



Centre for Transportation and Logistics

INDIAN INSTITUTE OF MANAGEMENT AHMEDABAD

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NEWSLETTER

JANUARY - JUNE 2023

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CTL Faculty Spotlight



Dr. Maya Ganesh
Assistant Professor
Operations and Decision Sciences

1. What is your take on technology enabled improvements being implemented in an attempt to improve the efficiency of government schemes targeting food security and poverty eradication in India?

Beneficiaries of India's food security programme have traditionally been assigned a specific agent from whom they receive their food entitlements. Due to the monopoly of agents involved in last-mile delivery, the program suffers from several inefficiencies despite the massive amount of resources spent on them. Many state governments have recently introduced technology enabled agent choice to empower the beneficiaries. As part of our studies, we found that while a significant number of beneficiaries are using this choice, the usage levels among the vulnerable populations such as rural, the poor, the elderly and the socially disadvantaged is lesser in comparison to their non-vulnerable counterparts. This underscores the limitation of technology-driven improvements in welfare programmes, as the population segments most likely to benefit from them are also the least likely to reap the benefits due to lack of complementary network related improvements such as communication, awareness and ease of accessibility.

2. According to the Food and Agricultural Organisation (FAO), almost 40% of India's food produce is wasted. How can robust logistics network design and predictive analytics be used to resolve this problem?

The logistics network design and architecture play a vital role in how well supply chains perform. The design elements involve strategic decisions that include determining the number of warehouses, their location, size, and cross-docking locations; and tactical decisions that include distribution network planning and vehicle routing. The availability of micro-level data together with computing power enables the use of predictive analytics tools and makes it easier than ever before to make optimal decisions dynamically, that can influence the amount of food waste, by addressing the unique challenges of food supply chains, which can vary significantly based on factors like farmer population, produce, markets, pricing, variety, volume, and shelf life.

3. Food delivery and quick service restaurants are generating a massive volume of food consumption data especially among urban demographics. What do you think the future of food delivery and restaurant analytics looks like, and what future use-cases can we expect to see out of it?

On the one hand, the rich transaction-level data that is being collected by the restaurant industry can be used to accurately forecast demand on a micro level than was earlier possible - on the spatial, time, and variant dimensions. This would help design leaner inventory policies, which will have direct repercussions on wastage of food at all stages of the restaurant supply chain. On the other hand, this transaction-level data can be used to decipher changes in dietary patterns and consumption patterns of customers. Examining the heterogeneity in such patterns based on gender, age, income levels, and other demographic dimensions can go as inputs in policy making with respect to both evaluating the existing policies in healthcare, nutrition, and welfare benefit programs and making relevant modifications to better suit the requirements of various demographic groups

CTL Faculty Spotlight

A research article of Dr. Debjit Roy, Co-Chairperson and his then doctoral student Dr. Vishal Bansal, now a faculty member at IIM Calcutta has been recognised as a top cited article 2021-2022 by Naval Research Logistics



Due to demanding service levels in e-commerce order fulfillment, modeling and analysis of integrated storage and order picking processes in warehouses deserve special attention. The upstream storage system can have a significant impact on the performance of the downstream order picking process. With a particular focus on multiline e-commerce orders, we develop an analytical modeling framework for integrated analysis of upstream (shuttle-based storage and retrieval system) and downstream (pick system) networks. To capture the consolidation delays in fulfilling multiline orders, the downstream pick system is modeled with a closed queuing network that includes synchronization nodes. The configuration of the synchronization station is adapted to model the variety of order profiles handled at the pick station. For the downstream closed queuing network, we propose a decomposition-based solution methodology that results in good solution accuracy. The resulting semi-open queuing network (SOQN) of the integrated system is analyzed using the matrix-geometric method (MGM). To improve the accuracy of analytical estimates of the measures, we propose a hybrid simulation/analytical framework, where the performance measures of complex subnetworks are obtained from simulation. We also develop a detailed simulation model of the physical system for validating the analytical and hybrid estimates of the performance measures. The results from experiments indicate that the hybrid simulation/analytical approach reduces the error in the throughput time estimates to 3% from 18% obtained from the analytical model. Then, we investigate the effect of the upstream network configuration (such as the number of storage aisles) and the downstream network configuration (such as the mixed vs. dedicated picking, CONWIP control for orders, order batching) on the order throughput times. Our analysis provides a threshold on the maximum numbers of allowable orders (CONWIP control) and number of aisles beyond which the improvement in average throughput time of the integrated system is marginal. Numerical experiments with high-order arrivals also highlight that mixed picking in the downstream network can result in significant throughput time reduction in comparison to dedicated picking.

