks arriving to recovery centres, treatment or final disposal. This activity is similar to logistics strategy Cross Docking. The proximity of these two concepts is most evident in four key features: vehicles used (reverse), load flow, technical facilities, and maximum storage time. That is the reason that through a case study, an operation cycle of TS is constructed, using elements of this logistics strategy. In the methodological development were considered four basic steps: Determination of initial conditions and assumptions required, defining characteristics of necessary resources, defining characteristics of facilities, and analysis of results. One result is to observe the flow in Multipurpose Transfer Stations as an indirect Cross Docking because they are applied multiple touches over the load. MSW is discharged into the fossa where there are temporarily stored (one-touch), then they are separated and are classified according to material type (second touch) are then loaded onto outbound trucks (extra touches) and finally, they are send to usable market or final disposal site. This viewpoint allows to do a continuous improvement in TS.

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Thematic area: Urban Logistics

High-Resolution Urban Freight Modeling

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Abstract

As cities grow, more goods need to be delivered into urban communities to satisfy growing and varying consumption demands. Although a critical enabler of sustainable growth and quality of life, the urban freight system that delivers these goods is often seen as a nuisance from the public perspective, in large because commercial vehicles contribute to traffic congestion and make use of public spaces such as loading bays. In this sense the appropriate usage of public infrastructure by delivery companies is critical to reduce the impact on society. Local authorities are responsible of providing the adequate quantity of public loading areas to satisfy the delivery intensity of a particular zone and regulating the use of them. However, there is a lack of delivery data and suitable models that support local authorities for effective decision and policy making.

In this paper we propose a high-resolution methodology that balances theoretical and data-driven analysis to provide a decision support tool to local authorities. Initially we conducted a field study to collect primary data in Cambridge, MA and Madrid, Spain. This data collection process involved gathering information about business establishments, parking conditions and deliveries on the area studied. Then we used ordinary least squares to model the use of delivery bays as a function of business type and number of employees, quantify the number of delivery bays required and estimate future delivery intensity. Finally, we use location-allocation modelling to locate delivery bays on potential parking locations and allocate them to business establishments.

As a result, the new deployment of loading bays resulted in a better use of public spaces in accordance with the freight needs of the area analyzed.

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Thematic area: Urban Logistics

CDR (Call Detail Records) Data Validity for Identifying vehicular traffic patterns in Quito, Ecuador

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Abstract

Understanding vehicular traffic patterns in a city is critical to Urban Logistics Planning. CDR (Call Detail Records) data was analysed for four of TELEFONICA´s Cell Towers located at both ends of Tunel Guayasamín, a key connecting tunnel between Quito, Ecuador´s capital city, and the valley of Cumbaya. These CDRs included all call, text and data navigation events generated by cell phones connected to the four cell phone towers during a period of one month. Data was anonymized by replacing the phone number with a unique integer identifier and by only showing aggregated results. The information collected includes user anonymous identifier, cell phone tower identifier and date and time of the event. Our objective is to prove that traffic patterns observed at Tunnel Guayasamin can be described by analysing the CDRs generated in this zone. It is our intent to prove the validity of CDR data analysis for identification of vehicular traffic patterns though the use of this case study. We collected on average 18,000 events per week during four weeks and analysed them to identify common patterns and differences amongst hours of the day and days of the week. We also tested if the data followed a specific distribution and if there are any significant differences amongst days of the week. Our preliminary results include measures of tunnel usage each hour and peak hours of usage within a day as well as frequency of use of the tunnel and the effect of current traffic mitigation policy.

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14:00   Innovative Cases Studies in Logistics & SCM II   E51 – 372

Thematic area: Innovative Case Studies in Logistics & SCM

Out of the Box Portfolio – Avon Cosmetics Ltda.

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Abstract

Out of the Box (OTB) is a project portfolio that aims to face paradigms, review, simplify and improve Avon's Supply Chain (SC) in a synergetic and sustainable way, as a strategy to remain cost-efficient and up-to-date. Latin America Logistics (LAL) scenario is characterized by defective infrastructure, high dependence on land modal, small and dispersed suppliers and low level of integration. Avon's LAL has more than 1,000 routes and around 26,000 transactions, connecting five manufacturing branches, 11 Distribution Centers and about 100 Local Delivery Centers, fulfilling more than 3.3 millions of Representatives. The direct logistics costs represent 8.5% of total net revenue, so an efficient logistics management is the key to business survival and competitiveness. This case stablish a method to optimize SC operations, defining the best packing criteria with an end-to-end vision, linking inner and outer package, warehouse configuration and freight maximization. This portfolio allies PMBOK and Lean Six Sigma to develop OTB methodology, contemplating the business as a whole, the distinguishing feature of OTB. Thus, OTB developed coordinated programs that unfold in multifunctional projects, based on product launch flow. We can see expressive financial, operational and environmental benefits. By now, the results are reuse of 48% of corrugated material, reduction of 50% of wood waste, 3% of all SC expenses and 27% of total pallets movement. It is also worth mentioning an improvement of manufacturing box occupation of 17%, using the best pallet configuration, raising freight occupation in 30% and warehouse density to 85%.

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Thematic area: Innovative Case Studies in Logistics & SCM

Business plan for efficient management of pallet flow on ceramic manufacturing sector

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1: Universidad del pacífico, Lima, Perú.

Abstract

The paper illustrates a business plan for the creation of a company specialized in providing efficient management of wood pallet flow on ceramic manufacturing sector. In this respect the name of consultant firm will be C&G pallets and will provide the service for the top three ceramic manufactures in Peru: Celima, San Lorenzo and Gala.

The principal benefits for our customer will be: Monthly savings by increased in recovery and repair pallets and secondly improve its image due to the environmental impact.

After a feasibility analysis, it was decided to provide the service to the top three manufacturers of ceramic due to three following reasons:

- High consumption of pallets (size)
- High potential for synergies for joint service (common)
- To be a dynamic sector with high growth with operations in nationwide (activity)

C & G Pallets will have three pillars:

- People, ensure that we have adequate skills to the needs of the organization
- Process, achieve optimum management of pallet flow
- Technology, is a key factor in our service as it will provide information organized in real time to us and our customers

The business opportunity presented by inadequate internal management by customers is reflected in the low rate of recovery and repair of pallets. Customers do not have the capacity nor the expertise and technology to control the flow of their pallets at national level. With this information and with the market survey we conclude that there is a great business opportunity.

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Current position: Engineer of hardware services

Thematic area: Innovative Case Studies in Logistics & SCM

EDR systems and technical training integration towards cost and accident reduction on road freight transportation in Brazil.

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4: Driver Assistance Systems (ADAS), UPM – INSIA, Carretera de Valencia (A3) km7, Madrid, Spain

Abstract

Because of the impact of accidents, which annually generate financial losses of U$ 10 billion and 54,000 death on Brazilian highways, with other common consequences to developing countries of Latin America and the Caribbean, the integration of embedded intelligence equipment, training and operational management have the potential to become powerful tools to complete the goals set by OMS to reduce deaths in the decade of road action. This paper presents the initial results of the training process based on information coming from Event Data Recorder systems in transport loads Brazilian companies. Our main objective is to develop a procedure that can be replicated in all types of road Transport Company in order to reduce the risk of accidents, the operating costs in addition to training drivers and managers aiming to increase the efficiency of organizations in these countries. The methodology is monitoring 90 vehicles and 12 drivers of three companies have already been evaluated during three stages which are: hidden monitoring, conscious monitoring and trained monitoring. After the second stage, the drivers received training focused on understanding technology and economical driving. Throughout the process event rates have been generated made for each 100 kilometres. With these developments we were able to quantify the importance of the integration of technology, training with the management monitoring as a way to reduce traffic violence in underdeveloped and developing countries. We believe that the continuation of studies is going to allow an advance in increase of the reliability of road transport in the world.

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Thematic area: Innovative Cases Studies in Logistics & SCM

Supply chain risk assessment using discrete-event simulation: A case study in Colombia

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1: LOGYCA/Research, Av. El Dorado # 92-32 Torre G5 Piso 5 Ed. Connecta, Bogotá, Colombia.

Abstract

Supply chain risks are understood as the probability that an unexpected event may occur and affect supply chain operations and the agreements among providers, manufacturers and customers. When supply chain Risks occur lead to commercial, legal, financial, contractual and even reputational consequences that affect enterprises.

In Latin America, Supply Chain Risk Management is incipient due to the low of importance given to it in companies and the features of the current methodologies used to measure risks. The most widely and used approach to assess the probability of occurrence and severity of the consequences of the risks is the qualitative one, where the defined scale assigns a value of high , medium or low to these two characteristics.

Accordingly, the objective of this paper is to present a case study of the application of a quantitative methodology to measure and prioritize risk impacts to the supply chain of two Colombian manufacturing companies.

The methodology is based on the application of interviews to determine the flow of activities of each processes of the supply chain as well as a systematic analysis of all their activities to identify potential risks that could affect them and their consequences if such risks occur. With this information a discrete-event simulation model was built, in order to represent the supply chain of companies under study and simulate the impact that such risks would have on their operations and based on this result prioritize risks and recommend mitigation strategies for the most representative ones.

