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Introduction


The forty projects submitted by the SCM Class of 2021 at the Massachusetts Institute of Technology are presented here as executive summaries of the master’s research projects, framed for a business rather than an academic audience. These summaries are intended to give the reader a sense of the business problems being addressed, the methods used to analyze the problem, the relevant results and the insights gained.

The projects summarized cover a wide selection of interests, approaches, and industries, and address real-world business problems in areas including sustainability, urban logistics, digital transformation, supply chain strategy, machine learning, inventory management, and transportation.

Each of the projects is a joint effort between a sponsoring company, one or two students, and one or two faculty advisors. Companies who are members of CTL’s Supply Chain Exchange are eligible to submit their ideas for research projects in June and July and then present these proposals to the students in August. In early September the students select which projects they will work on. From September until early May the teams conduct the research and write up the results. In late May all sponsors, faculty, and students participate in Research Fest where all the research projects are presented.

The SCM program is designed for early to mid-career professionals who want a more in-depth and focused education in supply chain management, transportation, and logistics. We welcome roughly 80 students each year from around the globe and across all industries. The research projects give students hands-on opportunities to put into practice the learnings they are receiving in their coursework.

We hope you enjoy learning about the types of projects our students completed this year. You may also view all of the full research papers on the CTL website: http://ctl.mit.edu/pubs. If you would like to learn more about the SCM Master’s Program or sponsor master’s student research, please contact us directly.

Happy reading!

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Class of 2021 SCM Research Projects

**Supply Chain Segmentation in the Apparel Industry**
By Fabian Ptok and Jonathan Camargo  
Advisor: Dr. Cansu Tayaksi  
Topic Areas: **Data Analytics, Inventory Management, Supply Chain Strategy**

The nature of the apparel industry is enigmatic. Customers want differentiated products and agility, yet apparel is mainly produced in low-income countries with long lead times to compete on cost. Supply chain segmentation has been widely used to combat this problem. By segmenting products and customers based on demand and variability, we discovered an inventory reduction potential of 6,2 million Euro for a company operating in the apparel industry.

**Identifying Root Causes of Stockout Events in eCommerce Using Machine Learning Techniques**
By Federico dos Santos and Tzu-Ning Chao  
Advisor: Dr. Cansu Tayaksi, Dr. Josué C. Velázquez-Martínez  
Topic Areas: **Data Analytics, Inventory Management, Machine Learning**

2020 marked an unprecedented growth in e-commerce driven mainly by the COVID-19 pandemic. Spike in the demand of certain products, lockdowns, and restrictions caused severe disruptions in the supply chains, leading to stockouts in the digital shelves. The focus of this project is to identify the main reasons that lead to stockouts for the sponsoring company to a major online retailer and to develop a model to predict stockouts.

**Measuring Disruption Indicators in Food Service Delivery Supply Chain**
By Amy Schwendenman and Teng Yi Li  
Advisor: Dr. Chris Mejia  
Topic Areas: **Data Analytics, Risk Management, Supply Chain Strategy**

In our research project to find lead indicators of supply chain disruption, we first identified what supply shocks looks like. We then looked for relevant external datasets to build a predictive model. Lastly, we quantified their impact on the sponsoring company. Our models predict instances of expedited shipments and delayed shipments as they relate to macro factors, such as severe weather and national slaughter rates.

**Dynamics of Supply Chain Sustainability**
By Jason Pang  
Advisor: Dr. Alexis Bateman  
Topic Areas: **Data Analytics, Machine Learning, Sustainability**

To better understand dynamics of global supply chain sustainability (SCS), this research focused on applying k-means clustering, non-parametric tests and Tableau visualizations of industry survey data. We validated our results with executive interviews. The learnings from this research can help business leaders develop their sustainability practices for the future. Key findings included how SCS changed from 2019 to 2020, what the COVID-19 impact was on SCS commitments, and new profiles of industries based on different types of SCS behaviors.