Read here: <https://onlinelibrary.wiley.com/doi/full/10.1002/nav.21978>

CTL Faculty Research Papers

1. Project scheduling under the threat of catastrophic disruption

Our CTL faculty, Dr. Prahalad Venkateshan published a research paper with Dr. Joseph G. Szmerekovsky, Dr. Peter D. Simonson titled "Project scheduling under the threat of catastrophic disruption"

We consider the case of scheduling a project under the threat of a catastrophic disruption where the likelihood and timing of the disruption are independent of the project schedule and if the disruption occurs, the project is completely canceled. In such scenarios, there is high managerial interest to know the maximum investment at risk at any time during project execution. This can be answered using the alphorn of uncertainty which maps the maximum and minimum possible project costs during project execution when activity durations and, correspondingly, cash flows are random. We prove the NP-hardness of calculating the alphorn of uncertainty and provide a mixed integer linear program for calculating it. The mixed integer linear program is shown to be able to calculate the alphorn for projects with up to 145 activities efficiently. We also show that using railway scheduling as opposed to roadrunner scheduling can significantly reduce the maximum possible investment at risk without significantly delaying the project.

Read here: <https://www.sciencedirect.com/science/article/pii/S0377221722010049>



2. Multiple allocation hub location with service level constraints for two shipment classes

Our CTL faculty, Dr. Sachin Jayaswal published a research papers with Dr. Navneet Vidyarthi titled "Multiple allocation hub location with service level constraints for two shipment classes"

In this paper, we study a hub network design problem arising in the context of a third-party logistics (3PL) service provider, which acts as an intermediary between shippers and carriers. A 3PL service provider usually caters to different classes of shipments that require different levels of service, e.g. two-day delivery, next-day delivery etc. We, therefore, study the problem under stochastic demand from two classes of shipments, with one class receiving priority over the other in service at the hubs to maintain the different service levels required by them. To this end, we present two models for designing a capacitated hub network with a service level constraint, defined using the distribution of time spent at hubs, for each shipment class. The models seek to design the hub network at the minimum total cost, which includes the total fixed cost of equipping open hubs with sufficient processing capacity and the variable transportation costs. The network of hubs, given their locations, is thus modeled as spatially distributed priority queues. The resulting model is challenging to solve, for which we propose a cutting plane-based exact solution method.

Read here: <https://www.sciencedirect.com/science/article/pii/S0377221723001169?via%3Dihub>

3. Emerging practices and research issues for big data analytics in freight transportation

Our CTL faculty and Co-Chairperson, Dr. Debjit Roy published a research paper with Dr. Michael F. Gorman, Dr. John-Paul Clarke, Dr. René de Koster, Dr. Michael Hewitt, and Dr. Mei Zhang titled "Emerging practices and research issues for big data analytics in freight transportation"

Freight transportation has been experiencing a renaissance in data sources, storage, and dissemination of data to decision makers in the last decades, resulting in new approaches to business and new research streams in analytics to support them. We provide an overview of developments in both practice and research related to big data analytics (BDA) in each of the major areas of freight transportation: air, ocean, rail, and truck. In each case, we first describe new capabilities in practice, and avenues of research given these evolving capabilities. New data sources, volumes and timeliness directly affect the way the industry operates, and how future researchers in these fields will structure their work. We discuss the evolving research agenda due to BDA and formulate fundamental research questions for each mode of freight transport.

Read here: <https://link.springer.com/article/10.1057/s41278-023-00255-z>



Major Events Organized

Research Webinar

1. Bridging Optimization and AI: Some recent advances in solving transportation problems

Research Webinar on “Bridging Optimization and AI: Some recent advances in solving transportation problems” by Dr. Lavanya Marla, Associate Professor, Industrial and Enterprise Systems Engineering, University of Illinois Urbana-Champaign on January 6, 2023.