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Current position: Leader of research in Technology in Supply Chain

14:00   Applied Operations Research II   E51 – 376

Thematic area: Applied Operations Research

A discrete event simulation model for relocation problems of Emergency Medical Service vehicles: a case study

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Abstract

Emergency Medical Services-EMS are systems responsible for the pre-hospital stabilization and transport of patients with emergency medical conditions. The EMS ability to respond quickly to emergency calls means the difference between life and death of patients. In order to have quick response times, the EMS vehicles must be located at appropriate places. However, this is not an easy decision to make. Due to rapid changes on the operational conditions, demand patterns and operational restrictions due to limited resources, the EMS vehicles location has to change constantly to provide an adequate service to users. This is known as a *vehicle relocation problem*.

In this work, we address the vehicle relocation problem in an EMS. A discrete event simulation model based on a real EMS service is presented to simulate the behavior of the system under different relocation rules. The model was implemented on SIMUL8. Results indicate that the relocation policy has an impact on the quality and opportunity of the service. Particularly, it is shown that under the policy of relocating the vehicles in the neighborhoods where the last service was attended it is possible to reduce the percentage of cancellations and waiting times of patients. Moreover, this policy allows greater availability of vehicles to respond to requests of patients, because they are available immediately after finishing a service. In contrast, when vehicles must travel to a base after completing a service, a significant increase occurs in the travel times, which affects the availability and increases cancellations and waiting time.

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Thematic area: Applied Operations Research

Multistage kidney exchange program optimization model using integer programming

E.R.Pérez1, W.J. Guerrero 1, and V.E.Ospina2

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2: CTG-Informática, Decanatura de Ingeniería de Sistemas, Escuela Colombiana de Ingeniería Julio Garavito, Colombia

Abstract

In this paper, we study an optimization problem for the kidney exchange program as a treatment alternative for patients with chronic renal disease at stage five. The proposed model aims to maximize the number of pairs participating in the exchange program and to minimize the number of patients affected by random failure scenarios. An example of a failure scenario is when a patient quits the program. In this manner, the model has the following two binary decision variables: First, one associated to a kidney transplantation, and the other one showing if a patient is affected at each failure scenario. The constraints include: 1) the maximum number of surgeries performed per day, 2) a pair cannot receive a kidney if a surgery to donate a kidney is not scheduled the same day or a day after receiving, 3) and finally, there must be any pair starting the cycle, i.e., they will not receive a kidney before donating. Preliminary experiments show optimal results for random instances with up to fifteen pairs with computational time of about six days. Then, this problem represents a challenge for engineering, and it is of great interest to generate software to reduce the computational effort required by the model to make optimal decisions in failure scenarios, and the optimal reconfiguration of exchange cycles to benefit as many patients as possible.

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Current position: Professor

Thematic area: Applied Operations Research

Multi Criteria Location's Model of Center of Solid Waste Disposal in Valle del Cauca Colombia

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1: Universidad del Valle, Campus Meléndez Calle 13 N. º 100-00 Building 357, Cali, Colombia.

Abstract

One of the most important problems that environment currently faces in Colombia and Latin America, as a result of the evolution of the present consumer society, is waste production. The facilities, where waste is produced, processed or stored, are a big issue, which should be given a specific location in a two-dimensional space. This paper addresses the problem of locating solid waste disposal centers in the department of Valle del Cauca in Colombia by applying a multicriteria methodology Analytic Network Process (ANP) with fuzzy logic for determine the best location.

Each potential location area is first characterized by taking into consideration such issues as the industrial, social, and cultural dynamics, access roads, costs, topography, environment and taxes. The decision-making process based on the relationships that are formed by the opinions of those who are involved in the process; such issues as main evaluation criteria and possible locations considering benefits, costs, opportunities and risks (BOCR).

The Fuzzy Analytical Hierarchy Process includes, in its process of hierarchical analysis the subjectivity of human judgment, a feature that was adopted in this work to include in the model the experience in this type of systems provided by a group of experts, to some extent reflect the elements involved in the decision-making process for such unwanted facilities by the use of fuzzy logic. This issue can contribute to solid waste management, so that it can be performed by taking into account environmental and community factors, but also the interests or economic factors of the company.

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Thematic area: Applied Operations Research

Evaluation of operational investments in Colombian Pacific port through simulation

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Abstract

Due to international trade growth, the need for logistics infrastructure that offer advantages in terms of cost, speed and reliability on the distribution of goods has increased. Ports as logistics infrastructures play an important role within a country's economy, by allowing movement of goods at lowest cost. In the case of Colombia, the country has a geographical advantage that allows it to have eight important ports to trade with South American countries. In Colombia, particularly, ports present problems in competitiveness because their logistics costs are affected in a large scale due the permanence of ships. Hence, they are currently investing in order to become more competitive and attracting cargo transshipment from the main ports in Central America and the Caribbean.

In this article we analyze the ship container loading and unloading system of a Colombian port in the Pacific region. Through simulation of the current state, It is studied the effect of investments in infrastructure such as purchase of cranes and dredging of the access canal over the performance of the system. To quantify the impact of these changes, some scenarios were analyzed and compared in terms of productivity indicators. The results show that investments are considered appropriated and there is suggested some ways to eliminate future bottlenecks.

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Thematic area: Sustainability

Optimization Plan for recyclable solid waste management in Chaclacayo District

M.Chong[1], S. Honorio[1], G. Sifuentes[1]

1: Graduate School, Universidad del Pafico, Universidad del Pacifico, Av. Salaverry 2020, Jesús María, Lima 11, Perú

Abstract

The disposal of generated of solid waste, represents a major environmental problem requiring priority attention from municipalities. The National Environmental Action Plan 2011-2021, indicates that in the last ten years the generation per capita of waste grew by 40%, reaching the amount of 0.782 kg / person / day in 2009. The physical composition of the waste is divided in 51% of organic matter, 10% of plastics, 9% of hazardous waste and others. Currently, there are just ten landfills nationally authorized for disposal of solid waste. The Program of Segregation at Source and Selective Collection of Solid Waste (2013) states that in 2015, 205 municipalities had implemented its program of segregation at source.

The Municipality of Chaclacayo is responsible for the management and disposal of waste generated in households within the district, and has decided to join the program Segregation at Source.

This work aims to optimize the process of collection of recyclable solid waste within the Chaclacayo district in Lima, managed through that program. The city concentrates around 9,996 families that generate an average of 0,250 kilos daily inorganic solid waste that due to its nature can be reinserted back in the production process after proper segregation and collection from the source. For this activity, the Municipality has requested the services of an association called San Juan del Alto, who executes the processes of collection, transport, packaging and marketing of such waste.

This research aims to improve the management plan of recyclable waste in the city of Chaclacayo, in order to maximize the collection of waste and, therefore increasing the revenue generated with the sale of these wastes. To obtain these results an optimization plan should be proposed that includes the following: reduction of costs, increase productivity, reduction in the process times and reduction CO_2; that is, includes all the activities: involves the collection, handling, transport, packaging, storage and marketing.

Of the following alternatives for waste management: waste reduction at source; recycling; and control technology applied to the end of the process, we will work with the alternative of waste treatment and disposal. Involves costs and will focus only on those generated in homes, i.e. those of household origin, such as inorganic recyclable solid waste, which will include PET, hard plastics, glass, paper and cardboard, and cans.

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14:00   Urban Logistics II   E51 – 395

Thematic area: Urban Logistics

One policy does not necessarily fit all:
A comparison of logistics profiles and potential policy solutions in different congested
zones in Quito, Ecuador

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2: Center for Transportation and Logistics, Massachusetts Institute of Technology, 77 Massachusetts Av.
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Abstract

This paper introduces a fundamental study to inform the development of a comprehensive urban freight plan for the city of Quito. Based upon the *MIT better cities for logistics* toolkit, this paper presents a clustering of urban areas using a set of demographic, economic and road-network infrastructure variables relevant for logistics planning. Eight clusters were identified, two of which are particularly important due to the major levels of commercial and residential density observed: Quito's *Historic Center* and the entertainment district. The *Historic Center* is one of the oldest and most touristic zones, having mostly narrow, single-lane, one-way streets (with no parking lane), and the commercial activities revolve during the day. Nanostores are the prevailing store format in this zone. The entertainment district, also known as *La Mariscal*, is located in relatively more modern area of the city, with relatively wider (multi-lane), one-way streets and the commercial activities there revolve during the day and night with a mix of nanostores, big-box retail, foodservice and accommodation establishments.

Given these results, and after analyzing the current state of the urban freight policy in the city, this paper presents a preliminary set of policy recommendations tailored to the needs of each cluster and leveraging well-known urban logistics practices. This study's ultimate objective entails supporting the development of proper regulatory frameworks and sustainable urban freight plans. In addition, the results are promising in the sense that many other cities in Latin America have similar characteristics and thus the results obtained could be applied elsewhere.

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Thematic area: Urban Logistics

Risk Management in Urban Transport Systems for Logistics Planning in Brasília, Brazil

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1: ENC/PIBITI, Centro Universitário IESB, SGAS Quadra 613/614 - L2 Sul, Brasília, Brazil

Abstract

The objective of this paper is to present how risk management in urban transport planning can ensure smaller uncertainties, raising sustainability, accessibility and reliability in urban logistics. While risk analysis is an important aspect in the management of critical structures, its use in urban planning is underrated. Planners could use risk analysis as an urban logistics tool to suggest damage-mitigating elements and risk monitoring strategies in their designs. The risk analysis considers flood probabilities and expected consequences. The paper exemplifies the method by evaluating the transport network of Brasília with its real transport demand and by studying the local flooding probability using the concept of rainfall threshold. The potential damage to logistics is determined by comparing the distance of the routes in normal conditions and in case of an occurrence capable of making part of the network temporarily unavailable. The work presents the results of floods analysis in a map and later combines it with the estimated potential damage, generating the final risk study that indicates the most important infrastructures. Later, the network elements are ranked from the strategic logistic point of view using risk as criteria. Consequently, the authors identify the most recommended improvements and make general suggestions for urban design that can lead to further developments in the transports and urban logistics planning. The risk management process proposed is expected to contribute to future studies on infrastructure planning and on raising awareness on risk management in cities logistics.