**Optimal Production Planning Strategies for Global CPG Company**
By Omar Sakr  
Advisors: Jim Rice, Dr. Nima Kazemi  
Topic Areas: **Data Analytics, Production Planning, Supply Chain Strategy**

Companies in the Consumer-Packaged Goods Industry are faced with a chronic dilemma: efficiency vs. agility. The main purpose of this capstone was to build a production planning strategy, generating operationally-feasible recommendations in aspects of manufacturing and logistics. The intent is to use a Mixed Integer Linear Programming model to optimize total, end-to-end supply chain costs, instead of conducting department-based budget management, thus driving significant cost reductions.
Digital Transformation for Flexible Last Mile Distribution
By Krishna Kuppuswamy
Advisors: Dr. Maria Jesus Saenz, Dr. Ozden Tozanli Yilmaz
Topic Areas: **Data Analytics, Digital Transformation**

Flexibility in last-mile distribution has become a key differentiator for companies obsessed with driving up customer experience. However, conventional methods of network redesign and deploying new distribution facilities involve significant investments in cost and time. This project establishes digital transformation as the core driver of flexibility by leveraging value stream mapping and simulation based future state design for flexible last-mile distribution. Additionally, a multi-criteria-decision-model is used to assess the digital capabilities required for this transformation. This project unlocks the value of digitalization with a frugal investment of time and money to help organizations reimagine their business and create value to all stakeholders.

Optimizing the Logistics Network for Pipeline Inspection
By Alessandro Scutari and Aviva Kosansky
Advisors: Dr. Josué C. Velázquez-Martínez, Dr. Cansu Tayaksi
Topic Areas: **Data Analytics, Network Design, Supply Chain Strategy**

The sponsor company uses a service model for their equipment, managing forward and reverse movement between inventory holding "hubs" and customers' worksites. Because the company has no formal inventory policy or demand planning process, and transportation costs are high, this project creates a baseline inventory policy for the North American hubs. The proposed optimized network and inventory policy could lead to a total mileage reduction of 30%.

Goldilocks and the Three Dispatchers: Quantifying the Impact of Dispatcher Management on Truck Driver Performance
By Danielle Procter and Paulo Sousa Jr.
Advisor: Dr. David Correll
Topic Areas: **Data Analytics, Machine Learning, Transportation**

This study leverages data from a mid-sized American trucking carrier and machine learning to evaluate and quantify the impact of carrier dispatchers on truck driver performance. Through clustering and regression analysis, it was shown that dispatchers have managerial levers that they can employ to improve driver performance across three metrics: HOS utilization, miles driven efficiency, and driver retention. The analysis also found that there is an inherent tradeoff in these key metrics: those dispatchers with the most productive drivers also see the lowest retention.

Defining and Detecting Churn in Truckload Transportation
By Kawin Jungsakulrujirek and Saad Rehan
Advisor: Dr. Chris Caplice
Topic Areas: **Data Analytics, Supply Chain Strategy, Warehouse**

The truckload transportation industry is an established industry, in the US, with annual revenue for for-hire truckload greater than 300 billion dollars in 2019. A major problem encountered by for-hire truckload carriers is a sudden, unexpected, and sustained reduction in shipment volume over lanes referred to as ‘churn’. Churn leads to a significant disruption in the balance of the carrier’s network which, in turn, drives up costs, reduces revenue and decreases driver satisfaction. In this capstone, which is a first-of-its-kind study within the truckload industry, we leverage data from our sponsor - a large national trucking firm - to formally define churn using three parameters: base, drop and duration. Based on this definition we identify churn by origin within the carrier’s network and then establish correlations between the characteristics of an origin and the likelihood of churn at that origin. This framework allows carriers to quickly detect churn before it materializes and take proactive steps to mitigate its negative impact. Our research on churn opens avenues for further study in this area, within the TL industry, including studying churn at a larger scale to develop more widely applicable ways of defining, identifying, and detecting churn.
Maximizing Profits in a Warehouse and Distribution Business Using Segmentation Analysis
By Aidar Darmesh and Ramon Mantellini
Advisor: Dr. Chris Caplice
Topic Areas: Data Analytics, Supply Chain Strategy, Warehouse

This project deploys cost allocation techniques to estimate transaction-level profitability of a warehousing and distribution operation in a third-party logistics company. Profit mapping revealed that most customers responsible for higher-than-average gross margins do not have higher profits due to intensive use of fixed-cost resources. To maximize profits the company should target reduction of specific cost items, bundle unprofitable services with profitable ones, and exercise caution in pruning customers.