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Centre for Transportation and Logistics

Research Webinar on
**Bridging Optimization and AI:
Some recent advances in solving
transportation problems**

January 6, 2023 at 04:00 p.m. IST

Moderator :
Dr. Debjit Roy
Institute Chair Professor and
Co-chairperson, CTL

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Dr. Lavanya Marla
Associate Professor
Industrial and Enterprise Systems Engineering
University of Illinois

Abstract

Dr. Marla discussed the problem of collaborative routing of aircraft and unmanned vehicles, under non-stationary conditions with spatial-temporal correlations. Prof. explained how her studies generate optimal/near-optimal sampling policies under: (i) state independent routing, and (ii) state-dependent routing and how on the aviation data, the results show that collecting the right information and utilizing it to plan future aircraft routes could reduce a flight's travel time and associated fuel burn by 5% on average.



2. It's Not Simply Luck: The Impact of Network Strategy, Schedule Padding, and Operational Improvements on Domestic On-Time Performance in the US Airline Industry

Research Webinar on It's Not Simply Luck: The Impact of Network Strategy, Schedule Padding, and Operational Improvements on Domestic On-Time Performance in the US Airline Industry " by Dr. Milind Sohoni, Professor of Operations Management, Indian School of Business on January 10, 2023



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Research Webinar on
It's Not Simply Luck: The Impact of Network Strategy, Schedule Padding, and Operational Improvements on Domestic On-Time Performance in the US Airline Industry

January 10, 2023 at 5:00 p.m. IST

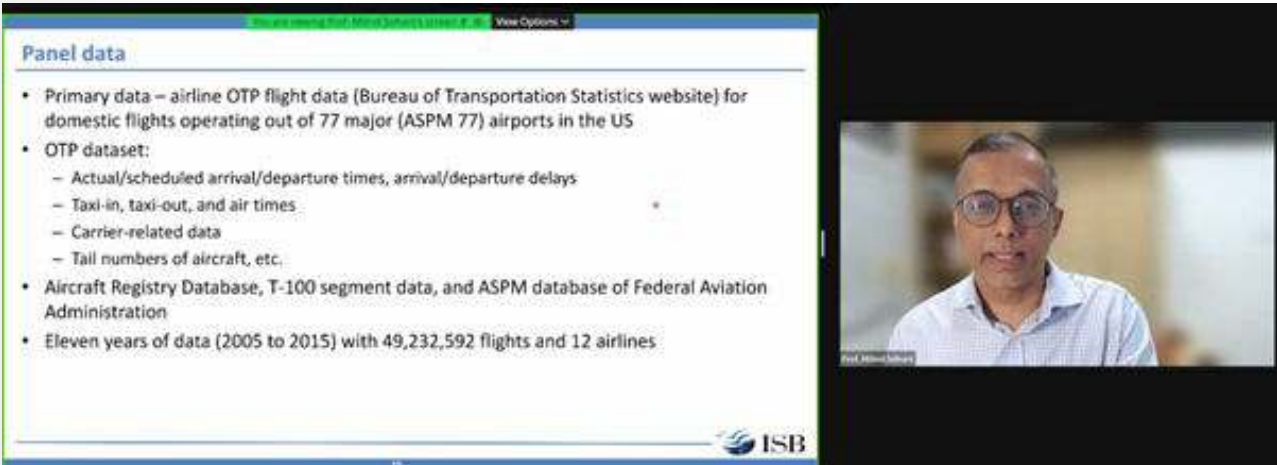
Moderator :
Dr. Debjit Roy
Institute Chair Professor and
Co-chairperson, CTL

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Dr. Milind Sohoni
Professor of Operations Management
Indian School of Business (ISB)

Abstract

Dr. Milind discussed the impact of schedule padding, operation improvement and a third factor called "retrospective luck" on the on-time performance (OTP) of airlines. The framework quantified the impact of the three factors and studied the effect of these strategies on OTP rankings of airlines. The study used an eleven-year panel data of flights operated by the US domestic carriers from 2005 to 2015 to measure OTP changes, schedule padding, and operational improvements to build on the structural estimation model developed in prior literature. It was found that operational improvements have the highest impact on OTP and OTP rankings of the airlines. Further, the results indicated that active actions taken by airlines could have a higher impact than passive strategies.