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Thematic area: Urban Logistics

An urban freight transport observatory for optimal mobility and distribution

Y. Jimenez[1], A. Polania1

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Abstract

The fast growth of urban areas generate problems that creates new challenges for different actors who must live within these cities, for example, the problem of urban freight mobility has become very important in recent years because of the impact on the logistics costs of companies which equals between 50 % and 60%.

The topic of urban freight is very broad in its functional, economic, environmental, technological and social aspects and one of the most visible manifestations is the fast increase in the number of delivery vehicles inside the cities. Truck circulation in urban areas entails a wide range of consequences that generate interventions usually restrictive to local economic activity.

The present work shows the progress in the technological development of an *Urban Freight Transport Observatory,* whereby information and indicators of the actual behavior of different cargo fleets in the city, are provided. The information was captured via the GPS (Global Positioning System) of each one of the freight vehicles of certain cargo companies in Bogota. This information reflects urban mobility behavior allowing to identify the areas of high traffic flow and also shows indicators as the critical times, average mobility rates, average delivery times, waiting time cargo loading, and others to generate strategic decision making elements.

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Thematic area: Urban Logistics

Identifying logistics critical areas in Madrid City

Eva Ponce-Cueto[1]

1: Research Associate. Center for Transportation and Logistics, Massachusetts Institute of Technology, 1 Amherst St., Cambridge, MA, United States

Abstract

The main goal of this paper is to identify critical areas for urban freight operations in the city of Madrid, Spain. Using public data from multiple sources, a multivariate statistical analysis is applied to segment areas in Madrid City, including identifying critical areas for logistics operations.

Two types of data were included in this study, infrastructure and socio-economic data. Infrastructure data included two variables, road capacity and road density. The input variables proposed for analyzing socio-economic data are: population, income and other socio-economic indicators, number of establishments (per category and size), and number of employees per establishment type. We apply an iterative, four-stage approach to using k-means clustering as a means to efficiently characterize the infrastructural and socio-economic properties of cities as Madrid.

The main contribution of this paper is 1) the identification of nine clusters in the City of Madrid; 2) The interpretation of the nine clusters in terms of urban freight 3) The identification of critical logistics areas in the City of Madrid; and 4) the proposal of future projects to analyse in deep the critical areas in order to propose public policies that are tailored to the logistics characteristics of the city.

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16:00   Innovative Cases Studies in Logistics & SCM III   E51 – 372

Thematic area: Innovative Cases Studies in Logistics & SCM

Simple and efficient tool for reduction in total inventory for Mexican fashion retail industries

S. Nucamendi-Guillén[1], M. A. Moreno[1]

1: Department of Industrial Engineering, Universidad Panamericana, Guadalajara, Jalisco, Mexico

Abstract

We propose an inventory management tool, "Equalizer", for replenishment and supply scheduling problems in environments with uncertainty, volatile demand, and short life cycle. Its novelty lies in the fact of dynamically adjusting a future replenishment schedule for items according to their demand behavior. The tool involves two phases: 1) using and analyzing historical sales data, demand behavior, state probabilities and internal classification. This analysis allows determine an expected demand for the next planning horizon and helps to identify replenishment policies according to this projection; establishing initial orders, timing and size for subsequent orders and determining an aggregate plan consistent with these policies. As a result, a supply schedule is determined with the purpose of reducing stock out, carrying costs of inventory and total investment in inventory and, 2) real demand is entered into the tool in pursuit of comparing the demand behavior against the program and making the required adjustments in order to reduce the probability of stock out for items which significantly increased their sales rate as well as reducing the probability of inventory for products that considerably decrease their sales rate. A case study in a Mexican fashion retail company was conducted. To assess its effectiveness, a simulated scenario using the suggested supply policies by the tool is compared against the real made supply decisions. Preliminary results demonstrate that the tool can effectively be implemented in the Mexican fashion retail industry and its implementation can promisingly be extended to other retail industries.

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Thematic area: Innovative Cases Studies in Logistics & SCM

An MRO inventory management system for an oil and gas company

C. Ruiz[1], J. Pacheco.[2]

1: Escuela Colombiana de Ingenieria/Julio Garavito, AK 45 (Autonorte) #205-59, Bogotá, Colombia.
2: Ecopetrol S.A / Universidad de la Sabana / Oil & Gas, Cra 7 # 32 – 42 / Campus del Puente del Común, Km. 7, Autopista Norte de Bogotá. Chía, Colombia.

Abstract

The scope of project is to propose a new system to manage inventory of maintenance, repair and operations supplies (MRO) in Ecopetrol. The current inventory model for MRO in the company starts with a classification based first on criticality or risk of the item. A second classification is a traditional ABC analysis based on total stock value.

The objective is to develop and implement an inventory management system that helps the organization to improve the decision making process and reduce its operational costs. It includes a classification scheme, considering different factors and inventory policies. First a multi-criteria ABC classification is proposed considering quantitative (objective) and qualitative (subjective) criteria.

In order to define a total score for each SKU a procedure derived from the Brown and Gibson model is proposed. The relative weight for each criteria was defined by consensus of opinion between different members of the staff, and the weighting procedure used within an Analytical Hierarchy Process (AHP) framework is used.

The inventory policies proposed depend first on the multi-criteria ABC classification and second on inventory turnover. Faster-moving items are planned with continuous and periodic review policies depending on the item category. Slow–moving are planned with min-max policies considering the Poisson distribution more suitable to describe demands of A and B items. A lot for lot approach is used for slow-moving C items. So far, the project has shown reduction in inventory related costs and improvement on the company's inventory and supply chain management.

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The effect of road gradient on vehicle routing decisions. The case of hilly topography cities

Thematic area: Urban Logistics

V. Suarez[1], W. Sarache[1] and Y, Costa[2]

1: Department of Industrial Engineering, Universidad Nacional de Colombia, Manizales, Colombia.
2: Logistikum, University of Applied Sciences Upper Austria, Steyr, Austria.

Abstract

The vehicle routing problem considering environmental and economic aspects is a relevant topic for City Logistics. In particular, fuel consumption is an issue of great interest due to its impact on transportation cost and greenhouse emissions. Several optimization models have been developed to address the suitable balance between cost and environmental impacts. However, in the particular case of hilly topography cities, the effect of road gradient on these performance goals has been narrowly covered and still demands for further assessment. In this sense, the present paper proposes the analysis of road gradient for the Heterogeneous Fixed Fleet Vehicle Routing Problem, which is probably one of the most studied variant in Vehicle Routing Problems (VRPs). This VRP variant is examined in the context of cities located in hilly regions. After a significant number of experiments, we design a different cost matrix based on a mathematical expression that includes the road gradient, average speed and total weight (vehicle and load). A genetic algorithm NSGA-II has been implemented to establish the route that minimizes the traveled distance and CO_2 emissions. The computational experiments show high quality solutions and reasonable computation time. The proposed model reflects a realistic situation set up in a Colombian city located on the Andean Cordillera. By applying the algorithmic proposal, a significant reduction on transportation cost and CO_2 emissions is observed. The obtained results show that the shortest distance is not always the best decision when the road gradient is considered.

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Thematic area: Urban Logistics

Characterization of urban logistics in an HORECA intensive area. Case study: "The T Zone" in Bogotá, Colombia

J. Chicaiza[1], D. Hidalgo[2]

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2: Pontificia Universidad Javeriana, Industrial Engineering Department, Cra. 7 #40-62, Bogotá, Colombia

Abstract

The fast growth of urban areas in major cities in Latin America is undoubtedly one of the biggest concerns for city officials. Data indicates that currently 81% of Latin American population live in urban areas, and trends and statistics suggest that by 2030 this amount will reach 86%.This will bring economic, political and social implications. Therefore, Urban Logistics is becoming moreover an increasingly important consideration in the overall city performance, and its management requires an efficient rationalization of its components.

In Bogota are given several places where the food services (hotels, restaurants, coffee shops - HORECA), pubs and bars are located. One of them, known as "Zona T (The T Zone)", is placed in the northern area of the city; it has plenty of food courts, fashion designers stores, convenience stores, shopping malls, pubs, discos and offices, being a critical zone of the city where distribution needs to be performed at its best to fulfil the requirements of customers.

The main objective of this study was to characterize urban logistic operations in "The T zone" by using the Km2 methodology defined by MIT. The novelty of this study is on the proposed key performance indicators to measure and compare information gathered using Km2 methodology; main results shown that there are three main KPI's categories: Operational, Energy & Environmental, and Traffic. Findings on this study show that urban logistic faces plenty challenges and have special needs to perform on the best possible way.

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Current position: Academic teacher

16:00   Urban Logistics III   E51 – 395

Thematic area: International Trade & Logistics

Business plan for export company organic chocolate

M. Chong[1], E. Buse[2], L. Lavaggi[3], G. Mori[4], M. Rozas[5]

1,2,3,4,5: Graduate School, Universidad del Pafìco, Universidad del Pacifico, Av. Salaverry 2020, Jesús María, Lima 11, Perú

Abstract

The objective of this business plan is to establish the feasibility of exporting Peruvian dark organic chocolate to the US market. This market is growing, because, the target audience is more aware of factors, such as a single origin beans, cocoa content, gourmet flavors and health care.