Power Influence in Horizontal Collaboration Relationships
By Juan Suarez
Advisor: Dr. Maria Jesus Saenz
Topic Areas: Data Analytics, Supply Chain Strategy, Transportation

This research explores the influence of power in the performance of horizontal collaboration. Power causal effect was measured on the horizontal collaboration performance. Three different power asymmetries were computed to explain power relationships: income, cargo, and network, over two outcome variables, number of consolidated shipments and shipment cost per kg. These causal effects were computed for a set of 3,276 dyads and 1,095 single companies using, the augmented inverse propensity weight estimator method (AIPW) to analyze the average treatment effects empirically. A set of 16 experiments were conducted to understand the influence of the different asymmetries in the horizontal collaboration performance. Power shows both positive and negative effects regarding the dyad’s relationship features. Adequately managing power can boost supply chain horizontal collaboration.

Portfolio Modeling and Forecasting of Single-Use Rare Disease Treatments
By: Jordan Leising and Olivia Goldman
Advisor: Dr. Jarrod Goentzel
Topic Areas: Demand Planning, Healthcare, Supply Chain Strategy

Gene therapies are a new class of biopharmaceutical technology that might help address the many rare diseases with no current treatment. This capstone partnered with Roche to consider how portfolio theory could be applicable to the commercial supply chain strategy and global design for a mostly undefined clinical pipeline. Developing novel product forecasting techniques, portfolio modeling, and simulation are essential to addressing this problem.

Inventory Management for Slow Moving and High Volatility Items
By Esat Efendigi and Kristin Cameron
Advisor: Dr. Milena Janjevic
Topic Areas: Demand Planning, Inventory Management

Inventory management is critical due to its role supporting business continuity. When high service levels are required, companies frequently choose to overstock inventory, which is an inefficient use of working capital. Our capstone sponsor Optimas, a distributor of fasteners, requested an inventory policy playbook for slow-moving, high-volatility items. Using Python, SKUs were categorized, and appropriate inventory policies were applied to each category. The results show that using these recommendations, Optimas can save up to 50% of their total inventory cost while maintaining their customers’ required service level.
**Should Shippers Be Afraid of Ghost Freight? An Empirical Analysis of a Customer Portfolio from TMC, a Div. of C.H. Robinson**

By Alex Miller and Sherry Liu  
Advisors: Dr. Chris Caplice, Angela Acocella  
Topic Areas: **Demand Planning, Machine Learning, Transportation**

Ghost freight occurs when a shipper awards a lane to a primary carrier yet ultimately doesn’t tender any loads to that carrier on that lane. This concept has yet to be studied formally, and many industry experts suspect that ghost freight has significant implications for capacity planning and shipper-carrier relationships. This capstone develops an analytical framework to explore this topic using data visualization and linear regression. The frequency of ghost freight is analyzed along with its influence on shipper-carrier business outcomes and overall network trends.

**MIT Campus PPE Demand Planning**

By Kelly Sorel and Song Gao  
Advisors: Dr. Alexis Bateman, Dr. Jarrod Goentzel  
Topic Areas: **Demand Planning, Sustainability**

During the COVID-19 pandemic, MIT developed a temporary, centralized model for sourcing and distributing PPE and cleaning supplies. To inform this new model, we identified department strategies for requesting, receiving, and using these items. Additionally, we developed a calculator to help departments estimate their demand in a rational way. These initiatives contribute to the development of more sustainable PPE and cleaning supplies planning on campus.

