



Centre for
Transportation
and Logistics



ANNUAL REPORT

2021-2022 •

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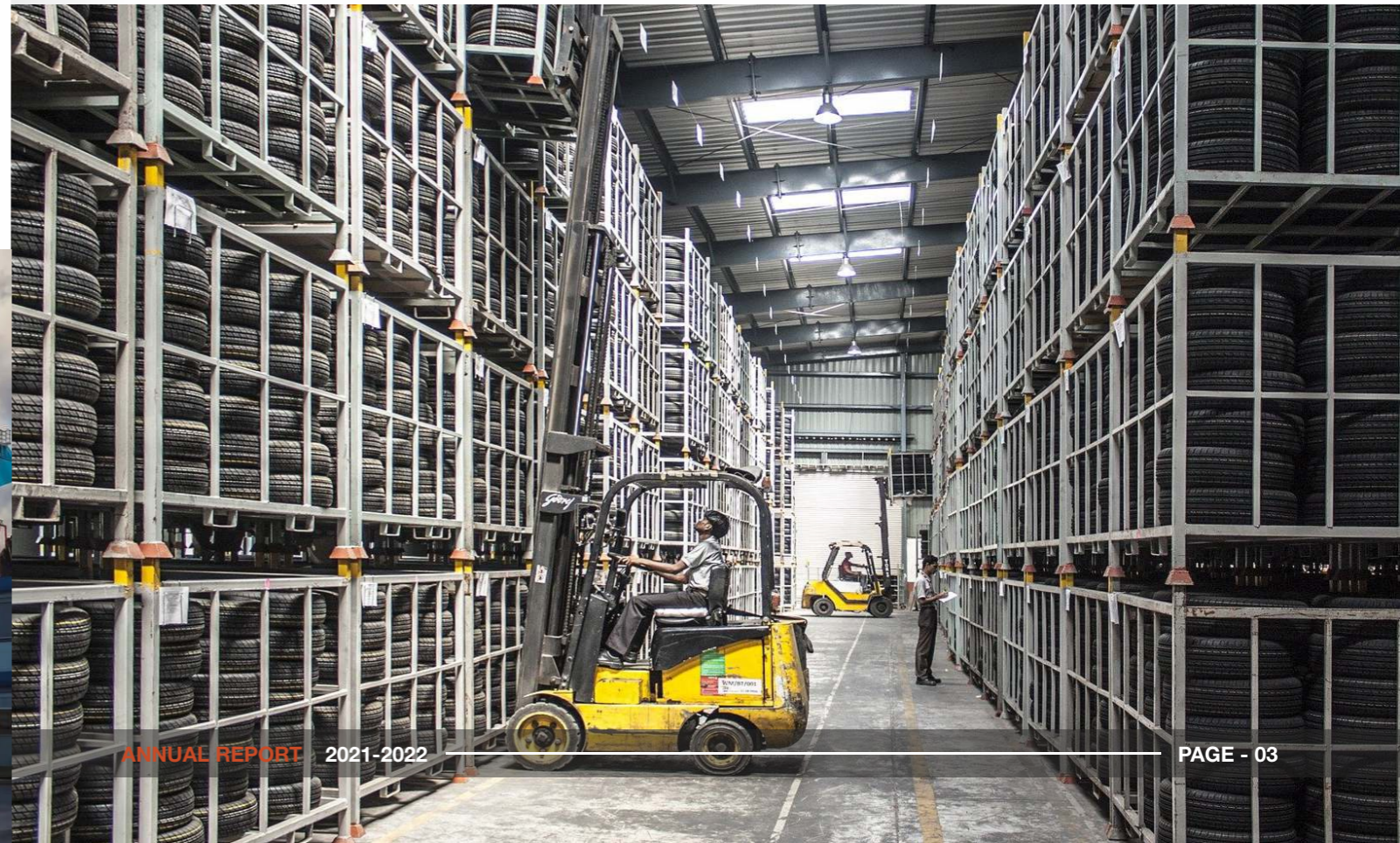
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MESSAGE FROM CO-CHAIRS



Dr. Debjit Roy

Ph.D. and MS (University of Wisconsin-Madison)
Intralogistics; road and oceanic freight transport
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The Indian Institute of Management Ahmedabad has a rich legacy of seminal contributions to research, practice, and teaching in the areas of transportation and logistics. Leveraging on its existing strengths, CTL members have a strong research interest in the area of logistics (such as facility location, routing, intralogistics, agri-logistics, etc.) and transportation (such as public transportation planning, sustainable mobility, policy issues, etc.). The purpose of this Centre is to develop a strong connection with industry and government, address cutting-edge problems that are relevant for policy and practice, and make fundamental contributions to both the scholarly and practitioner literatures. The flagship INFORMS TSL Workshop was held in 2022 and registered worldwide participation from academia and industry alike. Top leaders from industry and world-class academicians joined hands to offer keynote talks and participate in panel discussions. Over the year, CTL hosted a series of research webinars from distinguished internationally recognised faculty members on a wider range of contemporary topics. CTL also hosted online workshops from leading practitioners in areas such as shared mobility, EVs, supply chain disruptions, container logistics, etc. Thematic panel discussions on topics such as the future of transportation and logistics, and aerial mobility also recorded a good response. The Centre has received several opportunities for collaborating with industry and government on research and training that are currently being explored. Various Centre events have led to new partnerships expected to promote impactful research in the domain. Over the past year, Centre members have individually produced a large body of work in transportation and logistics, including peer-reviewed publications, media articles, research and consulting project reports, and so on. Centre faculty members have also started collaborating on research projects, training initiatives, and even to develop web based interactive educational products to introduce fundamental concepts of transportation and logistics that can enrich the classroom experience. The Centre intends to form an industry consortium with technology, logistics, and mobility companies in the near future.

CTL aims to facilitate cutting-edge research in transportation, logistics and allied areas, and thereby contribute to scholarship, practice, and policymaking in India and abroad.

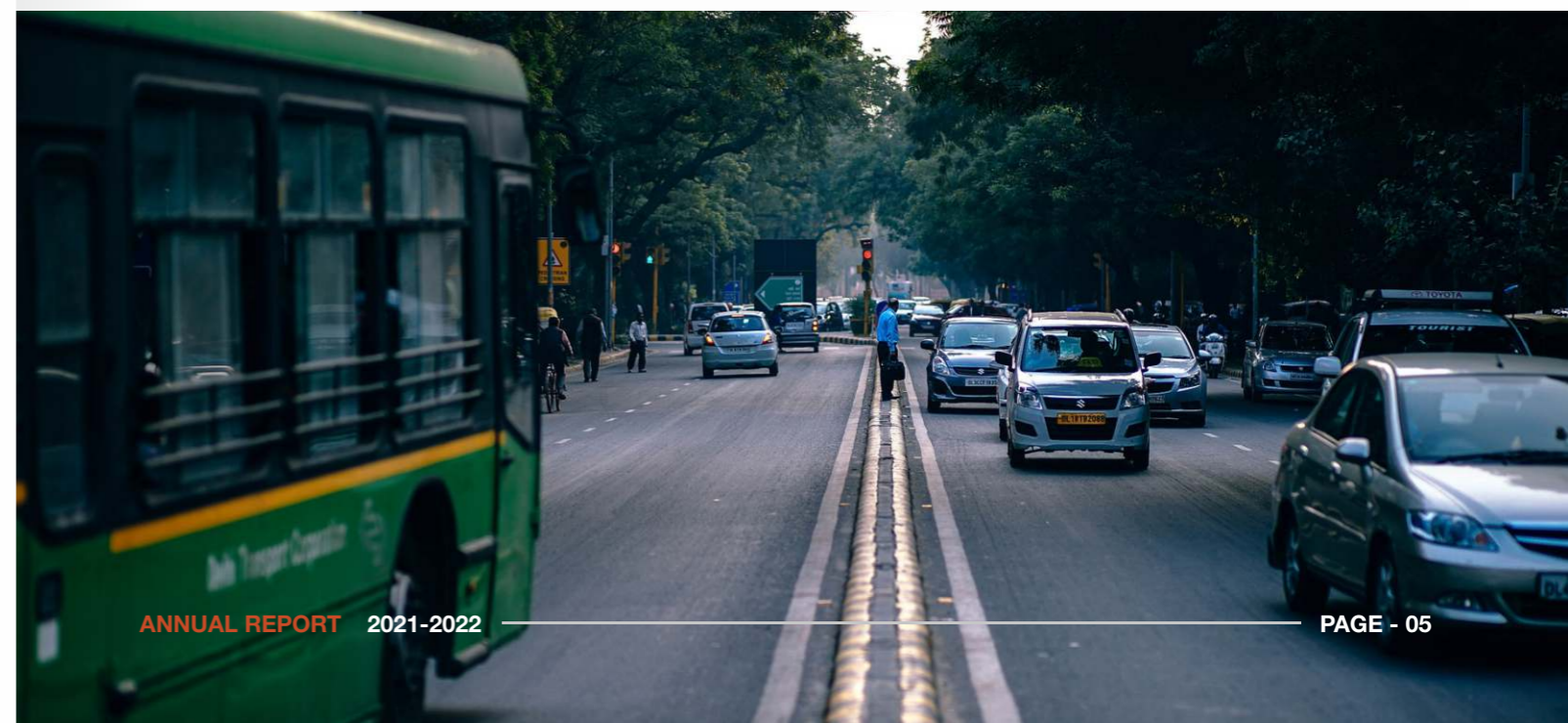
MESSAGE FROM AVP



Mr. Avi Dutt

Associate Vice President
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The Centre for Transportation and Logistics is an interdisciplinary centre of research in transportation and logistics comprising both freight and mobility. The Centre has focussed on societally relevant research work and dissemination across academia, government, and industry. The Centre took an active part in major government policy initiatives such as PM Gati Shakti, ULIP (Unified Logistics Interface Platform), drone policy, electric vehicle policy, etc. Industry linkages have been developed through various modes of engagement, such as workshops/symposia, research seminars, panel discussions, etc. Over the last academic year, the Centre hosted the flagship INFORMS TSL Workshop 2022 with participation from 14 countries, 170+ paid registrations from 86 institutes over 3 days. The Centre facilitated eight academic research webinars, two thematic panel discussion, and two industry-oriented workshops. Centre faculty members have published industry relevant opinion pieces, technical notes, research papers catering to research, practice, and teaching in the areas of transportation and logistics. CTL aims to build industry consortiums, develop more academic collaborations, disseminate knowledge, and cater to the growing research needs in transportation and logistics.