One of the most representative category are the dark chocolate tablets, which reached a 21% of the total market sector and also grew by 7% in terms of value of the US market in 2015.

The preference of gourmet for products in US adults is significant; 20% is definitely looking for this alternative when they purchase their home products and almost 60% occasionally. Additionally, 30% of consumers are willing to pay more for this kind of product, and 6% do so gladly.

To obtain the above the following general and specific objectives have been identified. General: identify and analyze the target market for our organic chocolate; know the main means of marketing and quality attributes for organic chocolates in the target market; determine the existing demand for organic chocolate in the target market. Specific: knowing the global chocolate market and trends in the premium segment; determine the destination country and know specifically the chocolate market; identify access conditions (tariffs, agreements, quotas and sanitary restrictions, etc.) in the target market; know the main distributors and retail outlets of organic chocolate in the target market; identify benchmark product prices and determine the current demand and potential output.

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.

Thematic area: Urban Logistics

A Comprehensive Disaggregated Urban Freight Model for Policy Evaluation

Y. Lee[1], C. Zegras[2] and, E. Blanco[3]

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3: Walmart Labs, 950 Elm Ave, San Bruno, CA 94066, USA

Abstract

We propose a conceptual framework that describes behaviors of individual decision makers within urban freight transportation systems. The framework provides a foundation for designing urban freight microsimulation systems for policy evaluations. The proposed model system extends beyond existing models in several ways. The framework includes the full range of relevant decision makers in the urban freight system, including firms, receivers, shippers, carriers and vehicle operators. Second, it aims to represent agents' various decision time frames, from long- to short-term, thus accounting for a range of decisions, from firms' location choice decisions, to trading activities, transport logistics network designs, vehicle scheduling, and en-route driving decisions. Thoroughly representing these time frames can help account for how short term decisions, such as order generation, may affect longer term decisions such as freight vehicle acquisition. Furthermore, the framework explicitly reflects how transportation system performance, the immediate observable outcome of short-term decisions, ultimately feeds back into other relevant choices by various agents. Finally, the model system intends to be consistent with microsimulation approaches being developed to model passenger travel demand and supply in urban areas, enabling a complete analysis of freight and passenger interactions. This comprehensive model system is designed to allow the full assessment of a range of policies and other interventions -from land use planning to road pricing to loading bay management- through estimating their direct and indirect impacts on all decision makers in the urban mobility system. The framework has implications for urban freight data collection, modeling, and policy evaluation approaches.

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Thematic area: Urban Logistics

Evaluation of best practices introduction for the managerial improvement in the urban freight transport

C. Oliveira[1,2], M. D' Agosto[1], M. Preger[1], D. Gonçalves[1], F. Gonçalves[1], F. Assumpção[1] and L. Marujo[3]

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3: Department of Industrial Engineering, Federal University of Rio de Janeiro, Av. Horácio de Macedo, 2030 – F101, Cidade Universitária, Rio de Janeiro, Rio de Janeiro, Brazil

Abstract

This study aims to evaluate the economic and environmental sustainability, as well as the level of service provided using electric tricycle (ETD) in urban mail delivery in Rio de Janeiro Municipality. The evaluation methods adopted and the data collection technique were designed to be suitable to the case study. Through the methodology used and the data collected a monthly reduction of up to 16.33% in total operational costs was identified for the use of ETD compared to traditional intermodal distribution (TID). Regarding to the environmental aspects, the amount of air pollutants and GHGs emitted by traditional intermodal distribution (TID) and avoided by the use of ETD was estimated as 33.72 g/CO; 64.48 g/NO$_X$; 0.03 g/RCHO; 6.06 g/NMHC; 0.14 g/CH$_4$; 0.66 g/PM and 28.89 kg/CO$_2$. There was an increase of 21% in ETD operation level of service (ratio between the number of customers served and the total time of the route). The use of ETD is feasible both from economic and environmental aspects, improving the Brazilian Post Office Company (Correios) level of service. Because it seems to be appropriate not only for urban mail delivery in Rio de Janeiro, this study could be considered relevant and applied to the entire urban freight transport in any city in the world. The direct social gain related to the use of ETD arises as recommendations for future works.

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Thematic area: Urban Logistics

The São Paulo Off-Hour Delivery Pilot: Impacts for City Logistics

H. Yoshizaki[1], C.B. Cunha[1], J. Giacon[1], F. Almeida[1], I. Kako[1], P. Laranjeiro[1] and C. Hino[1]

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Abstract

This paper discusses the main results of the off-hour delivery (OHD) pilot test in the city of São Paulo, Brazil, which took place between October, 2014 and March, 2015. The pilot was led by the city secretary of transport, and had support from the motor carrier syndicate, retailers' association, police, and academia. Its goal was to determine what are the main requirements, constraints, opportunities and threats for establishing a public policy related to shifting deliveries to late night in order to mitigate traffic congestion. Differently from the well documented New York's OHD pilot, all participant companies were volunteers, with no need of cash incentives. Eleven companies (grocery, fast food, cosmetic and pharmacy chains, and two manufacturers, including Coca Cola) participated, with forty five establishments (stores). Primary focus in São Paulo was on issues of safety and noise, besides productivity aspects of travel time, truck speed and delivery time. The pilot was considered very successful by the authorities and companies, with no registered complaints of noise or security incidents. Travel speeds were obtained from GPS tracking data and internal delivery systems, and showed significant gains. To the authors' knowledge, it is one of the few successful OHD projects in Latin America. The paper compares daytime and night operations, and shows that productivity in some chains would be improved significantly, but noise and safety must be carefully controlled to guarantee the expansion of the concept.

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16:00   Student Paper Competition   E51 – 376

Thematic area: Sustainability

Optimization in urban transport: An intermodal simulation with emphasis on energy efficiency

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Abstract

In general, it can be said that patterns of energy production and consumption have been based on fossil fuels, which generates emissions of local pollutants; greenhouse gases (GHGs) and jeopardize the energy supply long-term on the planet. With regard to urban transport, Brazilian cities have developed with emphasis on road transport. Thus, it is relevant to study energy efficiency in transport, to implement good solutions that meet the movements of users, and promote the efficient use of natural resources. The aim of this paper is to estimate, on a network of fictitious transport, energy efficiency displacement of a given passenger demand using different modes of transport in order to measure the energy efficiency of the network. Specifically, we intend to verify and compare the energy consumption and carbon dioxide emissions in intermodal transport by rail modes - Light Rail (LRT) and bus - bus. The methodology was developed based on documentary and bibliographical research for data collection, and applied operations research technique to assess the energy efficiency of the simulated network. The review includes the study of transport, their indispensability and influence on the environment. Energy efficiency in the transport matrix and the use of operations research as a support tool for optimization models are discussed. Finally, it observed that the modal integration, feeder system - distributor system - is an efficient solution as the energy consumption and GHG emissions. The methodology proved to be satisfactory and relevant and can be used for larger networks and real scenarios.

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Thematic area: Student Paper Competition

Re-designing the water-distribution system in low-income areas: A social oriented supply chain model for Pamplona Alta

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Abstract

Water is the driving force of nature and an important element for survival, welfare and socio-economic development. Although, this resource should be available to everyone; according to the UNICEF, 10.2% of the world population lacks of access. Inhabitants in Pamplona Alta (Lima, Peru) live this unfair reality and, according to the BBC, pay ten times more than families in residential districts.

Our study defines the guidelines in designing a new efficient distribution system for reducing the costs of the whole supply chain in Torres Minas –a human settlement in Pamplona Alta. For gathering data, we used in-depth interviews with the three main stakeholders: families, water-tank drivers, and the government's water supplier. First, we determined the average demand of water and geographical characteristics. Then, by applying Operations Research and Network Analysis, we optimized the non-linear system to propose a cost-minimization distribution network. We planned orderly distribution points called 'bus-stops of water' to enable the network.

The results show that the application of the guidelines reduces the costs of the current system and increases the resource accessibility. Indeed, the components of the actual cost for families –transactional cost and price-paid– were reduced in 52.67% and 26.62%, respectively.

According to the World Bank, access to water services in Latin America is highly unequal. With a rural access to sanitation of only 60%, the main challenge is how water is managed. Our study provides guidelines that could be used in other low-income areas to allocate water and enable a sustainable growth for Latin Americans.

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Thematic area: Student Paper Competition

Urban Logistics: Generating Solutions to Create a Better Environment for Commercial Logistic Activities. A Case Study of the Historic Center of Quito

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Abstract

Nowadays Latin America presents the highest rate of population and urbanization growth. Consequently, demand for goods/services has increased, leading to the creation of a complex delivery system and thus increased logistical activities. The city of Quito, especially the Historic Center, is facing the logistics problems mentioned above. The objective of this paper is to improve the commercial logistic activities related to loading and unloading goods in a dense commercial area of the Historic Center of Quito, Ecuador. As a possible solution to this urban freight problem, the calculation of the optimal number and location of loading and unloading bays was proposed. A delivery survey of the zone collected data regarding frequency and amount of deliveries. Based on this information, an optimization model was proposed to determine the optimal number and location of the aforementioned bays. Finally, a simulation of the delivery process was performed to readjust the bay´s optimal number. A total number of 75 bays was calculated to serve the total shopping stores of a representative square kilometer (km^2) of the Historic Center. This solution will minimize the delivery time, distance for deliveries and thus will help improve urban freight transportation and traffic congestion. This study could be used as guideline for further investigations in urban logistics, especially in Latin America where urban logistics is still under study. This paper is part of a Research Project of Urban Logistics in Quito, led by Universidad San Francisco de Quito (USFQ), in association with the Megacity Logistics Lab of MIT.