**Increasing Resilience Through Advanced Analytics in a Pharmaceutical Company**

By Danning Chen and Valentina Anzola  
Advisor: Jim Rice  
Topic Areas: **Digital Transformation, Inventory Management, Machine Learning**

COVID-19 was a major pandemic that struck the world at the beginning of the year 2020. Many companies suffered sudden disruptions in their manufacturing operations, logistics and even in their capacity to reach their customers. This capstone project addressed the need of a global pharmaceutical company to understand what digital capabilities were required to be more resilient. In depth interviews, a resilience literature review and an application of a digital transformation framework helped identify transparency and advanced analytics as the main digital capabilities to increase resilience. In addition, the team implemented machine learning techniques to demonstrate how advanced analytics can help improve resilience. The team used decision trees and random forest to understand what factors influenced the capacity of the company to fulfill their order in its emerging market distribution centers.

**Adaptability of Manufacturing Operations through Digital Twins**

By Maria Fernanda Reyes and Sachin Garg  
Advisor: Dr. Ozden Tozanli Yilmaz  
Topic Areas: **Digital Transformation, Machine Learning, Manufacturing**

This project focused on studying how digital twins can react to a complex and dynamic environment to create an adaptive mechanism and how can digital twins add value to increase operational efficiency. To answer these questions, a learning feedback loop between discrete-event simulation and artificial intelligence algorithm was created. Methodologies in this paper provide insights and discover value associated with adopting these technologies for better decision-making.
Fuel Efficiency and Safety in Coca-Cola FEMSA Last-Mile Logistics
By Arturo Torres Arpi Acero and Fernando Gonzalez Gil
Advisor: Dr. Maria Jesus Saenz
Topic Areas: Digital Transformation, Machine Learning, Transportation

Driving styles of truck drivers in last-mile logistics have an undeniably important impact in both safety and fuel efficiency. We used data from a year’s worth of trips of over 3,000 trucks from Coca-Cola FEMSA to quantify the impact that driving styles have on fuel efficiency and safety. Most importantly, we discovered and analyzed the inherent tradeoffs between efficiency and safety. Our research serves as a data-driven framework to guide projects to improve driving styles.

Leveraging Predictive Analytics to Assess Operations Metrics
By Chiwei Kong and Nicholas Artman
Advisors: Dr. Maria Jesus Saenz, Dr. Ozden Tozanli Yilmaz
Topic Areas: Digital Transformation, Supply Chain Strategy

Key performance indicators (KPIs) are metrics that many organizations rely on to effectively manage their business. Our research identifies a robust methodology for utilizing predictive analytics and machine learning to assess different performance metrics. These methods provide insight into which KPIs are driving performance, their impact on corporate objectives, and forward-looking sensitivity analysis. Our research contends that predictive analytics can be used as a fast and cost-effective approach to review operations metrics.

Developing a Digital Solution to Container Triangulation in China
By Jieming Feng and Mauricio Moreno Sanchez Briseno
Advisor: Dr. Ozden Tozanli Yilmaz
Topic Areas: Digital Transformation, Transportation, Urban Logistics

How to improve container turnaround has become an increasing challenge for the shipping industry. Container triangulation can be defined as the reuse of import containers for export shipments. This research investigates the automatization and digitalization of the container triangulation process in China for Maersk. This study showed that triangulation can save time, cost, and carbon emissions but requires collaboration among different parties in the container transport industry.

Demand Forecasting for Food-Rations at the United Nations Darfur Mission
By Shawn Xiang and Langdon Hollingsworth
Advisors: Dr. Jarrod Goentzel, Chelsey Graham
Topic Areas: Humanitarian, Inventory Management

Our sponsor company, Agility, supplies food rations to United Nations (UN) peacekeeping missions in Darfur (UNAMID). Currently, Agility uses a simple three-period moving average forecasting method, also known as MA(3). Due to frequent errors in the order quantity forecasted using this method, along with various supply chain uncertainties, Agility incurs stiff penalties due to forecast inaccuracies. This study explores how these penalty costs can be reduced through forecasting accuracy improvements through the application of the optimized Holt-Winters forecasting model. With this optimized forecasting model, Agility could save at least $25,000 per year in just penalty costs at UNAMID alone. An additional study is recommended to explore how this model can be applied to further increase cost savings at other UN peacekeeping missions.
Network Design for Two-Day E-Commerce Fulfillment
By Cosmo Valentino and Ryan Wilson
Advisors: Dr. Matthias Winkenbach, Dr. Milena Janjevic
Topic Areas: Inventory Management, Network Design, Transportation