CENTRE VISION AND RESEARCH THEMES

Vision

To facilitate cutting-edge research in transportation, logistics and allied areas, and thereby contribute to scholarship, practice, and policymaking in India and abroad.

Centre overview

The IIMA Centre for Transportation and Logistics (CTL) will address critical passenger and freight transportation, and logistics challenges in India through an integrated, multidisciplinary program of research, post-graduate and executive education, technology transfer, and policy advice for enhancing the mobility of people and goods. CTL's objective is to contribute to improving the efficiency of multi-modal transportation systems and supply chain logistics, thereby promoting economic growth and fostering sustainable development.

Research themes

The following strategic themes will constitute priority research areas for CTL. The themes have been identified based on current trends in research, innovations in practice, and policy priorities in India and across the world. Priority themes will be reviewed and updated periodically as the transportation and logistics industry/environment evolves.

Passenger transportation and sustainable urban mobility

- Leveraging technology for improving urban and regional mobility

This theme focuses on examining emerging technologies such as intelligent route guidance systems, dynamic road pricing, smart parking, integrated transit fare systems, app-based shared transportation services, high-speed rail, etc., and their potential for improving passenger mobility and accessibility within and between cities. The impact of connected and autonomous vehicles in increasing safety and capacity utilisation, enhancing system reliability, influencing travel behaviour, and altering location choices of households and firms will be analysed. Innovative ways of collecting and applying big data in transportation for evidence-based planning and improved real-time operations of multi-modal systems will be explored. The role of government and public policy for better leveraging technology will be considered.

- Reducing environmental impacts and enhancing resilience of transportation systems

This theme focuses on exploring ways to reduce environmental impacts of transportation while meeting or improving mobility. Research areas include: a) Ways to reduce carbon footprint of transport infrastructure (e.g., roads, airports, ports, public transit systems, etc.) construction, maintenance, and operation; b) New fuel and vehicle technologies across modes, including plug-in hybrids and battery electric vehicles, that significantly reduce lifecycle emissions, and c) Government actions, including pricing policies as well as mandates or restrictions, to promote supply and demand of low-carbon transportation systems. Research analysing and suggesting improvements to the multi-modal transportation system's preparedness for short-notice (e.g., earthquake, terrorist attack, etc.) or planned (e.g., cyclone, virus outbreak, etc.) evacuation or system management at various geographic scales, and research exploring ways to develop systems that are resilient (with respect to damages and disruptions) to both short-notice events and long-term climatic changes will be covered under this theme.

- Promoting sustainable and safe urban transportation

This theme focuses on research involving strategies to promote shared (e.g., public transit, car- and ride-sharing arrangements, etc.), non-motorised/active (i.e., walking and bicycling), and low-carbon (e.g., electric vehicles) transportation in India's megacities and high-growth regions. Strategies can range from private sector initiatives/innovations in the provision and management of sustainable transportation modes and systems, to government policies (i.e., land use planning, supply-side investments, and demand management initiatives) to influence activity-travel decisions. Methods can span across disciplines, from travel behaviour analysis using revealed preference or stated-choice surveys, to experimental approaches of evaluating the impacts of specific interventions. Issues of equitable access to jobs and other urban amenities, particularly for the transportation disadvantaged, will be addressed. Research exploring ways to make urban travel safer will also be covered under this theme. This theme is aligned with global initiatives including India's policy priority of promoting sustainable urban development, and the creation of healthy and liveable cities.

Freight transportation and logistics

- Optimising logistics networks

This theme covers research for identifying optimal locations of facilities within a network and allocating customer orders to each location, which is an important decision area for all retailers including e-commerce players. For last mile delivery, optimal vehicle routing and minimising customer misses is key to business profitability. Also, during disruptions, the optimal order fulfilment policies such as the choice of the warehouse location for fulfilling a customer order with due date constraints is critical. With recent growth in electric vehicles, designing and optimising charging networks for transportation is another potential research area. Other areas of optimisation include identifying optimal transportation mode, route, and time choice. The methods used in optimising networks include integer programs, queuing theory, game theory and simulation.

- Managing terminal and warehouse operations

Managing the performance of logistics facilities such as warehouses or container terminals is critical for achieving high customer service levels. Many facilities are robotised today, and we expect more warehouses to be robotised in the future. Likewise, container terminals are undergoing automation. Performance analysis of such facilities using analytical and simulation models is a key step in the design conceptualisation process. While traditional optimization and simulation methods are used to analyse decision problems in container terminals such as quay crane assignment problem, berth allocation problem, yard crane assignment problem, analytical models are also useful for long-term technology investment decisions in the terminals. Also, applications of IoT in intra-logistics will be investigated. Related research will be covered under this theme.

- Sustainable urban freight and last-mile connectivity

This theme will cover research aimed at improving the efficiency and reducing the negative environmental impacts of freight activity within cities. Strategies involving technological (e.g., low-carbon or non-motorised vehicles), land use (e.g., urban consolidation centres), analytics (e.g., optimised routing), and policy (e.g., taxes or restrictions) interventions will be evaluated. Research under this theme is significant given changes in consumer demand and preferences, and concurrent innovations in logistics and supply-chains.

- Improving eco-efficiency and safety of goods transportation

In India, commercial vehicles are a dominant source of CO2 emissions. Old vehicles not only add to the emissions but also cause driver attrition. While the government is implementing the vehicle scrappage policies to eliminate polluting vehicles (over 15 years old) from the road, the implications of the scrappage policies on the vehicle demand estimation, overall CO2 emissions, and driver productivity and safety is still unknown. This centre would research policies to improve driver safety and retention. A project that attempts to link driving behaviour with fuel efficiency and road safety has already been initiated.

The annual report covers key activities of the centre since inception of the centre October 2020 till March 2022.



CTL MEMBERS

The selected research area from CTL faculty members are mentioned below



Dr. Sandip Chakrabarti

Area of Research:

Transport policy analysis | Transportation demand analysis and modelling
Land use-transportation interactions | Travel behaviour/choice analysis
Public transit planning and policy | Active travel
Parking | Multi-modal system performance measurement and monitoring
Impact analysis of new transportation investments
Applications of big data in transportation



Dr. Prashant Das

Area of Research:

Commercial real estate
(Private Equity, REIT, CMBS, Sustainability, Hotels)
Sentiments | Valuation
Real estate in India



Dr. Sundaravalli Narayanaswami

Area of Research:

Transport and operation
(particularly railway and urban transport) education
Pricing and revenue management
Contingency and emergency management
Automation of operation and knowledge



Dr. Debjit Roy

Area of Research:

Logistics and service systems including container terminals,
automated warehouses, vehicle rental, trucking, dine-in restaurants.
Stochastic processes | Queuing theory
Optimisation | Simulation
Empirical



Dr. Amit Garg

Area of Research:

Blockchain based peer-to-peer energy sharing and trading platform
Water-energy-agriculture-climate change nexus
Green infrastructure, energy policy and energy modelling
Green products and services | Green corporates
Uncertainty assessment and risk management for corporates due to climate change
Carbon finance | Adaptation policy for climate change impacts
Climate change mitigation policy | Development, energy and climate change
Solar agriculture pumps | Emission inventory assessment
Demand side management | New and renewable energy technology policy



Dr. Diptesh Ghosh

Area of Research:

Metaheuristics
Evolutionary algorithms
Layout problems



Dr. Sriram Sankaranarayanan

Area of Research:

Game theory | Optimisation problem
Climate change | Energy market policies



Dr. Chetan Soman

Area of Research:

Food supply chains
Advanced planning & scheduling in process industries
Application of simulation for decision making



Dr. Sachin Jayaswal

Area of Research:

Facility location | Large-scale optimisation
Stochastic optimisation | Supply chain management
Operations - marketing interface: pricing, lead time and capacity decisions
Product differentiation/price discrimination



Dr. Sunil Maheshwari

Area of Research:

Turnaround management
HRM in healthcare management
Leadership



Dr. Anish Sugathan

Area of Research:

Governance | Environmental policy
Energy policy | Strategy
Sustainable development



Dr. Rama Mohana R Turaga

Area of Research:

Public policy analysis and management
Environmental economics and policy
Corporate sustainability and corporate social responsibility
Pro-environmental behaviour



Dr. Poornima Varma

Area of Research:

International trade | Trade and agriculture
WTO related issues, trade and environment
Sustainable agricultural practices
Food security issues
Issues of food security and food safety
SPS and TBT in international trade
Price formation in agricultural markets



Dr. Prahalad Venkateshan

Area of Research:

Mathematical programming
Network design
Facility location
Vehicle routing



Dr. Sanjay Verma

Area of Research:

E-governance
Knowledge management
Multiple resource constrained project scheduling problems
Measurement of business performance

POST DOCTORAL FELLOW

Dr. Satyajit Mondal's primary area of research has been in the field of Traffic and Transportation Engineering. He has a total of eighteen publications in various peer-reviewed journals, thirteen conferences, and 1 book chapter. He has also attended and presented his work at top conferences like TRB, WCTRS, CTRG, EASTS, etc. Most of his recent publications were focused on electric vehicles, driving behaviour for Indian mixed traffic stream and road safety assessment to mitigate the number of road crashes. Currently, he is working on various transportation and logistics projects, including the adoption and policy environment in India for electric vehicles.

Research and publication activities

- Sustainable Road freight transportation – Primarily on platooning operations and its characteristics for autonomous vehicles. We are also preparing a technical article focusing on benefits of truck platooning for sustainable road freight transportation.
- Adoption and policy environment in India for electric vehicles. This study is carried out in the context of electric vehicles in India, focusing on technological, infrastructural, financial, behavioural, and external challenges. It also highlights the current state of EV deployment and research in India. The technical article has been submitted to Research and Publication in IIMA for possible publication.
- Urban consolidation centre (UCC) and its impact on freight trips. The primary objective of this study is to introduce a UCC to reduce the number of freight vehicle trips inside a city centre which will be beneficial for various negative externalities due to city logistics and goods movements like traffic congestion and pollution.
- Research on critical risk factors to mitigate potential road crashes on various highways in India with the collaboration of faculty members from IIT (BHU) Varanasi.
- Research on driving cycle to evaluate emission and energy consumption for Indian mixed traffic environment. The technical article on this research theme has been submitted to the Transportation Research Board for possible publication.