Panel data

- Primary data – airline OTP flight data (Bureau of Transportation Statistics website) for domestic flights operating out of 77 major (ASPM 77) airports in the US
- OTP dataset:
 - Actual/scheduled arrival/departure times, arrival/departure delays
 - Taxi-in, taxi-out, and air times
 - Carrier-related data
 - Tail numbers of aircraft, etc.
- Aircraft Registry Database, T-100 segment data, and ASPM database of Federal Aviation Administration
- Eleven years of data (2005 to 2015) with 49,232,592 flights and 12 airlines

ISB

To watch the webinar visit: <https://www.youtube.com/watch?v=A6OasPPAqy0>

3. Nudging Drivers to Safety: Evidence from a Field Experiment

Research Webinar on "Nudging Drivers to Safety: Evidence from a Field Experiment " by Dr. Vivek Choudhary, Assistant Professor, Nanyang Business School, NTU Singapore on February 14, 2023.





Centre for Transportation and Logistics

Research Webinar on
**Nudging Drivers to Safety:
Evidence from a Field Experiment**

February 14, 2023 at 03:00 p.m. IST

Moderator :
Dr. Debjit Roy,
Institute Chair Professor and
Co-chairperson, CTL

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Dr. Vivek Choudhary
Assistant Professor
Nanyang Business School
NTU Singapore

Abstract

Driving is an integral component of many operational systems, and any small improvement in driving quality can have a significant effect on accidents, traffic, pollution, and the economy in general. However, making improvements is challenging given the complexity and multidimensionality of driving as a task. Dr. Vivek discussed the effectiveness of nudging to improve driving performance. In particular, a smartphone application launched by his industry partners to send three types of nudges through notifications to drivers, indicating how they performed on the current trip with respect to their personal best, personal average, and latest driving performance. They measured the resulting driving performance using telematics technology (i.e., real-time sensor data from an accelerometer, GPS, and gyroscope in a mobile device).



Compared to the "no-nudge" control group, they found that personal best and personal average nudges improve driving performance by approximately 18% standard deviations of the performance scores calculated by the application. In addition, these nudges improve inter-accident times (by nearly 1.8 years) and driving performance consistency, as measured by the standard deviation of the performance score. Noting that driving abilities and feedback-seeking may vary across individuals, they adapted a generalized random forest approach which shows that high-performing drivers who are not frequent feedback seekers benefit the most from personal best nudges, while low-performing drivers who are also frequent feedback seekers benefit the most from the personal average nudges. Finally, they investigated the potential mechanism behind the results by conducting an online experiment in a non-driving context. The experiment shows that the performance improvements are directly driven by the changes in participants' effort in response to different nudges, and that our key findings are robust in alternative (non-driving) settings. Their analysis further shows that nudges are effective when the variability in reference points is low, which explains why the personal best and personal average nudges are effective, while the last score nudge is not.

To watch the webinar visit: <https://www.youtube.com/watch?v=jYK0ZWoINc>

4. Load Planning of Double-Stack Intermodal Trains and Related Problems

Research Webinar on "Load Planning of Double-Stack Intermodal Trains and Related Problems" by Dr. Emma Frejinger, Professor, Department of Computer Science and Operations Research (DIRO), Université de Montréal on March 13, 2023. This webinar was moderated by Dr. Sriram Sankaranarayanan





Centre for Transportation and Logistics
Research Webinar on
**Load Planning of Double-Stack
Intermodal Trains and Related Problems**
March 13, 2023 at 05:30 p.m. IST

Moderator :
Dr. Sriram Sankaranarayanan
Assistant Professor
Production and Quantitative Methods
Indian Institute of Management Ahmedabad

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Dr. Emma Frejinger
Professor, Université de Montréal
Department of Computer Science and
Operations Research (DIRO)
Canada Research Chair in
Demand Forecasting and Optimization of
Transport Systems
CN Chair in Optimization of Railway Operations