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Thematic area: Student Paper Competition

Urban Logistics Solutions in Latin America: A Study of a Modern Commercially Dense Neighborhood in the City of Quito-Ecuador

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Abstract

Population in Latin America has been increasing its growth rate through the years. As the cities expand and people move to urban areas, businesses have to struggle with major logistics challenges and rely heavily on timely and effective deliveries of resources in order to cope with consumer demand. The city of Quito, in Ecuador, is currently facing the logistic challenges mentioned above. To address these logistical challenges, concepts and techniques of urban logistics are proposed and developed in the literature. The objective of this paper is to understand the loading and unloading logistic activities in one of the most commercially dense neighborhoods in the city of Quito called "La Mariscal". An optimization model was used to determine the number of loading & unloading bays, and their optimal location, that should be implemented with the goal of enabling transportation companies to transport and deliver resources in a more efficient and effective way. Later, a simulation model was used in order to assess the performance of the solution in a more real context.

This investigation is part of a bigger urban logistics project in Quito that is currently being led by Universidad San Francisco de Quito (USFQ), with the support of the MIT Megacity Logistics Lab (MIT MLL).

As the following paper shows, with urban logistics solutions, simulation and optimization models, it is possible to make cities in Latin America become more mobile, sustainable and above all, livable.

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Thematic area: Student Paper Competition

A multicriteria approach for item classification in an inventory system applied to an emergency medical service

V. Carvajal[1]

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Abstract

Emergency medical services (EMS) are responsible for prehospital stabilization and transport of patients for which the availability and condition of medication is crucial, since it directly impacts patients safety.

In order to understand medication management on EMS, we performed an analysis in a couple of EMS. We detected deficiencies on the inventory review derived from the time constraints imposed by EMS dynamics.

Based on the analysis and taking as a reference an EMS in Medellin, we implement a multicriteria classification (MC) to prioritize 58 medications and generate inventory control policies which reduce the time dedicated to check the inventory but guarantees all inventory review. MC methodology consists of three phases, namely, determine criteria weights, integrate data system with criteria weights and group items into A, B and C groups. Based on the premise that our methodology must be effective, reproducible and easy to understand and apply in EMS, we selected analytic hierarchy process AHP as scoring method to determine the criteria weights and Pareto principle as clustering method to establish the groups of items.

Results establish a review size which indicates how many references of each group must check the crew on every shift. The partial prioritize inventory inspection, reduces the time dedicated to the review but at the same time guarantees all inventory is inspecting, allowing to improve the service offered to patients, increase response capacity and reduce operational costs related to resource utilization.

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Thematic area: Innovative Case Studies in Logistics & SCM

Supply Chain Decision Making: A System Dynamics Approach

J.S. López[1] and A.F. Cardona[1]

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Abstract

This article presents an analysis of the impact of delays, information management and type of demand, on the performance of a three echelons supply chain, based on the "beer game". Four scenarios of access to information on final demand for different members of the chain were developed over a system dynamics model. For each of these scenarios delivery delay times and type of demand were changed and four indicators were used to measure the supply chain performance: return on assets, accumulated income, and accumulated value of inventory and service level. The results show that the location (echelon) of the access to information is critical to the performance and in contrast to previous studies, this effect is independent of the type of demand. Moreover, the results are consistent with previous studies on the positive effect of the reduction in delays on the overall performance of the chain, regardless of the type of demand

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Current position: Student

Thematic area: Sustainability

Service Quality and Financial Sustainability of a Mass Transit System

I. Polanía[1], M. González[1]

1: Research on the system dynamics field, Icesi University, Calle 18 No. 122-135, Cali, Colombia.

Abstract

The Western Integrated Mass Transportation System (MIO) has faced over time several financial crisis due to multiple factors. To give a solution, system operators have focused in the reduction of operating expenses (maintenance budget, fleet size) as a short-term solution. The following article seeks to describe, through simulations based on a system dynamics model, the operational and financial performance of this mode of transport under three measures: gradual reduction of the maintenance budget, the withdrawing of a significant amount of buses and the increase of the bus fare. The application of the first two measures cause an evident decrease in operating expenses were the results for each measure are gradual and immediate, respectively. Both measures, however, aren't representing a long term meaningful operating cash flow. Although the bus fare increase causes a relieving behaviour both in the operating income and the cash flow, on the long term it stabilizes back in the crisis. The results shows that by taking such decisions, an unintended consequence could be a long-term negative impact on the operating cash flow that will deepen the crisis. This shows that the MIO should take other measures to improve the long-term effects. Between them, a possible decision may include integrating alternative modes of transport that used to be considered substitutes. This article will help other transportation systems in Latin American to see the risks of taking such decisions implemented by the MIO.

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Current position: Part of the group of researchers on the system dynamics field.

Day 2 – Tuesday, March 22
8:30   Sustainability I   E51 – 372

Thematic area: Sustainability

Car-free centers as a support method to urban planning: experiences from the perspective of Latin America's countries

S.S.A. Bortolazzo[1], M. Fujiwara[1], J.C. Souza[1] and A.M. Valente[1]

1: Transport Engineering and Management of Territory, Federal University of Santa Catarina, Post code 5156, Florianopolis, Brazil.

Abstract

The car-free centres is a new urban planning strategy, trend in many developed countries, is seen as a planning model for sustainable development of the central areas of cities. Car-free centres is an intervention that promotes sustainable mobility and equality, integrated with urban planning policies, social and land use, being an important educational factor and raising awareness of this theme. This paper seeks to verify how the major cities in Latin America have dealt with the problems of congestion in the urban centres and examines the measures, methodologies and policies in force or under development, to reduce vehicle traffic in central areas. Positively, the car-free centres practices add treatments for social and environmental issues known as atmospheric, visual and noise pollution, road safety, reducing health problems and obesity rates, climate, social isolation and lack of community cohesion. It can provide funds for investment in road infrastructure and public transport and contributes to reducing the use and dependence on resources such as oil. Most of the cities surveyed, there was no regulatory measures, but actions and experimental campaigns as Car-Free Day, Traffic Calming, associated or not, the Intelligent Transportation Systems (ITS), and incentives for non-motorized transport and pedestrian areas. In Brazil it will be motivated by political and current plans for urban mobility (Law No. 12.587 of January 3, 2012 and Law No. 13,089 of January 12, 2015) associated with these or even alone.

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Thematic area: Sustainability

Using a Dynamic Systems Perspective to dimensioning an electric bike sharing system: encouraging sustainable mobility in Universities

Karla Gamez-Pérez[1], Jenny Díaz Ramírez [2], Eleazar Puente Rivera[3]

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2: Civil and Industrial Engineering Department, Pontificia Universidad Javieriana Cali, Calle 18 #118-250, Cali, Colombia

3: Industrial Engineering Department, Monterrey Institute of Technology and Higher Education, Av. Eugenio Garza Sada SN Cerro Gordo CP. 37190, León, México

Abstract

The basic premise of the bike sharing concept is sustainable transportation. Particularly, public electric bike sharing systems (e-BSS) are gaining popularity in many regions of the world and some have suggested that could provide an even higher level of service compared to existing systems. Universities generally have serious mobility problems as a result of the increase in private vehicle travel. This study proposes a dimensioning of an e-BSS using a Dynamic Systems Perspective aimed at promoting the use of more sustainable alternatives to private vehicles at University zones. This study has been done in the Northern part of the University district in the city of León, Guanajuato, Mexico. It includes four universities with about 10,000 students in total, where the topographical conditions of the area and the absence of urban transportation systems encourage the adoption of an e-BSS.

The research methodology used includes: (1) the precedents and generalities of the e-BSS operation in worldwide implementations, (2) a description of a real case in the city of León, (3) the design and dimensioning methodology which involves: (3.1) Declared Preferences (DP) surveys; (3.2) an optimal stations location modelling and (3.3) a dynamic simulation model for evaluating and determining the ideal number of bicycles in each station, in order to make a final evaluation of service quality indicators such as unsatisfied demand and system utilization. An essential point to be highlighted in terms of the methodology is the use of a Dynamic Systems Perspective for the dimensioning of a new e-BSS.

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Thematic area: Sustainability

Returns Management Process for food recovery in Colombian retail sector

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Abstract

It is estimated that in one year, one third of the food produced in the world is wasted, in Latin America about 800 million tons of food are produced each year, however 200 kg/year per capita of food is wasted due to an inefficient distribution model that contributes to social, environmental and economic impacts. The present study analyze the returns management process for one retailer and two manufactures and propose a qualitative methodology in order to identify gaps and business best practices designed to prevent unsaleable product loses.

As a result, three main hotspots were detected: 1. Product handling and storage. The knowledge and abilities of back-store operators on issues such as cross-contamination, cold chain maintenance and quality standards, are vital for proper handling and storage of products for returning, especially products that can still be consumed by humans. 2. Decision making. It was identified that the handling, classification and separation activities of the returns, are not part of the core operations of the traditional supply chain stages, letting the final decisions with the operators. 3 Cost and legal issues: During the study established that donate the returns able for human consumption to the Food Banks could reduce food waste. However the Food Bank have to struggle with convincing potential donors in a country where donating food is more expensive than send it to the landfill, due to the local tax system and the lack of regulations that encourage donation.