Dr. Satyajit Mondal

RESEARCH WEBINARS

The Centre organised eight research webinars across various thematic areas.

Research Webinars		
Topic	Speaker	Date
The role of data in container transportation	Dr. Rob Zuidwijk Rotterdam School of Management, Erasmus University	March 19, 2021
Pricing and matching for shared mobility	Dr. Hai Wang School of Computing and Information Systems Singapore Management University	April 23, 2021
Models and algorithms for urban mobility planning – The case for underground trains and flying cars	Dr. Vikrant S. Vaze Stata Family Career Development Associate Professor of Engineering, Dartmouth College	June 25, 2021
Regional impact of high-speed rail development: experience from China	Dr. Zhenhua Chen Assistant Professor City and Regional Planning The Ohio State University	August 20, 2021
The impact of COVID-19 on urban logistics	Dr. Laetitia Dablanc University Gustave Eiffel	September 15, 2021
The impact of market structure and scheduling competition on Prices: An evidence from the airline industry	Dr. Benny Mantin Professor and the Director of the Luxembourg Centre of Logistics and Supply Chain Management (LCL) University of Luxembourg	November 26, 2021
Investing for sustainable and resilient roadway infrastructure	Dr. Elise Miller-Hooks, Bill and Eleanor Hazel Endowed Chair, Infrastructure Engineering George Mason University	January 14, 2022
Designing sparse graph stochastic matching with an application to middle-mile transportation management	Dr. Linwei Xin Assistant professor of Operations Management Booth School of Business University of Chicago	March 26, 2022

The role of data in container transportation

Research Theme: Freight Transportation and Logistics

No. of people attended the webinar: 72

Moderated by: Dr. Debjit Roy

Speaker: Dr. Rob Zuidwijk, Rotterdam School of Management, Erasmus University

Dr. Rob Zuidwijk is the professor of Global Supply Chains and Ports at Rotterdam School of Management, Erasmus University (RSM). The chair focuses on three topics: coordination for sustainable global supply chains, synchro modal transport networks (a flexible and integral deployment of different modes of transport on a network to better meet customer demand and sustainability objectives), and inter-organisational systems in logistics.



Abstract: The webinar topic was synchro modal transport solutions that offer mobility of freight instead of specific transport capacity. Containers that need to be transported are matched with transport options in a dynamic way. Practitioners have demonstrated the feasibility of the concept, while academics have elaborated on various decision models in support of e.g., network design, capacity planning, and routing. The living lab now progressively involves new modes of transport, such as semi-automated trucks that dynamically form platoons where consolidation is viable. Advanced planning concepts, where multiple modes of transport are involved, tend to be more data intensive. However, the transportation industry is progressively recognising the value of data as a strategic asset, not to be shared without compensation. Therefore, a proper understanding of what data is needed to enhance quality of planning is key. In some cases, a marginal improvement of data quality may already help create better prognostics and planning.



Rotterdam School of Management
Erasmus University

RSM

Webinar @ IIM Ahmedabad
The role of data in container transportation
Rob Zuidwijk rzuidwijk@rsm.nl

RSM - a force for positive change

Agenda: The webinar covered the role of data container transportation (container transportation, collaborative systems, and digital platforms). It explored the value of data sharing, perishable cargo data and logistics and stability of cooperative arrangements. It also discussed the ongoing developments such as automated transport as a new mode and role of data ownership in container chains.

Key takeaways: Some of the important takeaways from the webinar were that synchro modal transport is a flexible system which is data hungry. The value of the data emerges at the container and at the cargo level. Further, the quality of data determines the logistics performance. The container transport connects innovative practices and academic discourse.

Pricing and matching for shared mobility

Research Theme: Passenger transportation and sustainable urban mobility

No. of people attended the webinar: 68

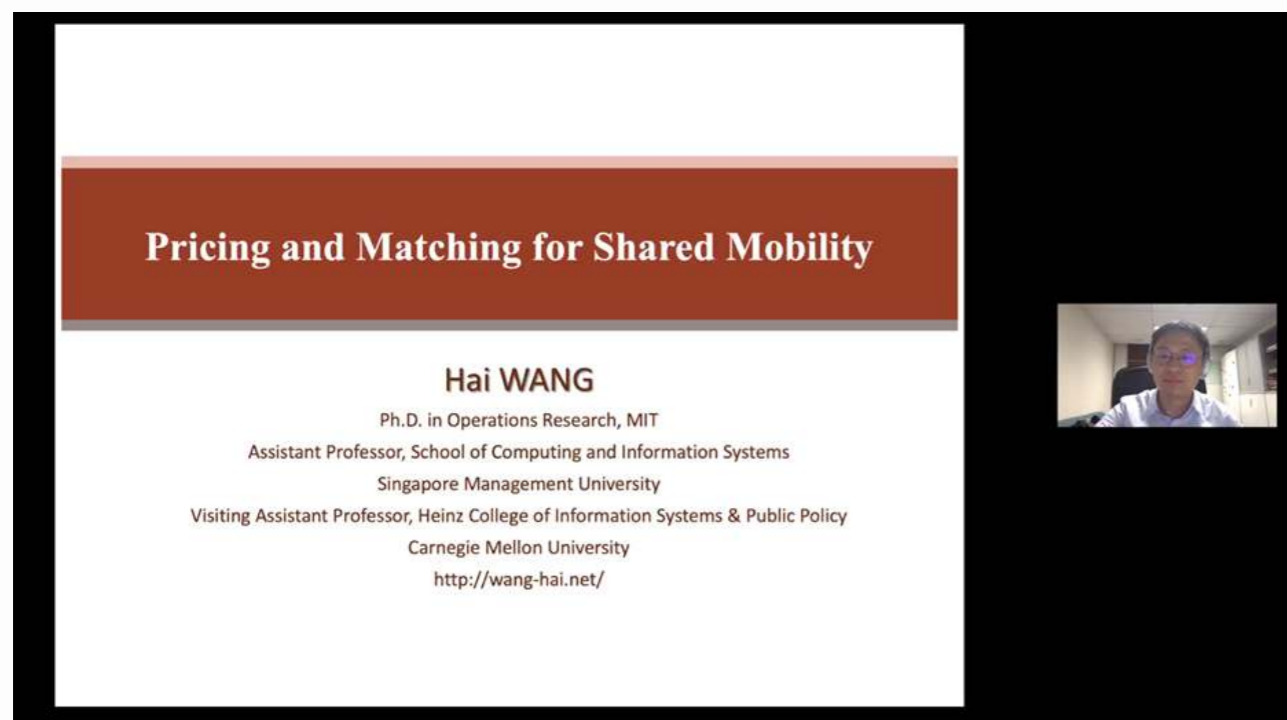
Moderated by: Dr. Debjit Roy

Speaker: Dr. Hai Wang, School of Computing and Information Systems, Singapore Management University

Dr. Hai Wang is an Assistant Professor in the School of Computing and Information Systems at Singapore Management University and a visiting faculty at the Heinz College of Information Systems and Public Policy at Carnegie Mellon University. His research focuses on methodologies of analytics and optimisation, data-driven decision-making models, machine learning algorithms, and their applications in smart cities and urban systems.



Abstract: With the rapid development and popularisation of mobile and communication technologies, dynamic ride-sharing platforms, as pioneers in a sharing economy context, provide on-demand shared mobility services and are disruptively changing the transportation industry. The webinar talk discussed the coordination of platform demand and supply using prices and wages. The researcher used a queueing model with endogenous supply and demand and present steady-state performance in equilibrium to determine the optimal price and wage that maximise the platform's profit or social welfare. Secondly, it discussed the matching problem, in which the platforms match passengers and drivers in real-time considering multiple objectives such as platform revenue, pick-up distance, and service quality. Finally, the researcher developed an efficient online matching policy and demonstrate its good performance through numerical experiments and implementation using real data.



Pricing and Matching for Shared Mobility

Hai WANG
Ph.D. in Operations Research, MIT
Assistant Professor, School of Computing and Information Systems
Singapore Management University
Visiting Assistant Professor, Heinz College of Information Systems & Public Policy
Carnegie Mellon University
<http://wang-hai.net/>

Agenda: The webinar discussed the general framework for pricing and matching of shared mobility. It accounted for the customer behaviour and alternative travel modes while assessing the demand. While assessing supply, it considered the factors such as other job options and worker attributes and behaviour.

Key takeaways: The major takeaways from the webinar were that it focused on the multi-objective matching, debt and adapting matching policy. It explored the attainability of multi-objective targets and on achieving target based optimal solutions. Industrial testing shows passengers will have better service, drivers will benefit from higher income for better service, and platform will have higher revenues.

Models and algorithms for urban mobility planning – The case for underground trains and flying cars

Research Theme: Passenger transportation and sustainable urban mobility

No. of people attended the webinar: 59

Moderated by: Dr. Debjit Roy

Speaker: Dr. Vikrant S. Vaze, Stata Family Career Development Associate Professor of Engineering, Dartmouth College, USA

Dr. Vikrant Vaze is Stata Family Career Development Associate Professor and the Program Area Lead of Mechanical, Operations and Systems Engineering at Dartmouth College. He works on solving large-scale transportation problems involving consumer choice modelling, schedule planning, and disruption management using optimisation, game theory, and machine learning.