Online shoppers are becoming accustomed to free and fast delivery and Small and Medium-sized businesses are experiencing rising transportation costs to follow this trend. Our sponsoring company is a 3PL that seeks to configure its distribution network to serve these types of businesses. To support the sponsoring company, we have built an optimization model that minimizes the total logistics cost to meet demand within two-days and with a high level of service, while balancing the tradeoff between inventory and transportation cost. The model has been implemented on two customers and has been capable of adapting the network configuration depending on product characteristics such as weight and demand frequency.

How Postponement Strategy Can Reduce Cost and Lead Time for Pharma Supply Chains
By Lukasz Ploszczuk and Rebecca Nolan
Advisor: Dr. Matthias Winkenbach
Topic Areas: Inventory Management, Supply Chain Strategy

This capstone focuses on evaluating different inventory replenishment scenarios for low-volume SKUs to achieve the sponsoring company’s key objective of providing customers with life-saving medicines while minimizing cost, lead-time and inefficiencies. The goal of the model is to provide the proper tools and information necessary for our sponsoring company to use when evaluating whether or not to adopt a postponement strategy.

Micro-Fulfillment Feasibility for Metro Trade Area Transformation
By Feng Zhu and Sai Priyanka Jarugumilli
Advisor: Dr. Ozden Tozanli Yilmaz
Topic Areas: Inventory Management, Supply Chain Strategy, Urban Logistics

The recent change in customer behavior towards on-the-go orders drove Starbucks to optimize its store format to offer stronger curbside pick-up capabilities. To redesign the network with pickup-only stores, Starbucks needs to enable frequent inventory distribution to allow stores to meet demand while storing less inventory. By establishing distribution centers closer to stores, micro-fulfillment can allow stores to place small orders and receive deliveries frequently.

Tradeoffs in Strategic Capacity Planning Under Demand Uncertainty
By Jimmy Rose and Matthias Stolz
Advisor: Dr. Maria Jesus Saenz
Topic Areas: Inventory Management, Supply Chain Strategy

New Product Introductions often require strategic capacity investment decisions while there is significant demand uncertainty. Multi-tier supply chains and long investment lead times only add to the decision complexity. Through the optimization of 2400 scenarios, this project demonstrates a methodology for uncovering both the intuitive and non-intuitive tradeoffs in inventory and manufacturing capacity investments required to minimize total investments and the risk of lost sales.
The Secret Recipe for Modeling Warehouse Throughput
By Dana DeSutter and Sherry Gao
Advisor: Dr. Cansu Tayaksi
Topic Areas: Machine Learning, Supply Chain Strategy, Warehousing

Accurate throughput estimation is necessary for effectively planning replenishments, inventory levels, and labor resources to meet the needs of customers. We utilized linear regression to predict throughput, achieving a mean absolute percentage error (MAPE) near 10%. Companies with different packaging, demand volatility, and storage requirements can use this data to understand which variables drive throughput, and to optimally store inventory and make labor decisions.

Channel Flow Optimization for Product Allocation in Grocery Retail
By Abhijeet Singh and Yixuan Fang
Advisor: Dr. Eva Ponce Cueto
Topic Area: Network Design, Omnichannel, Sustainability

Product allocation in grocery retail is critical to ensure product availability at fulfillment locations. This project is focused on improving product allocation at the sponsor company. This goal is achieved by determining the most optimal values for key input factors of the model and layering in an additional parameter to improve the supply chain efficiencies of the process. The recommended solution could result in 12% annual logistics cost savings for the sponsor company.

By Austin Saragih and Syed Tanveer Ahmed
Advisor: Dr. Chris Mejia
Topic Areas: Network Design, Supply Chain Strategy, Urban Logistics

With 50 million nanostores globally, nanoretailing is the most important retail channel in developing countries. Fragmented channels of exclusive distribution cost nanostores more than half of their margins and hurt their business. We propose a non-exclusive eB2B distribution strategy that reduces fragmentation and cost-to-serve. Our results identify key factors on urban network design and strategic threshold values for companies to achieve optimal cost savings and profitability.