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Thematic area: Sustainability

Eco-driving by replicating best driving practices

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4: Mechanical Engineering Department, Tecnológico de Monterrey Campus Toluca, Av Eduardo Monroy Cárdenas 2000, 50110, Toluca, México

Abstract

Fuel consumption accounts for about 50% of the operating costs of vehicle fleets used to transport cargo and passengers. By training drivers on these companies have reduced up to 40% To reduce fuel consumption, eco-driving techniques are based on keeping the engine speed within its green strip of best operation. However, major differences in fuel consumption among drivers have been observed even after eco-driving training programs. In this work we propose that, for each section of the route, vehicles replicate the operating conditions of those vehicles with similar technology, circulating on the same stretch of track that showed the best performance; that is, the lowest fuel consumption. To demonstrate the benefits of this alternative, a sample of 25 recent technology buses that travelled a route of 70 km was monitored for more than eight months on location, altitude, engine RPM, fuel consumption, and instantaneous speed. The route was located at high altitude (> 2500 MAMSL) with both flat and hilly terrain in urban and rural areas.

Vehicle velocity and motor velocity profiles per kilometre were constructed based on a statistical analysis of the best driving performance. When drivers were instructed to follow these profiles on the same route, an average 11% reduction in fuel consumption was observed.

Currently we are developing an IT tool that records in real time operating conditions of vehicles on each stretch of track, selects and updates those showing the best fuel consumption and reports them to new drivers moving on the same stretch.

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8:30   General Topics on Logistics & SCM I   E51 – 376

Thematic area: Sustainability

Valuation of a distribution center of an auxiliary rail freight terminal: Using real options with fuzzy sets and binomial trees

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2: Unidad Profesional Interdisciplinaria de Biotecnología del IPN, Av. Acueducto de Guadalupe S/N, 07340, Ciudad de México, México.

Abstract

In this paper the financial evaluation of the extension of an auxiliary rail freight terminal to integrate it into a logistics platform (LP) is presented. The investment takes place in phases, the first being the construction of a distribution center (CEDI), as part of a comprehensive project of high commercial and strategic impact in Mexico. The evaluation is done through Real Options methodology based on binomial trees Cox, Ross and Rubinstein type incorporating the expected volatility over the expected cash flows in order to determine the benefit of postponing the project in (T-t=3) term, providing flexibility to investors in their decision making. On the other hand, in the valuation of real option associated with the project, fuzzy sets theory as an alternative technique is applied, Milanesi G. Silverio. By using binomial trees in the valuation of a real option of American type of purchase it was determined that the value of the option to postpone the project is 30.37% of the value of investment in the CEDI project. While the valuation of the option that incorporates fuzzy logic the value of the option is the 29.94% of the value of investment in the construction project. The perspective of valuation of real options and the investor is fuzzy logic provides the flexibility to exercise according to which present financial and economic environment is an advantage for the investor to be more robust valuation techniques for capturing uncertainty.

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Thematic area: General Topics in Logistics & SCM

Intermodal Transportation Hub Location for the Bogotá – Buenaventura Logistics Corridor in Colombia

J. González-Velazco[1], J. C. Metaute[1], C. A. Rojas-Trejos[1], C. J. Vidal-Holguín[1]

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Abstract

Intermodal transportation networks have become an important topic for the logistics performance in Colombia, but the networks are still to be developed. Nowadays, Colombia's intermodal transportation focuses almost exclusively in commodities that move in incomplete networks. Consequently, very little research and development have been done on this topic in the country. In the present applied OR work, a purely binary optimization model, adapted from Alumur, Kara, & Karasan (2012), is proposed to determine the optimal number and location of intermodal hubs in the Bogotá-Buenaventura logistics corridor, through which moves around 51 percent of the total freight transported in Colombia. The model enhances the importance of the rail transportation in the country and the need for improving the infrastructure. In addition to standard formulations, the decision variables consider the selection of hub technology, which may be significant to reduce the hub opening and operating costs in the network. The model minimizes the fixed costs to open hubs and the transportation costs between hubs and between these and nodes; transportation costs between nodes assigned to the same hub are calculated separately and added to the objective function. The results show that the best solution is to open three hubs in Buga, La Felisa, and La Dorada, in addition to the two natural hubs located at Bogotá and Buenaventura; the best technology selected was container on flat car. This work shows the importance of using optimization models to improve the decision making processes concerning the transportation infrastructure in Colombia and Latin America.

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Thematic area: General Topics in Logistics & SCM

Optimization under uncertainty for the Retail Location Problem

C.D.R.Pico[1], W.J.Guerrero[1] and M. De Lara[2]

1: Escuela Colombiana de Ingeniería Julio Garavito, Colombia.
2: CERMICS, École des Ponts ParisTech and Université Paris-Est, France

Abstract

This paper studies a Retail Location Problem with inventory management decisions under uncertainty on the demand. The objective is to maximize the profit computed as the net present value of the cash flow. This problem context requires making strategic and tactical decisions periodically. We propose an integrated framework to optimize location and inventory management decisions for a company. Initially, we present an approach considering deterministic demand by an MILP (Mixed Integer Linear Program). Secondly, we present a Two-Stage Stochastic Program (TSSP) and a Multi-Stage Stochastic Program (MSSP) in order to include the uncertainty, where the demand is represented as a random process with a known probability distribution. Experimental results show that a MSSP produces a better representation of the uncertainty and real situation problems. We found that a scenario representation allows anticipating the demand, and then stockout or storage costs never appear. In addition, the TSSP cannot be solved, within reasonable computation time, when the number of scenarios is large. We decompose the MSSP in three different versions with increasing complexity as follows: i) A single retailer only optimizing the inventory management policy ii) A N-retailer case where transhipments between retailers is possible iii) The case where retailers opening decisions might be made at any period of the time horizon, and not only at the beginning.

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Thematic area: Sustainability

Stochastic multi-objetive optimization approach to redesign the sustainable reverse supply chain network for plastics recycling

M. Feitó-Cespón [1], W. Sarache[2], F. Piedra-Jimenez[3] and R. Cespón-Castro[3]

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3: Industrial Engineering Department, Central University "Marta Abreu" of Las Villas .Km 5 ½ Carretera de Camajuaní. Santa Clara, Cuba

Abstract

This paper presents a multi-objective mixed integer non-linear problem (MINLP) to redesign the sustainable supply chain for recycling several products. The model addresses the lacks found in scientific literature, by including environmental and economic integrated objectives with deep sustainability approach and the support to several decisions, both tactical and strategic, such as facility location, material flow design and allocation of transport, Furthermore, the decision making considers the utilization of fuzzy scenarios. The environmental impact objective is calculated through the Life Cycle Assessment (LCA) methodology, using the Eco-indicator 99. A multi-criteria programming approach algorithm to manage several objectives, linked with stochastic programming to address the uncertainty is developed in this research. Also, to assess the obtained solutions and to reduce the uncertainty effect on decision making an indicator is proposed. The model feasibility has been tested in Cuba. In this case study, the redesign of a supply chain for plastic recycling is examined. Experimental results showed the supply chain configurations that improve the sustainability performance.

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Current position: Profesor Titular

10:30   Sustainability II   E51 – 372

Thematic area: Sustainability

Urban Rail Transport in Brazil: barriers and trends

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Abstract

In general, it can be said that Brazilian cities had their urban development based on road transport. The quality of life in these cities has been deteriorating, causing diseconomies due to congestion, accidents and environmental impacts. Specifically, in the metropolitan areas, it works to implement good transport solutions that meet the movements of users, and at the same time, promote the efficient use of natural resources and investments. This short paper aims to foster discussion on urban mobility by rail, emphasizing issues such as: urban modal distribution, energy efficiency, difficulties and trends of this mode of transport. The paper is part of a developing research project, being grounded in their literature. Through research, it was concluded that the rail mode is a favourable alternative to equalize the urban transport matrix of the main Brazilian cities, can contribute to energy efficiency and reduce the amount of emissions of greenhouse gases. The difficulties have highlighted the need for greater investment and technological development, the practice of cheaper rates to be able to stay competitive among other modes. As trend for urban mobility, it can be concluded that the way has been evolving in Brazil, mainly through light rail vehicles (LRV), as in the case of the city of Rio de Janeiro that is shown in this paper as a case study.

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Thematic area: Sustainability

Mixed integer formulations for the Green Location Routing Problem

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Abstract

Over recent years, the need to design a sustainable logistic chains is increasing since it has become a differentiating factor for companies not only in Latin America but also worldwide. In this paper, two mixed-integer programming models are presented. The models decide the number and location of depots to be opened, the allocation of customers to those depots and the routing of a homogeneous fleet of vehicles to distribute a single product while satisfying customer demands. Likewise, the goal is to minimize the level of CO_2 emissions, which are correlated to the energy consumed by vehicles, assuming that it depends on the distance travelled and the load carried by the vehicle on each arc of the distribution network. The first model is inspired by the standard formulation of the Location-Routing Problem (LRP), often presented in the literature, and adapted for the new objective function. The second model modifies the definition of decision variables excluding the index associated to vehicles, and replacing it by an index for depots. A computational study is carried out using adapted benchmark instances. Preliminary results show significant differences in the performance of the mathematical models when solving the problem to optimality. On average, the proposed model solved the instances 96.72 % faster than the adaptation of the traditional formulation. Further, an analysis of the impacts of using the proposed objective function is presented. On average, the new objective function may reduce up to 35% the amount of CO_2 emissions compared to the solutions considering a cost minimization objective function.