Abstract: Fast-growing needs for urban mobility are worsening congestion, energy use, and greenhouse gas emissions. At the same time, the sector is being rapidly transformed by on-demand businesses and new vehicle technologies. Long-term sustainable mobility growth requires developing novel technology, business, and policy solutions. The webinar talk was focused on two such specific solutions. First, despite their various benefits, ride-hailing platforms like Uber, Ola and Didi have also been associated with increased road congestion and declining public transit ridership. The first half of the talk was focused on the question: Can public transit and ride-hailing co-exist and thrive in a way that enhances the urban transportation ecosystem as a whole? The researcher developed a new mathematical model and a novel computational framework optimising transit schedules, while explicitly accounting for their impacts on road congestion and passenger mode choice. It demonstrates that, through better alignment of transit services with passengers' preferences and ride-hailing services, transit agencies can lower costs for passengers, operators, and the system as a whole — a rare win-win-win outcome. The second half of the talk explained how electric vertical-takeoff-and-landing (eVTOL) vehicles enable a new form of transportation known as Urban Aerial Mobility (UAM). The second half of the talk focused on optimising the number, location, and capacity of vertiports in a metropolitan area. The researcher captured interdependencies between strategic vertiport deployment, tactical UAM operations and customer adoption. Researchers developed an original exact algorithm based on adaptive discretisation and provide a provable solution quality guarantee. Results indicate that the optimal UAM networks vary widely across metropolitan areas, as a function of geographic, urban, and commuting patterns. Vertiport networks grow in a nested fashion, starting with a few "obvious" vertiports and adding vertiports as penetration increases. Finally, it uncovers two potential use cases for UAM technologies: airport shuttle and long-distance commutes.

Agenda: The research webinar discussed on-demand urban air mobility and strategic vertiport network design.



17/45

TRAYER SCHOOL OF
ENGINEERING
AT DARTMOUTH

**On-demand *Urban Aerial Mobility (UAM)*:
Strategic Vertiport Network Design**

Kai Wang, Alexandre Jacquillat and Vikrant Vaze
<https://www.youtube.com/watch?v=44b5w-wPW4c>

Key takeaways: The major takeaways from the research webinar are that the algorithm incorporating the passenger choice and road congestion into transit scheduling model results in significant system wide savings and enables better matching of passengers to travel options. Adapting transit networks and schedules to the new normal can be a win-win situation for the passengers, service-operators and the city as a whole.

Regional impact of high-speed rail development: Experience from China

Research Theme: Passenger transportation and sustainable urban mobility

No. of people attended the webinar: 51

Moderated by: Dr. Sandip Chakrabarti

Speaker: Dr. Zhenhua Chen, Assistant Professor of City and Regional Planning at The Ohio State University

Dr. Zhenhua Chen is an Assistant Professor in City and Regional Planning at the Austin E. Knowlton School of Architecture at the Ohio State University. He was also a visiting fellow of the Asian Development Bank. His research interest includes infrastructure planning and policy, risk, and resilience assessment of transportation infrastructure.



Abstract: Mega infrastructure projects, such as High-Speed Rail (HSR), have experienced rapid development in many countries in the world. But how could planners and decision-makers better understand the regional impact of the gigantic system to make rational decision-making for future investment and development remains a challenge. The webinar discussed the regional impacts of HSR using China as an example. The assessment covers a range of issues, such as land use, real estate, tourism, modal competition, regional economy, and the environment. The objective was to provide lessons learned for transportation planners and decision-makers in India with a holistic perspective to understand the benefits of HSR investment on regional development.



Agenda: The research webinar discusses the development of the High-speed Rail and its future. The discussion lays out the recommendations for the policy makers.

Key takeaways: The research webinar provided insights on the infrastructural development of the high-speed railways. It also detailed the need to improve public awareness through public campaigns and education. Strong and continuous support by research and collaboration is needed.

The impact of COVID-19 on urban logistics

Research Theme: Freight transportation and logistics

No. of people attended the webinar: 20

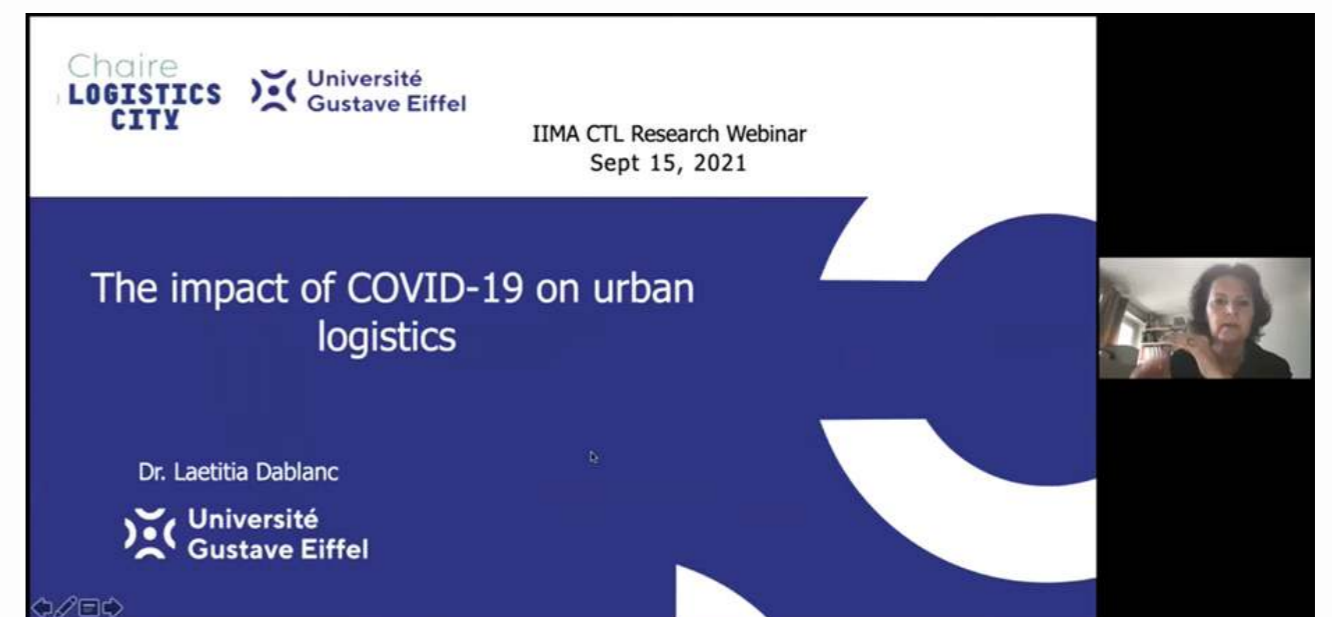
Moderated by: Dr. Sandip Chakrabarti

Speaker: Dr. Laetitia Dablanc, University Gustave Eiffel, Paris

Dr. Laetitia Dablanc is a Professor at the University Gustave Eiffel in Paris where she heads the Logistics City Chair. Dr. Dablanc was previously Professor at the French Institute of Science and Technology for Transport, Development and Networks (IFSTTAR, University of Paris-Est). Her areas of research are freight transportation, freight and the environment, urban freight and logistics, freight policies, and spatial issues related to logistics.

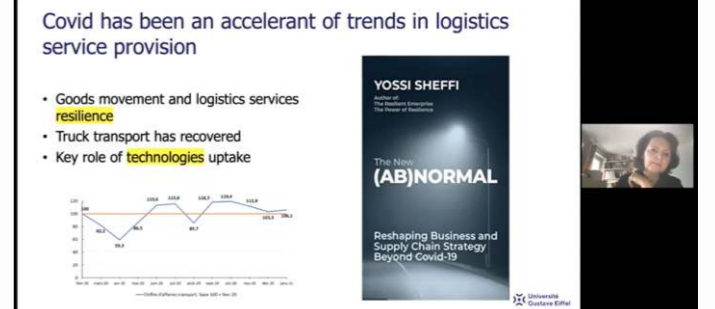


Abstract: Dr. Laetitia Dablanc presented a soon-to-be published book chapter on the impact of COVID-19 on urban logistics. Dr. Dablanc and her team have conducted three surveys in Paris, France, during the pandemic in 2020 on logistics service providers, logistics real estate developers as well as other stakeholders such as municipalities. These surveys show how urban freight activities have been challenged and transformed because of the pandemic. In addition to the survey results, Dr. Dablanc also presented an extensive literature review and data collection efforts on COVID-19 impacts on urban consumers' shopping habits.



Agenda: The webinar delves deeper into the impact of the COVID-19 on urban logistics and examines different trends in logistics.

Key takeaways: The webinar concludes that due to COVID-19 impact, there is accelerating use of technologies such as automated delivery vehicles (robots and drones), plate number recognition cameras and there is discussion on methods for sharing urban freight data. Focus has also shifted on the situation of gig workers and on-demand instant delivery platforms. It has also accelerated the implementation of new and low emission zones.



The impact of market structure and scheduling competition on prices: An evidence from the airline industry

Research Theme: Freight transportation and logistics

No. of people attended the webinar: 113

Moderated by: Dr. Sachin Jayaswal

Speaker: Dr. Benny Mantin, Professor and the Director of the Luxembourg Centre of Logistics and Supply Chain Management (LCL), at the University of Luxembourg.

Dr. Benny Mantin is a full professor and the Director of the Luxembourg Centre of Logistics and Supply Chain Management (LCL), at the University of Luxembourg, which is a member of MIT's SCALE network. His research covers diverse aspects of supply chain management, dynamic pricing, and revenue management, as well as transportation economics.



Abstract: Measuring the degree of competition in markets is important for setting competition and regulatory policy as well as developing management strategies. Commonly used structural indices, such as the HHI, overlook the way in which firms compete and, hence, set their prices in markets. The research proposes a new horizontal differentiation measure, which encapsulates firms' portfolio of products as well as the degree of overlap and substitution between competing services. Applied to aviation markets, it is termed as Schedule Differentiation Metric, or SDM, and the research demonstrates the significant importance of SDM in explaining price levels and structure. This work is a collaboration with David Gillen, Tuba Delibasi, and Vijay Kumar.

Measuring Competition Intensity and Product Differentiation: Evidence from the Airline Industry

IIMA - Centre for Transportation and Logistics (CTL)
26 November 2021

Benny Mantin, University of Luxembourg

Joint with
David Gillen, UBC Sauder School of Business
Tuba Toru Delibasi, Nera Economics
Vijay Kumar, O2Solutions



Innovate,
Impact,
Inspire!



Agenda: The webinar discusses the importance of measuring the degree of competition in markets and product differentiation. It provides useful insights from the airline industry.

Key takeaways: There were major takeaways from the webinar. Firstly, measuring the competition is important and needs more insights to measure. It also proposes a metric that captures the schedule overlap which plays an important role in aviation markets. Secondly, SDM can be extended for the oligopolies. It interacts with market structure, has no role in LCC rivalry and has a consistent effect in network rivalry.