Delivering Locally Sourced Nutritious Food to Indian Households
By Sanchita Das
Advisor: Dr. Chris Mejia
Topic Areas: Network Design, Supply Chain Strategy, Transportation

World Health Organization (WHO) reports that in the South Asian region, the number of undernourished populations has hardly decreased in the last decade. This situation calls for a concerted effort to combat malnutrition. The effort must be grounded in nutrition and executed by supply chain mechanisms to reach all society segments. The key contribution of this thesis is a framework for identifying consumer clusters with similar taste preferences, designing an assortment of locally grown, preferred food items for each cluster and their distribution at scale. The scope of our study is the poorest of poor households in India (AAY population) and meeting their requirements of cereals and pulses for a healthy living.
Carbon Efficient Network Design: Evaluating The Trade-Offs Between Carbon Emissions, Transportation Cost and Delivery Time For a Middle-Mile Distribution Network

By Ars-Vita Alamsyah and Namuun Purevdorj
Advisor: Dr. Alexis Bateman, Dr. Suzanne Greene

Topic Areas: Network Design, Sustainability, Transportation

This research solves for the optimal middle-mile distribution network that minimizes carbon emissions while meeting transportation cost and delivery time objectives. Pareto frontiers were plotted to derive the trade-offs between objectives and the optimal scenarios that align with global climate targets. Results indicated it is necessary for companies that have transportation-heavy operations with short delivery timelines to transition into alternative-fuel vehicles to meet climate targets.

Potential Benefits of Drones for Vaccine Last-Mile Delivery in Nepal

By Adriana Lembcke and Ornipha Vongasemjit
Advisor: Tim Russell

Topic Area: Network Design, Transportation, Urban Logistics

This research determines which districts in Nepal could use drones for vaccine last-mile delivery, quantifies the benefits, and recommends appropriate drone types. The results indicate that implementing drones is suitable for rural health facilities of the mountainous regions of Nepal. However, the implementation provides cost benefits only when start-up costs are subsidized or when the drone operation is outsourced by lower than $0.10 USD/dose.

Network Optimization: International Inbound Logistics

By Lipsi Kumari and Scott Sladecek
Advisor: Dr. Milena Janjevic

Topic Area: Network Design, Transportation

Optimizing the flow of goods across the globe is incentivized by logistics savings, amplified by an enterprise's economies of scale. Waters' international shipments are majorly carried out via air freight and are exclusively performed by three main carriers: Expeditors, FedEx, and UPS. The specific problem addressed in this capstone is finding the best solution to systemically reduce the overall inbound international logistics costs for Waters Corporation, which have been flagged as higher than necessary over the last two years. The project methodology followed three main steps: receiving raw data, analyzing the excel spreadsheets, and finally providing outputs of findings. The different sets of raw data were bucketed into two main categories: historical shipment level detail (SLD) and Waters negotiated rates (rates). The carrier-selection cost savings are estimated at 1% of Water's total international logistics costs into their three DCs. There is a growing opportunity to expand that savings target by reducing the number of annual shipments. The estimated 1% savings can be materialized through a decision-making tool allowing automatic selection of a carrier that ensures lowest shipping costs.

Vessel Network Optimization in the Great Lakes Region

By Sena Perk and Yashar Ahmadov
Advisor: Tim Russell

Topic Area: Network Design

In this project we developed a vessel network optimization model for a dry bulk shipping services provider in the Great Lakes region. The model provides the optimal allocation of vessels for each trade lane and the optimal monthly sequence of trips for each vessel. The results indicate that the optimization model provides 20% reduction in ballast ratio per net ton.
Improving Survival of Micro & Small Firms in Latin America During COVID-19 via SRM and CRM Strategies
By Rafael Illipronti
Advisors: Dr. Josué C. Velázquez-Martínez, Dr. Cansu Tayaksi
Topic Area: Procurement, Sustainability

In Latin America, the COVID-19 pandemic has put many micro and small enterprises (MSEs) in danger of bankruptcy. In this work we argue how those companies can leverage the use of supplier and customer relationship management to collaborate with other companies in the supply chain to improve their cash availability and increase the likelihood of their survival.