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Thematic area: Sustainability

Fuel consumption in freight long distance in Colombia

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3: Eindhoven Technical University, P.O. Box 513, 5600 MB Eindhoven, The Netherlands
4: Mechanical Engineering Department, Tecnológico de Monterrey Campus Monterrey, Av Eugenio Garza Sada 2501 Sur, Tecnológico, 64849 Monterrey, N.L., México, México

Abstract

Approximately 13% of the total GHG emitted into the atmosphere come from the transport sector, and 75% of this value is due to wheeled vehicles. Similar values are observed in Colombia, a tropical country characterized by having a mountainous road network.

As consequence, important initiatives focused on reducing fuel consumption and atmospheric emissions generated by long distance road freight are being developed worldwide. As part of these initiatives, this work presents analytical and experimental results developed to describe the freight in Colombia, considering data from a ceramic goods' firm with domestic coverage. A methodology to identify operational variables that help estimate fuel consumption distinguishes four sets: driver's profile, driver's performance, vehicle type and route.

Fuel consumption of a vehicle fleet made of different technologies and load capacities, running on routes with large variations in altitude and distance were monitored. It was found that fuel consumption exhibits a normal distribution with mean and standard deviation of 1.600 and 0.497 l/100km, respectively. Statistical analysis and modelling were carried out to identify operational variables that are worth being monitored to improve fuel consumption, safe driving and drivers' performance. In addition, differences between before and after an eco-driving campaign are discussed. Results are used to contrast recommendations found in literature on urban bus transit operators and suggest corporate strategic improvements on sustainability programs.

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Thematic area: Sustainability

Optimization Model for Efficiency Energy of Road Freight Transport

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Abstract

Currently transportation is based on fossil fuels, which has become a source of urban and regional pollution of greenhouse gases that vary according to the type of transportation. Transport accounts for about 19% of global energy consumption and 23% of CO_2 emissions. Transport, Energy and CO_2 (IEA/OECD 2011). Consequently, the transportation industry must go through a transformation to provide sustainable mobility, reducing the consumption of fossil fuels.

The general objective of this proposal research is "Develop a New Optimization Model for Efficiency Energy of Road Freight Transport" the specific objective are: To determine the parameters of greater influence on energy consumption in operations of road freight transport and Develop a new conceptual model that includes these parameters and strengthen optimization models of vehicle routing problem presented until now.

The methodology to develop this research are divided in six phases: Analysis and State of the Art; Analysis the problem conditions and road freight transport system; Parameters Determination: Determine and identify the most influential factors to reducing fuel consumption; Develop the Optimization Model: Validate route optimization models with emphasis in fuel consumption parameters in road freight transport; Develop the Solution Method: Determine the best solution method for the new optimization model including new fuel consumption parameters with the most efficiency in number of instances-nodes (clients), number of parameters including, time and computational capability; Model Validation: Validate the model in service vehicles to record position, speed, routes, fuel consumption and all available parameters; Case studies: Apply validated model to quantify potential fuel savings.

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10:30   General Topics on Logistics & SCM II   E51 – 376

Thematic area: General Topics in Logistics & SCM

The inventory-routing problem with hard time windows

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Abstract

The studied problem considers the inventory routing problem with time windows (IRPTW) in a supply chain consisting of a single warehouse and multiple retailers. The planning horizon is discrete, finite and the decisions to optimize are the quantities to supply to retailers, and the sequence of retailers to visit in each time period. The system has a single vehicle with limited capacity, storage capacity constraints at retailers and it is required to satisfy retailer´s demand. It is assumed that retailers have deterministic demand. A mathematical formulation based on mixed integer programming is proposed, and the impact of the time windows configuration on inventory routing decisions is studied with two optimization methods based on mixed integer programming. The first method optimizes decisions simultaneously, while the second considers sequential decisions, making it a heuristic method. A computational study with 80 instances is presented.

Results show significant cost savings by making simultaneous optimization of routing decisions and inventories compared to the sequential optimization method. The study quantifies the impact of having time windows on the costs of inventory management. The total cost increases on average 12.53% for the studied instances when narrow windows are included. Thus, empirical evidence that the configurations of the time windows increase logistics costs, affecting the performance of the chain, both in inventory management policies and routing is given. Current research includes a study applied to a steel producer company in Colombia, where we seek to implement the proposed model on a real case, while identifying further research opportunities.

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Thematic area: General Topics in Logistics & SCM

Realities of land transport in Colombia: Context and Lessons from an emerging economy's point of view

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Abstract

In Colombia, the location of companies has been given according to the benefits provided by environmental conditions, as well as work space conditions related to different activities, in one particular region. Thus, primary sector activities that are the basis of the Colombian economy as agriculture, livestock, fisheries, mining, among others, are developed in areas with the optimal required environmental conditions, while industrial activities are usually located in the periphery of cities and towns, and related services settle in the cities. Geographical distribution highlights the central role of transport allowing communication and interaction between all sectors of the economy where there is interdependence. Therefore, transportation is critical, as it has much to do with the movement of people and objects (materials, supplies, tools, raw materials, semi-finished products, etc.) required for the manufacture of goods and services.

Land transportation, and specifically Road Transportation becomes the most used in Colombia, because it provides greater number of connections than other options such as air or sea, it can be accessible to anyone, and additionally in emerging markets, public and massive transportation are the most commonly used. This paper presents an analysis of the situation in Colombia in land transport between major cities, cities and municipalities, and between municipalities. From the analysis, it can be concluded that transport is one sector of the economy that allows access to many others, becomes a determining factor in the economic development of a nation, which affects the well-being of people

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Thematic area: Applied Operations Research

T1: Improvement proposal for the integrated planning of Amcor Rigid Plastic del Peru S.A. (Amcor Peru)

C. Fabian[1], M. Orna[1] and M. Polo[1].

1. Supply Chain Management/Postgraduate School, Universidad del Pacifico, Av. Salaverry 2020, Jesus Maria, Lima, Peru.

Abstract

The present applied operations research tries to identify the best proposal for planning the supply and demand in Amcor Peru, who has the 28% of the Peruvian PET preforms market. Its main customer, Coca Cola, demands short lead times; that is why Amcor manages high inventory levels. However the over costs are around US$95K because inventory sometimes does not response to the actual customer's requirements. The first step was to define the project scope; in this case we focused in local production because it represents 84% of Amcor's sales, in which, we identified that 80% belongs to 22 critical SKU's. Then, we analysed each process of the supply chain management such as purchasing, production, warehousing, sales and distribution to elaborate the *value stream mapping*, with which we identified that the critical process was the *preform storage*. To detect the causes and effects of this critical process, we used the *tree methodology* and it showed us that functional departments work with an *island's effect*, which means that each area works to obtain its own objectives instead of maximize the Amcor's profit. To eliminate the island's effect we compared the three planning phases: MRP (Material requirement planning), S&OP (Sales and operations planning) and IBP (Integrated business planning), choosing the S&OP as the best alternative for Amcor because it has the best impact and feasibility to implement. The savings for Amcor with this implementation will be US$8.5M.

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Thematic area: General Topics in Logistics & SCM

An agent-based simulation of intermediation in food supply chains: A case study

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2: Department of Industrial Engineering, Universidad de los Andes, Carrera 1E No 19-A-40, Bogotá, Colombia

Abstract

This paper presents a computational model aimed to study market-level effects of producers' and sellers' strategies in a supply chain of fresh products. A socially desirable outcome is not only reducing the role of intermediation, but also assuring an equitable participation of all involved actors. However, a critical problem is the presence of a noticeable cost heterogeneity among producers, which makes economies of scale a factor of dominance in market operations and constitutes an impediment for small producers to access the market.
The model is illustrated through a case study of intermediation in a fresh food supply chain of Bogotá (Colombia). We develop individual-based computational modelling approach. The model aims to represent a set of interacting software agents, who would act on behalf of the users of the above-mentioned platform and would execute the market transactions.

We present an agent-based model where several adaptive strategies embodied by the supply chain actors, are explored in order to understand implication on market outcomes (e.g., aggregated welfare and profit distribution). Adaptive strategies are understood in the context of repeated interaction (Kirman, et al., 2001) and under several interaction structures (i.e., with different degrees of intermediation). The model allows understanding important trade-offs between (i) access opportunities for small producers and overall cost efficiency of the whole supply chain, and between (ii) reduced levels of intermediation and feasibility of the implementation. The results show that intermediation leads to greater traded quantities than direct sales through retailers and that intermediaries operation is not always profitable.

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14:00   General Topics on Logistics & SCM III   E51 – 376

Thematic area: General Topics in Logistics & SCM

A proposed set of criteria for supply chain strategy evaluation

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Abstract

This brief article explores the applicability of evaluation criteria to the problem of evaluating the supply chain strategy of an organization. A discussion of supply chain strategy evaluation is relevant today, as the validity of the dominant approach – proposed two decades ago and based on matching types – has come into question. While evaluation criteria have a long history in other disciplines, they are new to supply chain strategy evaluation. To help supply chain scholars assess the applicability of evaluation criteria to supply chain strategy, this brief article proposes a tentative set of criteria and provides insights derived from the authors' recent experience with their use in two projects. We propose that the use of criteria for the evaluation of supply chain strategy may be a useful alternative, or at least a complement, to the dominant approach. We invite the empirical validation of these proposed criteria by third parties.