Investing for sustainable and resilient roadway infrastructure

Research Theme: Freight transportation and logistics

No. of people attended the webinar: 106

Moderated by: Dr. Debjit Roy

Speaker: Dr. Elise Miller-Hooks, Bill and Eleanor Hazel Endowed Chair, Infrastructure Engineering at George Mason University

Dr. Elise Miller-Hooks holds the Bill and Eleanor Hazel Endowed Chair in Infrastructure Engineering at George Mason University, is an advisor to the World Bank Group, and the founding Editor-in-Chief of Elsevier's Sustainability Analytics and Modeling journal. She has expertise in: disruption planning and response; multi-hazard civil infrastructure resilience quantification and protection; stochastic and dynamic network algorithms; transportation systems engineering; intermodal passenger and freight transport; real-time routing and fleet management, including paratransit, delivery, ridesharing, and bikeways; and collaborative and multi-objective decision-making.



Abstract: Increased storm frequency and intensity, increased total precipitation, sea level rise and very high tides are among some of the concerns associated with climate change. With these impacts, more frequent temporary or permanent inundation of transportation system elements can be expected. This has important consequences for economies, needed response capacities and capabilities, and motorist safety. The webinar talk described a multi-temporal, stochastic optimisation-based solution technique for long-term transportation investment planning in protective measures for safeguarding the performance of roadway networks. The importance of explicitly considering the stochastic nature of future climate impact predictions and predictive accuracy to investment planning and enhanced system resilience is investigated. In events where pre-event investments do not suffice and significant inundation occurs, connectivity of the transportation network may be impacted, affecting the transportation system's performance, and precluding needed access for restoring transportation services and services of other critical lifelines. The webinar talk introduces a stochastic modelling approach that explicitly considers endogenous uncertainty for the problem of jointly prioritising post-disaster roadway inspection and restoration actions.



Centre for Transportation and Logistics

Research Webinar on:
**Investing for Sustainable
and Resilient Roadway
Infrastructure**

January 14, 2022 at 6.30 p.m. IST

Dr. Elise Miller-Hooks
Professor & Hazel Chair in
Infrastructure Engineering,
George Mason University

@CTLatIIMA
centre-for-transportation-and-logistics-iima

Agenda: The webinar focused on the sustainable and resilient road infrastructure. It elaborated on the stochastic optimisation techniques for transportation investment planning.

Key takeaways: The webinar provided useful insights on the investment planning for the transportation infrastructure. It used the optimisation approach to provide information on the stochastic nature of the climate change and its impact on investment in making road infrastructure more sustainable and resilient.

Designing sparse graph stochastic matching with an application to middle-mile transportation management

Research Theme: Freight transportation and logistics

No. of people attended the webinar: 30

Moderated by: Dr. Debjit Roy

Speaker: Dr. Linwei Xin, Assistant professor of Operations Management at Booth School of Business, University of Chicago.

Dr. Linwei Xin is an assistant professor of Operations Management at Booth School of Business, University of Chicago. His primary research is on inventory and supply chain management: designing models and algorithms for organisations to effectively "match supply to demand" in various contexts with uncertainty.



Abstract: The talk was based on a research study partially supported by an Alibaba Cainiao research grant. To consider the problem of designing a sparse subgraph that supports a large matching after some nodes are randomly deleted. It is motivated by how to balance the trade-off between transportation costs and network complexity in the context of middle-mile delivery operations. The researcher studied three families of sparse graph designs (namely, Clusters, Rings, and Erdos-Renyi graphs) and showed both theoretically and numerically that their performance is close to the optimal one achieved by a complete graph. The research tested the theoretical results using real data and concluded that adding a little flexibility to the routing network can significantly reduce transportation costs. This was a joint work with Yifan Feng (National University of Singapore), René Caldentey (Chicago Booth), Yuan Zhong (Chicago Booth), Bing Wang (Alibaba Cainiao), and Haoyuan Hu (Alibaba Cainiao).



CHICAGO BOOTH

Designing Sparse Graphs for Stochastic Matching

An Application to Middle-Mile Transportation Management

Linwei Xin
Booth School of Business, University of Chicago

Joint with Yifan Feng (NUS), René Caldentey (Chicago), Yuan Zhong (Chicago), Bing Wang (Alibaba Cainiao), and Haoyuan Hu (Alibaba Cainiao)

(Research partially supported by an Alibaba Cainiao research grant)

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Agenda: The talk focused on the middle-mile transportation problem particularly concerning the transportation costs and complexity of the networks.

Key takeaways: The webinar discussed the research work on the middle mile at length. Some of the major takeaways from the webinar were that the city concerned should operate on a 1-ring/2-ring network which would decrease its cost and be simpler to manage.

9th INFORMS Transportation Science and Logistics Society Workshop



The centre successfully organised the 9th INFORMS Transportation Science and Logistics Society Workshop on the theme "E-Commerce in an Emerging World" with participation from 86 different institutes and organisations from 14 countries and more than 175 participations. The workshop had eight technical sessions, two keynote addresses, and two panel discussions on the broad areas of last mile delivery and intralogistics.

Please find the details of keynote talks, panel discussions and closing remark sessions.

Sl. No.	Keynote Talk, Panel Discussions, and Closing Remarks	Speaker/Moderator
1	Keynote talk on customer experience in E-Commerce	Dr. Ravi Vijayaraghavan, Senior Vice President and Head, Analytics and Applied Sciences, Flipkart
2	Keynote talk on same-day delivery with fair customer service	Dr. Barrett Thomas, Professor of Business Analytics, Tippie College of Business, University of IOWA
3	Panel discussion on Last Mile Delivery	Moderated by Dr. Tom Van Woensel, Eindhoven University of Technology
4	Panel discussion on E-Commerce Fulfilment	Moderated by Dr. Rene de Koster, Erasmus University
5	Closing Remarks	Dr. Karen Smilowitz, James N. and Margie M. Krebs Professor, Industrial Engineering and Management Sciences, Northwestern University

Please find the details of all technical sessions

Sl. No.	Technical Sessions	Session Chair
1	Addressing E-commerce challenges in emerging economy	Dr. Srikumar Krishnamoorthy, IIM Ahmedabad
2	Order fulfilment decision – I	Dr. Diptesh Ghosh, IIM Ahmedabad
3	Vehicle routing	Dr. Prahalad Venkateshan, IIM Ahmedabad
4	Addressing E-commerce challenges in an emerging world-II	Dr. Sandip Chakrabarti, IIM Ahmedabad
5	Addressing E-commerce challenges in an emerging world-III	Dr. Sandip Chakrabarti, IIM Ahmedabad
6	Intralogistics	Dr. Debjit Roy, IIM Ahmedabad
7	Network design	Dr. Joris Kinable, Eindhoven University of Technology (TU/e), Netherlands
8	Order-fulfilment decisions – II	Dr. Sachin Jayaswal, IIM Ahmedabad

The following faculty members were the organiser for the 9th INFORMS Transportation Science and Logistics Society Workshop:

- Dr. Sandip Chakrabarti, Faculty, IIMA
- Dr. Joris Kinable, Faculty, Eindhoven University of Technology
- Dr. Srikumar Krishnamoorthy, Faculty, IIMA
- Dr. Debjit Roy, Faculty, IIMA
- Dr. Tom Van Woensel, Faculty, Eindhoven University of Technology

Day - 1



Inaugural Session: Inauguration of the 9th INFORMS TSL Workshop
Opening Remarks and Presentation: Decision areas in e-commerce and workshop topics
Presentation by Dr. Debjit Roy, Co-Chairperson
Keynote Talk: Customer experience in e-commerce
Speaker: Dr. Ravi Vijayaraghavan (Senior Vice President and Head, Analytics and Applied Sciences, Flipkart)
Moderator: Dr. Debjit Roy

Keynote Talk : Customer experience in e-commerce



Dr. Ravi Vijayaraghavan from Flipkart gave a keynote speech on customer experience in e-commerce. He discussed how every customer on the platform could have a unique need, and how data science and technology can be leveraged to scale up customer experience. What was also interesting is that though profitability is an important metric, building and retaining customer trust always remains on the forefront. Flipkart data platform leverages ingested data and further processed data for data-driven decision making. Data is translated to a business decision using machine intelligence. With use cases, Ravi explained how data can be used to measure and ensure customer experiences at various phases of the customer journey.

The wants of the e-commerce consumers range across:

- Pre-order experiences: Extracting meaningful reviews that are helpful for building customer trust are important. Good reviews are unbiased and drive trust rather than sales. Approaches based on NLP and ML were discussed.
- Selection of the product: A good assortment design is characterised by width, depth and quality of assortment. Partial difference plots portrayed the aspects to improve selection to substantially increase the demand.
- Post-order experiences: Solving for the last mile experiences through density-based demand segmentation, manpower planning and product quality (manual checks and past performance). Product quality is also important to gain customer confidence.

Panel Discussion : Last mile delivery challenges



This panel was moderated by Dr. Tom van Woensel. The panellists included Dr. Martin Savelsbergh (Georgia Tech), Prof. Lei Zhao (Tsinghua University), Mr. Suraj Sharan (Delhivery) and Mr. Abhinay Chaudhuri (BigBasket).

The discussion began with key last-mile delivery challenges in India. The importance of maintaining different temperatures in grocery items to stay fresh and creating a solution that will deliver products in a cost efficient manner. Specific discussions related to the following aspects:

- Non-standard addresses: Individual houses do not have zip code in India. Postal addresses include a pin code that covers a relatively large area. Thus, non-standard delivery addresses can pose a challenge for home deliveries.
- Payment forms: From around 2011, India started to see a growth in e-commerce activity. One of the reasons for this growth was the introduction of cash on delivery as a payment option. People did not have confidence unless the product was delivered to them. Now, customers can also pay using cards after delivery. E-commerce is growing rapidly in China as well, which has been further accelerated after the Covid 19 pandemic. On December 8, 2021, overall express delivery unit for the year reached 100 billion packages. Supply side has to deal with inconsistent demand, and they also want to maintain some consistency in service.

- Managing delivery costs: A new challenge faced by last mile delivery is managing costs as people want faster services but are not willing to pay for it. In the last few years (for companies like Amazon) the cost of delivery has gone up significantly. Human behaviour is a critical aspect of last mile delivery and willingness to pay for speedy delivery may differ among consumers. Incorporating these aspects into modelling for transportation and logistics can be an interesting research area.
- Shape customer behaviour: Consumers can also participate in reducing carbon emissions by choosing green slots and adopting community-driven purchasing strategies. However, these incentives work differently for different customers. Likewise, e-commerce companies can nudge customers by displaying how their product choices can affect packaging costs and emissions.