Abstract

The talk focused on the integrated load planning and sequencing problem (LPSP) for double-stack trains. This decision-making problem occurs in intermodal terminals and consists in assigning containers from a storage area to slots on railcars of outbound trains and in determining the loading sequence of the handling equipment. By extending prior work on load planning, the study proposed two different integer programming formulations. An extensive numerical study helped in solving instances with up to 50 containers with a commercial general-purpose solver in less than 20 min. A case study based on real data provided by the Canadian National Railway Company highlights that the LPSP can reduce the number of container handling in intermodal terminals compared to sequential solutions by on average 11.3% and 16.5% for gantry cranes and reach stackers, respectively. In the last part of the talk, Dr. Emma Frejinger discussed the importance of considering the operational load planning problem when devising tactical network plans for intermodal transportation. In this context, combining operations research and machine learning methodologies has great potential.



To watch the webinar visit: https://www.youtube.com/watch?v=f_p9a1b7CEY

5. Transforming Transport: Lessons from London in integrating institutions and services

The Centre for Transportation and Logistics, IIMA hosted a practitioner webinar on "Transforming Transport: Lessons from London in integrating institutions and services" by Mr. Shashi Verma, Chief Technology Officer, Transport for London on April 21, 2023. This webinar was moderated by Prof. Sundaravalli Narayanaswami.





Mr. Shashi Verma
Chief Technology Officer
Transport for London



Centre for Transportation and Logistics

**Practitioner Webinar on
Transforming Transport:
Lessons from London in integrating
institutions and services**

April 21, 2023 at 4:00 p.m. IST

Moderator :
Dr. Sundaravalli Narayanaswami
Associate Professor,
Indian Institute of Management Ahmedabad

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Abstract

Mr. Verma delivered a highly insightful presentation on Transport for London (TfL) and its journey of transforming the city of London's public transport system. He strongly emphasised upon the need for adopting public transport and incentivising its use over private vehicles. He demonstrated the on-ground impact of institutional integration and policy changes upon a range of factors including better air quality, efficient land use, improved public health statistics, accident reduction, greater accessibility, etc.



CTL Faculty Engagements

1. 7th Conference of Transportation Research Group of India (CTRG-2023)

The Centre for Transportation and Logistics, IIMA will be the supporting institute for the 7th Conference of Transportation Research Group of India (CTRG-2023) jointly organised by the Transportation Research Group of India and Sardar Vallabhbhai National Institute of Technology, Surat (SVNIT) from 17th to 20th December 2023.

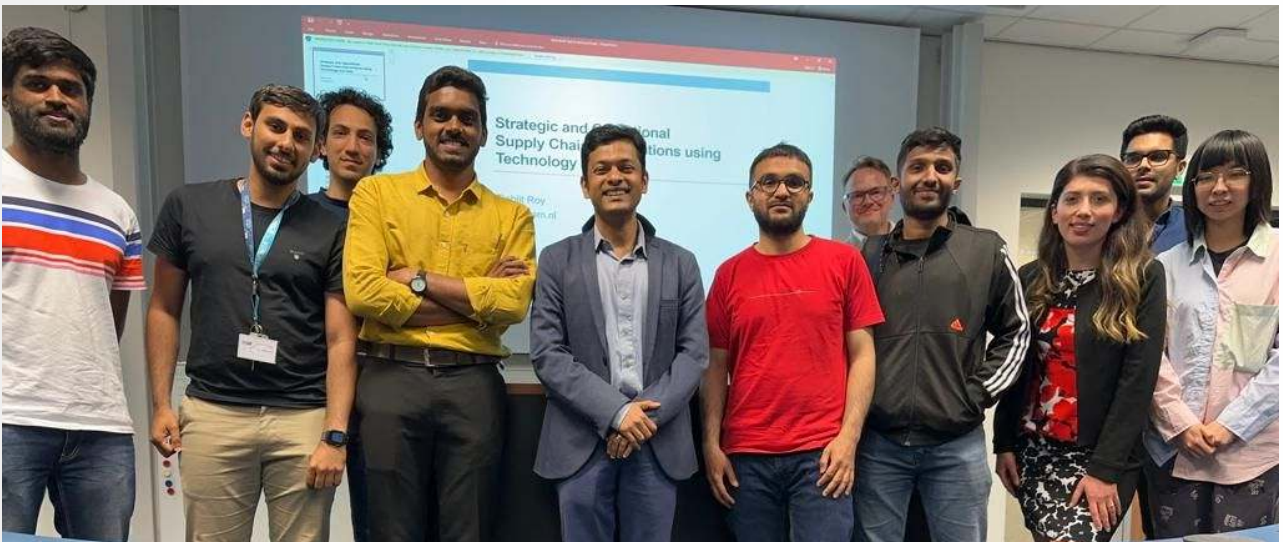
Dr. Sandip Chakrabarti, Co-chairperson, CTL IIMA is a member of the Scientific and Organising Committee of the 7th CTRG-2023. He is also an Executive Board member of the Transportation Research Group of India. The objective of the 7th CTRG-2023 is to explore innovative research and practice that promotes sustainable, resilient, transformative, adaptable, and technology-empowered passenger and freight mobility for today and the future. ([7th CTRG](#))