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Thematic area: General Topics on Logistics & SCM

A methodology for VSP with heterogeneous fleet. A case study in Colombia

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4: Department of Supply Chain Management, University of Applied Sciences Upper Austria Wehrgrabengasse 1-3 A-4400, Steyr, Austria.

Abstract

The optimal utilization of public transportation has become necessary to mitigate road congestion, noise pollution and GHG emission in the urban zones. Firms in charge of city transport system mainly focus on their fleet efficiency, ensuring the vehicle availability in the right time and right place under minimum total cost. In this context, the Vehicle Scheduling Problem (VSP) is a key issue to obtain suitable solutions for urban transportation. This NP-hard problem is concerned with assigning vehicles to trips so that the total vehicle costs are minimal.

In this paper, we present a methodology to solve the VSP with heterogeneous fleet of vehicles, minimizing the lead time and deadheading as the primary objectives. The proposed solution includes a heuristic procedure that generates sequence of trips for which the crew time break has been considered. Subsequently, a set covering model is created using the sequence of trips as input parameters. Then, the vehicle scheduling decisions are achieved after solving the set covering model.

The proposed methodology has been applied to a realistic case study. In particular, we studied the vehicle scheduling process in a Colombian public transportation company. Experimental results show a significant reduction in the lead time and vehicle deadheading after visiting the assigned locations. Finally, the outcomes indicated that our proposal presents better fleet utilization compared to the current company solution approach.

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Thematic area: General Topics in Logistics & SCM

An empirical analysis of the robustness of the parameters of the Inventory Control Policy *(ROP, Q)* using simulation

C. Castro-Zuluaga[1], A. Castro-Urrego[1]

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Abstract

This paper presents a comparison between the expected costs and service levels for theoretical parameters in the inventory control policy *(ROP, Q)* and the real results that are achieved with these values. The replenishment order was calculated using the economic order quantity (*EOQ*), while the reorder point was found for a 95% of Cycle Service Level (*CSL*). The reality is represented by a simulation model, which generates random values of demand that assumes that it is normally distributed with mean μ and standard deviation σ. A numerical example with three different scenarios is used to show the robustness of the model. Although, the results show that in general the expected values of service levels and total costs are close to the results obtained in the simulations, there are significant differences mainly in the order costs and stock out costs when the simulations are made in periods of months, so it is necessary to re-evaluate how these costs should be calculated. Moreover, if the simulations are performed in days, exist a high similarity between the expected values and the results obtained in the simulation, which varies according with the values of deviation of the demand. A preliminary analysis has allowed to establish than if the ratio between daily demand and its deviation is under 1.0, the differences in CSL are near to 1.5%; the fill rate is close to 0.5% and the total cost has a variation of approximately 6.0%, which gives an idea of the robustness of the model.

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Thematic area: General Topics in Logistics & SCM

Supply Chain Optimization for a Developing Furniture Manufacturer

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Abstract

This paper reveals the importance of having a production plan, especially in start-up companies. It improves the ability to act proactively instead of reactively to sudden changes. To make this possible it is important to have a full view and understanding of all the elements surrounding the manufacturing process.

The main problem SMEs (Small and Medium Enterprise) face is the lack of structure, this paper proposes many improvements to the company, but in order to take advantage of these, several changes in the information processes and layout should be made.

SMEs are the backbone of the Mexican economy because of the impact they have in the generation of jobs and in GDP growth. This paper highlights the importance for effective and efficient planning and administration of the supply chain in SMEs.

The main objective of the project is to optimize the supply chain of a furniture manufacturer in its developing stage. An "Engineer to Order" model was developed, focusing on raw materials inventory control. The project is constituted by three main components; demand analysis, installed capacity and inventory control.

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14:00   International Trade & Logistics   E51 – 372

Thematic area: International Trade & Logistics

Improved process for delivery in empty containers refrigerated in Logistica Integral Callao SA

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Abstract

International trade in Peru is growing boosted by the sustained growth of the economy (OLARTE, 2015) and the signing of 19 trade agreements negotiated by the Ministerio de Comercio Exterior y Turismo-MINCETUR and 4 more that are being negotiated (ADEX, 2015). It means that there is a greater requirement to provide effective and efficient solutions within the entire logistics chain, without excluding any sector in order to face globalization efficiently that suppliers and customers will demand; the need to work in strengthening research, tools and actions and be able to add competitiveness.

Logistica Integral Callao SA (LICSA), operates as an exclusive terminal of the shipping line Mediterranean Shipping Company of Peru SAC (MSC). It is through this terminal that MSC serves customers in reception and or delivery of containers, which are used for the load of exporting products from different sources and after exported to different destinations. To be competitive, this process, like the rest of the chain must be fast, fluid and should add value to the supply chain itself.

By improvement of 4 areas: management of an appointment system; implementation of a system for a better location of containers with improved inventory management; optimisation in the distribution of containers in the delivery process and selection and approval of transport companies.

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Thematic area: International Trade & Logistics

Value-Added Logistics-Services Potential after Panama Canal Expansion

Zoila Y. Guerra de Castillo[1], Pablo Alcides Arosemena[1], Ada Carolina Kelso[1] and Juan Marcos Castillo[2]

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2: IMSE Department/University of Texas at Arlington, WH room 420, 500 West First Street, Arlington, TX, USA.

Abstract

The transit using the Panama Canal represents 87.06% of the shipment flow, but just a 12.09% of the cargo movements arrives to Panama as a cargo (Panama Maritime Authority, 2013). However, the geographic position and the actual future opportunities based on the Panama Canal expansion can serve as a strategic hub of Value-Added Logistics-Services (VALS). Thus, this research aims to characterize the VALS in Panama identifying critical variables that enhance these services. A qualitative research was developed using a survey approach that applies a "Means-end Value Hierarchy Model" designed by Mentzer. The results shows what VALS providers and VALS customers ranked as an important issues in their trade. VALS providers is approximately 10 companies. Each company serves a mean of 20 customers, where 22% are national and 78% are international. The companies consider relevant the fact of working with logistics experts from Panama because of the geographical position and expertise. Another finding is that the load which receives value added in Panama it's mainly: labelling 45%, marking or tags 39.3% and repackaging 25%. As a limitation, the access to the managers of VALS providers was difficult, because their schedule.The research reveals the necessity of knowledge about VALS and their advantages in the Logistics sector. In addition, the results of this research was one of the inputs of the "Gabinete Logistico Nacional de Panamá" to develop a plan of VALS based on the Panama Canal.

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Thematic area: International Trade & Logistics

Estimating the impact of trade facilitation in regional supply chains: a case study in Colombia

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2: LogPort – Innovación Logística, Universidad del Norte, Km. 5 Vía Puerto Colombia, Área Metropolitana de Barranquilla, Colombia,

Abstract

This paper shows how the use of a supply chain perspective allows for better estimation and evaluation of the impact of trade policies on the economy. Based on a modelling framework which estimates costs related to international trade for buyers and sellers, we analyse extensive data from 16 economic sectors in Colombia to estimate the impact of modelling trade facilitation under a supply chain framework. We estimate the impact of trade to be 11.8% of the total trade volume. The model is also used to evaluate the potential impact of different trade policies, highlighting the importance of investing in in-country transportation to improve supply chain competitiveness. It is noticeable that for one scenario on improved payment terms the total global logistics cost did not show better results. The modelling framework and results provide the evidence for making the necessary changes on the mesoeconomic economic policies, in order to focus on the appropriate investments on logistics infrastructure, technology and logic for the improvement on the international of the regional economy. We also enhance previous research on trade facilitation and evaluate a global supply trade cost function on a vast sample of Colombia's import/export products. To the best of the authors' knowledge, this modelling framework applied to an emerging economy has not been implemented yet on a regional basis. Furthermore, the scenario planning structure used in this paper is novel. The information was gathered from direct declared preferences from participating firms in the study and other parameters defined by the authors.

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Thematic area: General topics in logistics and supply chain

Impact on fuel consumption of the use of fuel additives on heavy duty trucks and buses under different driving conditions

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Abstract

Fuel consumption in road freight transportation is a major source of gas emissions to the environment and accounts for a large portion of transportation costs, generating an increasing need for more fuel efficient freight transportation systems to be developed. In this context, several technologies have surged to improve heavy duty vehicles' fuel economy, such as: aerodynamic improvement devices, low rolling resistance tires and additives, among others. Therefore, it is important that their effectiveness be measured in ways that provide accurate and scientific results, while generating information to aid in the decision making process.

The primary objective of this paper is to determine the effect of a widely used additive by the transportation sector on fuel consumption in several conditions. Impact on fuel consumption due to the use of the previously mentioned additive was measured in four test conditions using two test procedures: "SAE J1321-Joint TMC/SAE Fuel Consumption Test Procedure" and "NCh 3331-Fuel consumption test method for transportation vehicles". Heavy duty trucks and urban buses were tested on a closed test track with driving conditions similar to those of their normal urban operation and another round of tests on trucks was carried out on a highway, with driving conditions representative of this kind of road. Further measures were carried out in order to meet the requirements established in both test procedures, mainly in the subject of driving cycle's determination. This study identifies and presents solutions to situations that can arise when undertaking tests using the test procedures mentioned before.

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