Key opportunities for research:

- Include human behaviour in last-mile delivery models.
- Shape customer behaviour to develop sustainable last-mile delivery models.
- Modelling joint community purchases
- Packaging, where empty spaces in packaging can cause higher emission.

Session 1 : Addressing e-commerce challenges in emerging economy - I



Session Chair: Dr. Srikumar Krishnamoorthy (Indian Institute of Management Ahmedabad)

Integrated last mile delivery and workforce scheduling to meet demand surges in e-commerce retail: Dr. Saurabh Chandra and Dr. Amit K Vatsa (Indian Institute of Management Indore)

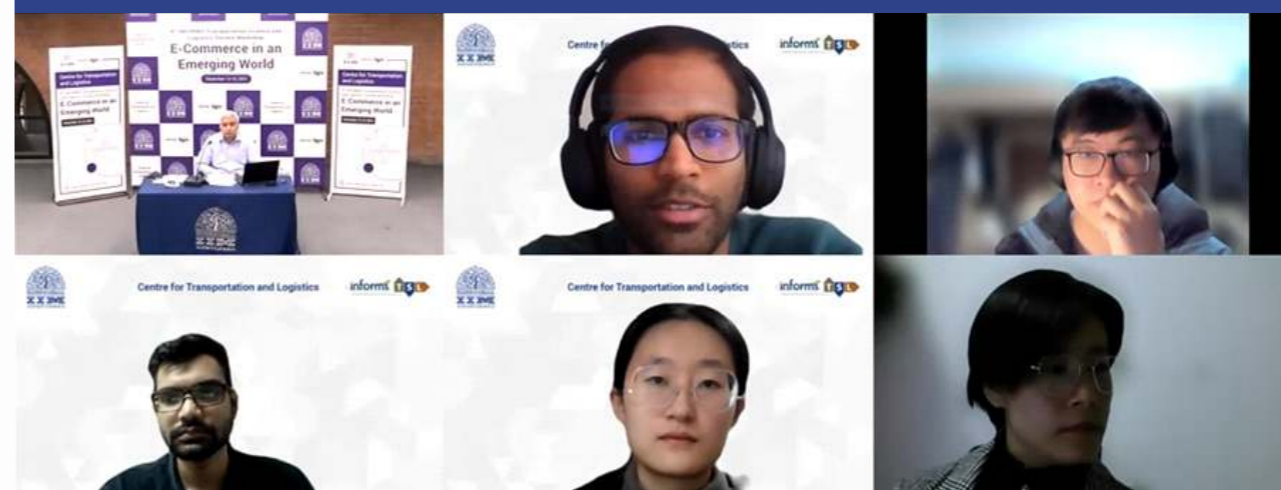
A case study for last-mile routing in B2B E-commerce: Mr. V Surya, Mr. Mohit Kumar, Mr. Aman Deep Singh and Mr. Alok Patel (Udaan)

Last mile delivery planning & orchestration – India topology review & challenges: Dr. Kishore Lanka and Dr. Kalyana C Chejara (Indian Institute of Management Kozhikode)

Challenges & opportunities using EVs for last mile e-commerce / e-grocery deliveries: Mr. Karan Kadaba (3ev Industries Private Limited)

Cost-quality performance trade-offs in multi-line e-commerce order fulfilment- picking, batching, and last-mile delivery: Mr. Gyanesh Raj and Dr. Debjit Roy (Indian Institute of Management Ahmedabad)

Session 2 : Order fulfillment decision - I



Session Chair: Dr. Diptesh Ghosh (Indian Institute of Management Ahmedabad)

An investigation of emissions for the last mile delivery with drones and delivery robots: Dr. Cheng Chen and Dr. Emrah Demir (Fujian Agriculture and Forestry University China, Cardiff University UK)

An optimal plan for autonomous last mile deliveries to improve energy-efficiency: A case of Chalmers University, Sweden: Dr. Lokesh Kalahasthi and Dr. Iván Sánchez-Díaz (Chalmers University of Technology, Sweden)

A machine learning approach for determining the optimal packaging box assortment: Mr. Shanthan Kandula, Dr. Srikumar Krishnamoorthy and Dr. Debjit Roy (Indian Institute of Management Ahmedabad)

Dynamic inventory relocation for a one-way electric car sharing system with uncertain demand: Dr. Rui Liu, Dr. Shu Zhang and Dr. Ping Chen (Chongqing University, Nankai University China)

Dynamic pickup and delivery problem with shared electric vehicles: Dr. Yutong Gao and Dr. Shu Zhang (School of Economics and Business Administration, Chongqing University, China)

Session 3 : Vehicle Routing



Session Chair: Dr. Prahalad Venkateshan (Indian Institute of Management Ahmedabad)
Tactical inventory routing with stochastic demand and supply: Dr. Umur Hasturk, Dr. Albert H. Schrottenboer, Dr. Evrim Ursavas and Dr. Kees Jan Roodbergen (University of Groningen, Eindhoven University of Technology; Netherlands)
An application of the clustered generalized vehicle routing problem: Order consolidation for e-tailers: Dr. Sajjad Hedayati, Dr. Mostafa Setak, Dr. Emrah Demir and Dr. Tom Van Woensel (K. N. Toosi University of Technology; Iran, Cardiff University; UK, Eindhoven University of Technology)
A branch-cut-and-price algorithm for the time-dependent electric vehicle routing problem with time windows: Mr. Gonzalo Lera Romero, Mr. Juan Jose Miranda Bront and Dr. Francisco Soullignac (CONICET-Universidad de Buenos Aires. Instituto de Investigación en Ciencias de la Computación (ICC); Argentina, Universidad Torcuato Di Tella / Consejo Nacional de Investigaciones Científicas y Técnicas)
Vehicle routing optimisation with relay: an arc-based column generation approach; Mr. Alexandre Jacquillat, Ms. Alexandria Schmid and Dr. Kai Wang (Massachusetts Institute of Technology, Carnegie Mellon University, Heinz College of Public Policy and Information Systems)
A chance-constrained two-echelon vehicle routing problem with stochastic demands Ms. Natasja Sluijk, Mr. Alexandre De Macedo Florio, Dr. Joris Kinable, Dr. Nico Dellaert and Dr. Tom Van Woensel (Eindhoven University of Technology, Netherlands)

Day - 2

Session 4 : Addressing e-commerce challenges in an emerging world-II



Session Chair: Dr. Sandip Chakrabarti (Indian Institute of Management Ahmedabad)
Viability of consolidation centre in urban freight delivery management in tier 2 cities: Dr. Garima (School of Planning and Architecture, Bhopal)
Impact of transportation infrastructure on informal firm productivity: a pseudo panel data analysis: Dr. Lokesh Posti and Dr. Atanu Bhuyan (Indian Institute of Management Kashipur)
Urban mobility and sustainable passenger transport: identifying critical success factors for India: Dr. Murari Srinivasa and Dr. Rajluxmi V. Murthy (Indian Institute of Management Bangalore)
A production routing problem with crowd-shipping: Dr. Sawyasachi Awasthi, Dr. Priyanka Verma and Dr. Balkrishna Eknath Narkhede (National Institute of Industrial Engineering, Mumbai)

Session 5 : Addressing e-commerce challenges in an emerging world-III

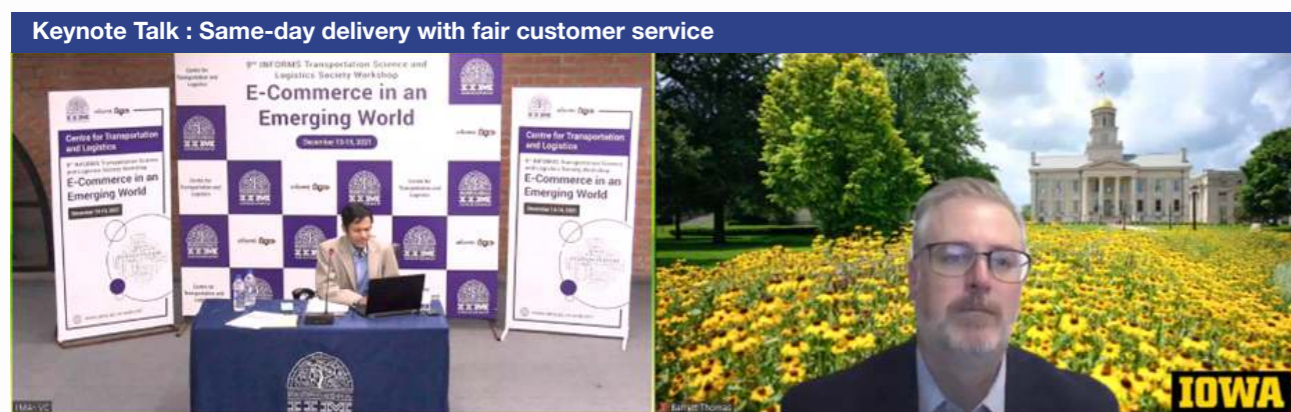


Session Chair: Dr. Chetan Soman (Indian Institute of Management Ahmedabad)
Resilient supply chain network design for production and distribution planning: Mr. Ramesh Kumar, Dr. L Ganapathy, Dr. Ravindra Gokhale and Dr. Manoj Kumar Tiwari (National Institute of Industrial Engineering [NITIE])
Smart hydroponics – disrupting the farms to forks supply chain: Ms/ Nayantara Mehta and Mr. Yash Malik (Bigbasket, Fractal Analytics)
E-Grocery sellers last-mile logistics challenges with special reference to Coimbatore city during COVID-19 pandemic period: Dr. Bamini Rajasekharan and Ms. Karnika Gayathri Rajasekharan (Sri Ramkrishna College of Arts India, Robert Gordon University UK)