The Transportation Research Group of India was founded in 2011. It provides a unique forum within India for the interchange of ideas among transportation researchers, educators, managers, and policymakers from India and all over the world, covering all modes, sectors and levels of transport for both passenger and freight movement in India. The Centre for Transportation and Logistics IIMA aims to contribute to improving the efficiency of multi-modal transportation systems and supply chain logistics by facilitating cutting-edge research in transportation, logistics and allied areas, thereby promoting economic growth and fostering sustainable development.

2. RSM Supply Chain Club, Rotterdam School of Management, Erasmus University

Dr. Debjit Roy, Co-Chairperson, CTL spoke on "Emerging technologies for operational and strategic interventions in supply chains" at a speaker session organized by the RSM Supply Chain Club at Rotterdam School of Management, Erasmus University. The discussion centred around the latest technological advancements involving machine learning, artificial intelligence, internet of things and digitalization, and their applications in managing complex supply chains.



Prof. Roy elaborated on the following use cases where latest research works were applied to drive efficiency in operations:

1. Applying time and motion study integrated IOT enabled solutions for determining factory layout to improve operational efficiency and productivity.
 2. Using AI powered robots and Human-Machine Picker Interface solutions for improving warehouse operations to overcome problems related to Automated Storage and Retrieval Systems (ASRS).
- Deployment of telematic systems that provide real time tracking service in the trucking industry to improve driver's safety and enhance asset utilization.

3. Masterclass on Supply Chain Management

Dr. Debjit Roy delivered a masterclass on "Emerging technologies for operational and strategic interventions in supply chains" at The Economic Times Supply Chain Management & Logistics Summit 2023 presented by Mahindra Logistics and co powered by Amazon Web Services on June 28, 2023 at Delhi, India. Prof. Roy spoke about the role of digitization in reshaping supply chain management, intralogistics, transportation, and procurement systems. Further, he discussed the various use cases of emerging technologies in streamlining supply chains and logistics operations to improve productivity and operational efficiency.

Click here to know more

<https://et-edge.com/conferences/supplychain/>



CTL Snippet

1. CTL Snippets E3: Mr. Sashi Verma, TfL

Mr. Shashi Verma, spoke to us about the role of public transport in tackling contemporary urban challenges like climate change, air pollution, road safety and public health. Mr. Verma discussed the transformational work done by him in TfL, especially in building a business case for Elizabeth Line using agglomeration economics, and developing innovative funding mechanisms for public transport in London. He spoke about the significance of bringing multiple stakeholders and institutions together to create an integrated public transport system. He explained how the unplanned growth of Indian cities is acting as a barrier in enhancing productivity of our urban economies. He further discussed the importance of modal shift to public transport in decongesting our cities and improving air quality. He advised PhD students and aspiring researchers to understand the needs of the industry and policymakers in order to come up with high impact, actionable research output.



Mr. Shashi Verma
Chief Technology officer
Transport for London

Watch here: <https://www.youtube.com/watch?v=e01rUggefFc>



Dr. Sriram Sankaranarayanan
Assistant Professor of Operations and Decision Sciences
Indian Institute of Management Ahmedabad

2. CTL Snippets E2: Prof. Sriram Sankaranarayanan, IIM Ahmedabad

Prof. Sriram spoke to us about his work on transportation systems, specifically on the link between electric vehicle charging locations and the electricity distribution network. He spoke about new areas of interest pertaining to dynamic pricing and ridesharing services optimization within the domain of transportation research. He also addressed the community of Indian management PhD students about the necessary skill sets and tools which would help them succeed as academics in the OM area.