Supply Chain Simulation for Production Strategy Evaluation
By Catherine Oswald Ballali and Rui Yin Tan
Advisor: Dr. Cansu Tayaksi, Dr. Nima Kazemi
Topic Area: Production Planning, Sustainability

In our research project we developed a Discrete Event Simulation model to determine the best production strategy that yielded the lowest total relevant costs and the highest fulfillment rate for a CPG company. seven scenarios of varying level of MTO and MTS strategy were used for analysis. Our model helps companies to consider seasonal demand and customer order lead time volatility in determining the effective production strategy for individual SKUs and Segmented SKUs. Results show that a hybrid production strategy yields the best fulfillment rate and lowest total relevant costs for a company facing volatile demand and customer lead time.

Advancing the Circular Economy of Plastics Through eCommerce
By Jacob Backstrom and Niranjini Kumar
Advisors: Dr. Eva Ponce Cueto, Dr. Suzanne Greene
Topic Areas: Retail Operations, Supply Chain Strategy, Warehouse

Despite efforts to increase plastics recycling over the years, the recycling rate is significantly lower than the production rate. This capstone project develops an innovative and convenient business model that leverages the existing eCommerce logistics network to facilitate a plastics closed-loop supply chain. Our results highlight the need for a multi-stakeholder coalition, with a high level of integration to make this model a success.

The Impact of Trade Credits in Nanostore Distribution
By: Blake Stimpson and Marcos Mogollon Linares
Advisors: Dr. Josué C. Velázquez-Martínez, Dr. Jan C. Fransoo
Topic Areas: Supply Chain Strategy, Sustainability, Urban Logistics

This project explores the effectiveness of trade credits in mitigating the effects of cash constraints in nanostore distribution networks. We find a 60% increase in sales, 40% decrease in rejections, and 20% reduction in stop duration. We further model return on investment, calculating 50-80% per month depending on credit level. These results support the implementation of credit for nanostore suppliers like our sponsor company and may contribute to increased productivity in the channel overall.
Diving Deep into the Determinants of Driver Dwell
By Leora Sauter and Michelle Roy
Advisors: Dr. David Correll, Dr. Chris Caplice
Topic Areas: Supply Chain Strategy, Transportation

This capstone explores one of the main causes of the underutilization of truck drivers, known as driver dwell. An understanding of the deeper complexities contributing to this issue will allow U.S. Xpress and other carriers to better support their drivers in working optimal hours. The benefits of improving this understanding will be widespread for drivers, trucking companies, and their customers. As drivers are paid for miles driven while carrying a load, better utilization will allow the truck driver to earn more, which will in turn drive higher retention rates. Higher retention rates allow companies to function more efficiently and better serve their customers.

Innovative Consolidation Techniques for Improved Transportation Efficiency
By Daniel Piechnik and Olivia Schaufenbuel
Advisor: Dr. Matthias Winkenbach
Topic Areas: Supply Chain Strategy, Transportation, Urban Logistics,

Many trucks in the US travel well below permitted cube and volume utilization. Consolidating two or more shipments onto a single multi-stop truckload (MSTL) route can increase truck utilization and decrease transportation costs. This report used a set-covering formulation of the Practical Pick-up and Delivery Problem (PPDP) in combination with clustering and an adapted column generation approach to identify consolidation opportunities. The model identified network cost reductions of 11% for a leading digital freight broker.

Automation of Warehouse Decision Making
By Roogers Marino and Zeyu Wu
Advisor: Dr. David Correll
Topic Areas: Warehouse

The current decisions being made by warehouse managers are not the most efficient. Lack of consistency in decisions and not being able to keep track of all the necessary variables to decide has driven the FMCG company to find a better approach by automating the decision-making process. A simulation model that runs different scenarios and policies was built to simulate and analyze the results for every scenario.
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