Session 6 : Intralogistics



Session Chair: Dr. Debjit Roy (Indian Institute of Management Ahmedabad)
Anticipatory order picking: Dr. Son T. Tran, Mr. Rui J. Almeida and Dr. Christof Defryn (Maastricht University, Netherlands)
Dynamic time-based parcel consolidation, vehicle selection and container loading in hyperconnected logistic hubs: Ms. Nidhima Grover and Dr. Benoit Montreuil (Georgia Institute of Technology, United States)
Order picking with in-store customers and collaborative robots in retail stores: Mr. Joyjit Bhowmick, Dr. Jennifer Pazour and Dr. Iman Dayarian (Rensselaer Polytechnic Institute, University of Alabama, United States)
The value of limited adaptability for workload balance in parcel sort systems: Dr. Reem Khir, Dr. Alan Erera and Dr. Alejandro Toriello (Georgia Institute of Technology)
Cross-dock truck scheduling with worker constraints: Dr. Ritesh Ojha and Dr. Alan Erera (Georgia Institute of Technology)



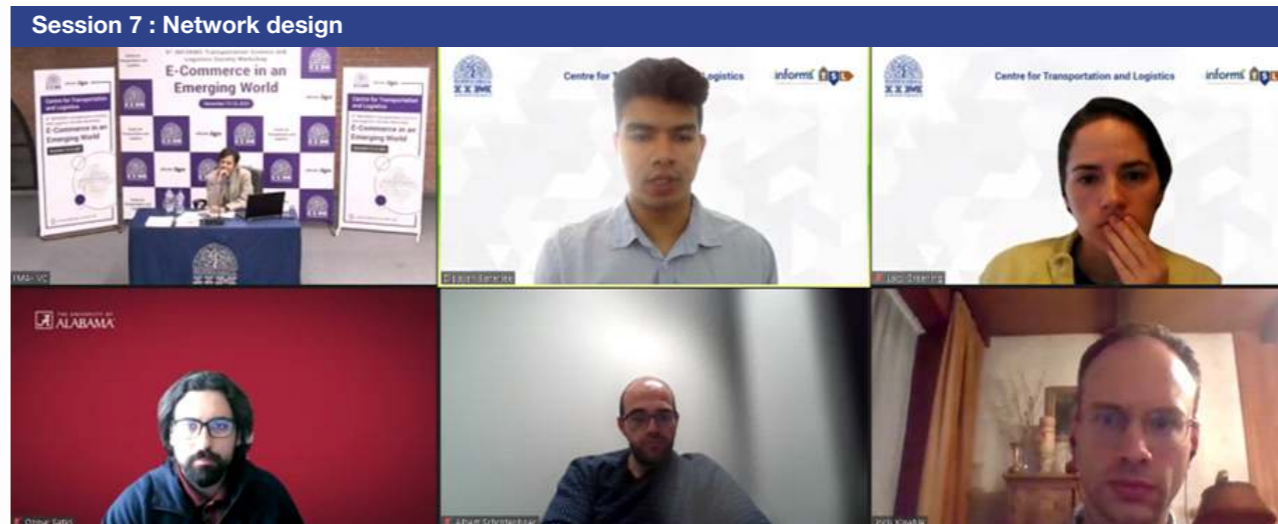
Speaker: Dr. Barrett Thomas, Professor of Business Analytics, Tippie College of Business, University of Iowa

Moderator: Dr. Debjit Roy

Same-day delivery (SDD) has increased rapidly in the last few years and has particularly boomed during the COVID-19 pandemic. SDD is not without controversy; several examples indicate that there can be possible potential bias in the algorithm.

Mixed fleet delivery is increasingly popular nowadays. The service level depends on where customers live, and over time (later into the day) a series of customers go unserved because of constrained resources. The company also has the opportunity to deny service if the customer consumes too many resources. There are going to be customers who are less likely to receive service because of where they live and where the company places its delivery depot. The question is whether there is any way to serve a broader group of customers and make the process fairer? The delivery deadline is one of the reasons servicing some customers becomes infeasible. The earlier decisions taken by the delivery service constraint the future decisions and capacity. Fairness is defined as the minimum rate of service to maximum rate of service. The area of delivery is divided into equal-sized regions, and the minimum regional service rate is maximized. It brings up the group of customers that was at the bottom of the receipt line without necessarily impacting the group that received the highest service. The study develops a model for a stochastic, sequential decision-making problem — Markov Decision Process (MDP). The solution to an MDP is a policy, where the action is assigned to each possible state to seek an optimal policy that maximizes the total expected reward. The reward is a marginal increase in the service rate and a marginal change in fairness. MDPs are traditionally solved via backward induction, where each action results in a random reward, and then we choose the action that maximizes the expected reward. MDPs often face what is called Curses of Dimensionality, which can be solved using the approximate Bellman equation. To get this approximate value, a reinforcement learning concept—the deep Q-learning concept, is used. Routing is a combinatorial optimization problem, and Q-learning is not well suited for such a problem since it is caused by a heuristic outside the Q-learning. The problem with reinforcement learning is that the exact values of the policy are not known, so an estimate needs to be generated without knowing the actual value. The decision-making needs to be simulated over the course of an entire day, which becomes an individual sample. Then the estimates are updated based on each one of these samples, and this is called the stochastic gradient method.

This approach can improve fairness at a low cost of utility. Hence, a greater impact can be achieved without dramatically changing the company's overall profit. The depot should be located in a region with higher customer density. In the e-commerce scenario, the best outcome in terms of fairness can be obtained right on the boundary of the middle and region two; by shifting it a little bit towards region one, both utility and fairness can be achieved. Fairness is also good for businesses; with fairness the company can maintain the total utility across the entire horizon while establishing the horizon. This is also a valuable outcome of this study. Further studies can be conducted on prioritizing the service for certain groups of people, e.g., the elderly who are at risk during the COVID-19 pandemic.



Session Chair: Dr. Joris Kinable (Eindhoven University of Technology)

Service network design for city logistics: Dr. Albert Schrottenboer and Dr. Martin Savelsbergh (Eindhoven University of Technology & Georgia Institute of Technology)

Who has access to e-commerce and when? time-varying service regions in same-day delivery: Mr. Dipayan Banerjee, Dr. Alexander Stroh, Dr. Alan Erera and Dr. Alejandro Toriello (Georgia Institute of Technology)

Middle mile consolidation network design problems: a time-constrained continuous rate model: Ms. Lacy Greening, Dr. Mathieu Dahan and Dr. Alan Erera (Georgia Institute of Technology)

Stochastic intra-city service network design: Mr. Ozgur Satici and Dr. Iman Dayarian (University of Alabama)

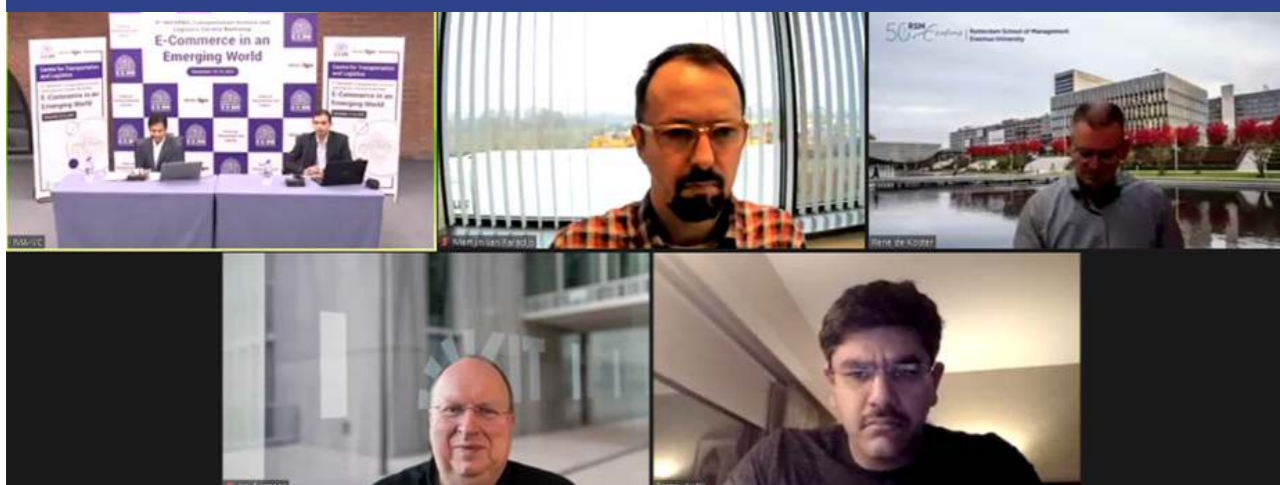
Day - 3



Session Chair: Dr. Sachin Jayaswal
A pricing mechanism to improve capacity utilisation in ridesharing: Dr. Srikanth Krishnaprasad and Dr. Rajeev Tripathi (Indian Institute of Management Bangalore, Great Lakes Institute of Management)
Dynamic pricing in advanced booking platforms: Dr. Neha Sharma, Dr. Milind Sohoni, Dr. Sumanta Singha and Dr. Achal Bassamboo (Kellogg Northwestern USA, Indian School of Business)
Dynamic order assignment in e-commerce order fulfilment under disruption risk: Dr. Govind Kumawat and Dr. Debjit Roy (Indian Institute of Management Udaipur, Indian Institute of Management Ahmedabad)
Robust drone-aided delivery: Dr. Yu Yang, Dr. Chiwei Yan and Yufeng Cao (University of Florida)
An efficient shortest path-based routing heuristic for drone-assisted delivery problems: Mr. Abhishake Kundu, Dr. Ricardo Gatica Escobar and Dr. Timothy I. Matis (Texas Tech University; United States, Pontificia Universidad Católica de Valparaíso; Chile)
Closing remarks by Dr. Karen Smilowitz (Northwestern University, Illinois)

- The panel posed engaging inquiries as food for thought into the articulation of how the execution of the automated software will ensure a higher return on investments alongside how quick commerce can make money without charging for speed.
- The Q and A round fetched on board several key aspects ranging across robotic developments focusing on flexibility, price of flexibility, convergence between offline and online commerce and drone technology associated with energy trade-offs.

Panel Discussion : E-commerce fulfilment



Moderator: Dr. Rene de Koster

Panellists:
Samay Kohli, CEO & Co-Founder, GreyOrange
Rohit Sharma, Head of Supply Chain, Grofers
Kai Furmans, Professor, Karlsruhe Institute of Technology
Martijn van Paradijs, Sr. Distribution Center Manager EMEA – Timberland / Icebreaker / Altra VF Corporation

The discussion was initiated with intriguing ideas associated with e-commerce fulfilment in terms of automation and omni-channel. Further, multifaceted aspects of e-commerce including propositions, developments, challenges and opportunities were conferred.