Watch here: <https://www.youtube.com/watch?v=eKnuhgLDPAE>

3. CTL Snippets E1: Prof. Vivek Choudhary, Nanyang Technological University, Singapore

Prof. Choudhary spoke to us about his work on behavioural interventions in operations management and its impact on society, the future of service platforms and human-AI interactions, and the potential impact of transportation and logistics research with a focus on the Indian scenario. He also addressed the community of Indian PhD students in the OM area about effectively choosing their field of research.

Watch here: https://www.youtube.com/watch?v=GnoHFYj_DDE



Dr. Vivek Choudhary
Assistant Professor, IT & Operations Management,
Nanyang Technological University, Singapore

News Watch

1. India achieves 38th rank in Logistics Performance Index, 2023

Box 3.2
India: Boosting performance with supply chain digitalization

Since 2015, the government of India has invested in trade-related soft and hard infrastructure connecting port gateways on both coasts to the economic poles in the hinterland. Technology has been a critical component of this effort, with implementation under a public-private partnership of a supply chain visibility platform,¹ which contributed to remarkable reductions of delays. NICDC Logistics Data Services Limited applies radio frequency identification tags to containers

and offers consignees end-to-end tracking of their supply chain. Implementation started in 2015 on the Indian east coast and was generalized in 2020. With the introduction of cargo tracking, dwell time in the eastern port of Visakhapatnam fell from 32.4 days in 2015 to 5.3 days in 2019.

Note
1. See <https://nidsl.in/>.

22 CONNECTING TO COMPETE 2023 TRADE LOGISTICS IN AN UNCERTAIN GLOBAL ECONOMY

The Logistics Performance Index is a comparative benchmarking index prepared and released by The World Bank to assess the logistics performance of the participating countries. The Index intends to benchmark a country's logistics performance across different dimensions of trade logistics and assess its performance at the global level.

For 2023, India has achieved a rank of 38 out of 139 countries. The country has seen an improvement of six places compared to the previous LPI released in 2018. Over the same period, the LPI score for India improved from 3.18 in 2018 to 3.40 in 2023, although lesser than the all-time high of 3.42 in 2016. In the subcategories, India achieved the best rank of 22 in International Shipments, while the worst rank of 47 was achieved in Customs and Infrastructure categories. With this performance, India ranks 13th in #Asia, 11th in #G20 nations and 3rd in #BRICS nations.

Find out more at: <https://www.linkedin.com/feed/update/urn:li:activity:7059841493913468930>

2. India's first water metro launched in Kochi

The country's first water metro was launched in Kochi, Kerala, on April 25, 2023. This unique battery-operated water transit system is estimated to reduce 44,000 tonnes of CO2E emissions every year. It adds to India's efforts towards achieving Net Zero through sustainable urban public transportation systems. The city has integrated its water metro service with the metro rail service, and the users can use Kochi One Card to buy tickets for both services. The metro system aims to provide last-mile connectivity to 10 islands from the mainland through energy-efficient, air-conditioned, electrically propelled ferries over 15 routes.



Find out more at: <https://www.linkedin.com/feed/update/urn:li:activity:7063752767844028416>

3. Release of Technical Roadmap for Zero Emission Trucking (ZET) in India by O/o PSA

In order to achieve India's goal of reducing the GDP's emissions intensity by 45% by 2030, the Office of the Principal Scientific Adviser to the Government of India recently released a five year technical roadmap for adoption of ZET in India. The document identifies 14 mini roadmaps divided under 4 major priority areas of field work, standards and regulations, technology assessment and development, and pilot preparation and running. For each mini roadmap, the document outlines the objective, tasks, stakeholders, methodology, deliverables and timelines along with a budget for completing all the activities. The strategy to achieve decarbonization of the trucking sector relies on Battery Electric Trucks and Fuel Cell Electric Trucks.

Find out more at:

<https://www.linkedin.com/feed/update/urn:li:activity:7072825274681241600>



The analysis piece is written by



Mr. Shubham Siwach
Research Associate, CTL IIMA



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