- Smart fulfilment for modern commerce: In the age of immediacy, fast delivery is the expectation that focuses on order fulfilment in real-time. The components of automated fulfilment for modern commerce highlighted AI cloud software, smart autonomous robots and certification networks.
- Omni-channel challenge: This brings on board the customers, structure (where and what), processes (how), and technology (picking, federated learning and driving in a store) and with key proposals that brick and mortar retail and e-commerce will merge in the end; automation will require cooperation from partners and sharing information about the product handling and urban space.
- Quick commerce is a mission next to near impossible with a direction towards key areas of high speed, high reliability and low cost.
- The key developments of the e-commerce concentrate on e-commerce and increased wholesale volumes, acceleration was driven by the COVID-19 pandemic, exploring partnerships, growth omni-channel options and sustainability.
- Challenges range across speedy deliveries with next to perfect reliability, assortment, availability alongside unit economics for a tech-driven supply chain, forecasting accuracy, managing peaks for outbound and returns, same-day shipping vs. next day shipping, managing e-commerce flow versus wholesale and retail flows, freight forwarder network capacity, peak management, returns flow planning and circularity product and packaging.
- The key propositions highlight:
 - a) Importance of anticipation of purchase, accurate and timely delivery over faster delivery
 - b) Management of large-scale multi-channel operations from a single warehouse is possible with automation
 - c) Circular life cycles and packaging solutions are persistent trends

Closing remarks



Closing Remarks by Dr. Karen Smilowitz. Dr. Karen Smilowitz is James N. and Margie M. Krebs Professor in Industrial Engineering and Management Sciences, Northwestern University

Workshops by practitioners

1. Electric vehicle: A primer for beginners

Dr. Arvind Kumar and Mr. Vignesh Nandakumar

Theme : Passenger transportation and sustainable urban mobility

Moderator : Dr. Sandip Chakrabarti

Total Registrations : 597

Total Attendees: 332



Workshop on:
**Electric Vehicle:
A Primer for Beginners**
June 15 and 22, 2021 at 5 p.m. IST

Dr. Arvind Kumar | Vignesh Nandakumar

About the Speakers: Dr. Arvind Kumar has 20 years of experience in the mobility domain. As a VP-R&D at Optym, an MNC in transportation space, he has helped several companies worldwide in improving the efficiency of their operations using advanced mathematical modelling tools. For over a year, he has been closely involved in the EV domain. He has guided the team at a Bangalore/Toronto-based EV start-up, Elocity, in developing solutions in EV space to help charge point operators, cities and electric utilities grow with the EV adoption. He also holds a B.Tech in Chemical Engineering from IIT Madras, and a PhD in Industrial Engineering from University of Florida. More about him at Dr. Arvind Kumar.

Mr. Vignesh Nandakumar has 20 years of corporate experience in the roles of lead executive and investor in large firms. Recently, as a Partner with LGT Lightstone Aspada, a global impact fund, he led the environmental sustainability focused investments, into electric vehicles, renewable energy and the shared and circular economy. He has also served as an active Board member of Amp Energy, Vogo Automotive and Lithium Urban Technologies as well as the co-CEO of Lithium Urban Technologies. He has a track record of developing and executing on renewable energy investments of over USD 750 million across India, South Africa and SE Asia with SunEdison and headed the sub-Saharan Africa business. He holds a B.Tech in Electrical Engineering from IIT Madras, and an MBA from ISB Hyderabad.

Agenda: The workshop focused on the major points related to Electric Vehicles such as:

- Understanding Electric Vehicles
 - BEV, PHEV, HEV
 - Powertrain (Typical components, compare to ICE)
- Understanding Batteries
 - Key Battery KPIs
 - Time needed for charging (C-rate, Power, etc.)
 - BMS (Battery Management System)
- Understanding EV Charging
 - Why do we need a charger?
 - AC and DC charging
 - Connectors Types
 - Home (single or multi-unit), office, and public charging
- Role of EV Domain Stakeholders
 - DISCOMS/utilities
 - Charge point operators
 - Mobility service providers
- Grid Impact
 - Managed impact of EV charging on grid
 - V2G (Vehicle to Grid)
- EV Global Protocols, and Software
 - OCPP
 - OCPI
 - Software Workflows
- EV Outlook
 - Penetration in India (2W/3W/4W, sales by model)
 - Personal use vs commercial use
- EV Adaption Challenges
 - Range Anxiety
 - Model Availability
 - Warranty and Service
 - High upfront cost & financing challenges

- Overview of Electricity and Transport policy in India
 - Electricity policy for Evs
 - Transportation policy
- Ecosystem view - challenges in EV adoption from a commercial use case
 - EV Financing
 - Understanding TCO (Total Cost of Ownership)
 - Hurdles
 - Enablers (current and future)
- Jobs and Research Opportunities
 - Key challenges, for example: Infrastructure, recycling, etc.
 - Examples of how some groups are addressing the EV adoption challenges
 - Engineering, financing, policymaking, business opportunities

Key Takeaways: The workshop gave a detailed insight on electric vehicles and the EV industry as a whole. Few players in the industry are developing in-house assembly lines for final products whereas collaborations and partnerships are more prevalent. The majority of firms — in automotive, auto-component manufacturing, battery manufacturing industries — are adapting to electric powertrain technology. Non-automotive firms are venturing into new product lines — such as batteries, packs and re-energising systems (charging/swapping) — and are thereby expanding beyond their parent industries. The manufacturing and assembling of electric two-wheelers, and deployment of charging solutions, offers a low entry barrier. As a result, these domains are now attracting entrants from non-automotive domains as well. Firms are thus kicking-in a network effect which is essential, for instance, to sell vehicles, attract fleet owners to use charging and other infrastructure, and access a consumer base that enables the sourcing of waste batteries. There is lesser interest in backward integration such as innovating in-house to design and manufacture products or finding cost-effective yet localised substitutes for equipment. International partnerships seem more prevalent than domestic partnerships at the moment. Regional clusters which have been limited to the auto-industry so far, are now seeing an increased presence of non-automotive players.

2. Supply chain strategies during and post pandemic: Preparing for the new normal (or the new better!)

August 4, 2021 6:00 PM

Dr. Richard Wilding OBE, Professor & Chair of Supply Chain Strategy, Cranfield School Of Management, U.K.

Theme: Freight transportation and logistics

Moderator: Dr. Debjit Roy

Total Registrations: 471 Total Attendees: 148



Supply Chain Strategies during and post Pandemic: Preparing for the New Normal (or the New Better!)

Richard Wilding OBE
Professor of Supply Chain Strategy
Cranfield University, U.K.

www.cranfield.ac.uk/som

Agenda: The workshop detailed the supply chain resilience and foundation of supply chain strategy. It elaborated on the supply chain arcs of integration, control and influence. It further laid emphasis on ESG (Environment, Social and Governance) as a source of supply chain resilience.

Key Takeaways: The workshop highlighted that a resilient supply chain requires continuous monitoring and intelligence along with the supply chain transparency. It also relies upon supply chain collaboration, supply chain design and engineering, supply chain risk management culture and agility as pillars.

Panel discussions

1. Trends and innovations in transportation and logistics

January 29, 2021 5:00 PM

Total Registrations: 165 Total Attendees: 111



Centre for Transportation and Logistics
Inauguration of
Centre for Transportation and Logistics
Panel Discussion
Trends and Innovations in Transportation and Logistics
Friday, January 29, 2021 | 5 p.m. - 7 p.m. IST

Opening speeches by:
Errol D'Souza
Director, IIM Ahmedabad
Tathagata Bandyopadhyay
Dean (Faculty), IIM Ahmedabad

Moderators:
Debjit Roy & Sandip Chakrabarti
Co-chairpersons, CTL

Speakers

 David Cebon Director, Centre for Sustainable Road Freight and Professor, University of Cambridge	 Abhinav Choudhari Co-founder, AgBasket	 Jalaj Gupta Business Head for Commercial Vehicle Business Unit, Mahindra Automotive	 Kunal Kumar IAS Joint Secretary & Mission Director (Smart Cities Mission), Ministry of Housing and Urban Affairs, Government of India	 Prabjeet Singh President IIM India & South Asia	 Geetam Tiwari Senior Chair Professor, Transportation Research and Injury Prevention Programme, & Department of Civil Engineering, IIT Delhi
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For more information, please visit:
www.iima.ac.in/web/ctl/
 @CTLatIIMA
 centre-for-transportation-and-logistics-iima



Key Takeaways: The panel discussion on “Trends and innovation in transportation and logistics” was organised by CTL at Indian Institute of Management, Ahmedabad. The panellists discussed various topics related to transportation and logistics. The recent pandemic has put up various challenges as well opportunities in front of the logistics and transportation sector. Some of the challenges were due to increased demand and supply disruptions due to lockdown. The panel members also delved deeper into how they addressed these challenges through innovative process changes or through innovative product offering. The discussion also highlighted policy related challenges such as less data on urban infrastructure, transportation funding and politico-economic hurdles. The panel members also discussed various government initiatives aimed at increasing awareness about cycling and walking. Various challenges faced by the commercial vehicle industry were discussed at length, ranging from policy issues, changing demand pattern and supply side disruptions, safety, etc. The factors which could lead to sustainable urban transportation were highlighted in the discussion. The discussion also enumerated various challenges faced in making road transport more sustainable such as lack of funds. The panel members also delved deeper into the challenges faced in decarbonisation of the transportation and logistics sector in India. Various avenues of decarbonisation were explored through the discussion.

2. Flying taxis and cargo drones: The future of aerial transport in India

October 2021 4:00 PM

Theme: Freight transportation and logistics

Moderator: Dr. Debjit Roy & Dr. Sandip Chakrabarti, Co- Chairpersons

Total Registrations: 723 Total Attendees: 256



Flying Taxis and Cargo Drones: The Future of Aerial Transport in India

Saturday, October 30, 2021 | 4 p.m. IST

Moderators:
Debjit Roy & Sandip Chakrabarti
Co-chairpersons, CTL

Speakers



For more information, please visit:



Flying Taxis and Cargo Drones: The Future of Aerial Transport in India



Panel Discussion
Centre for Transportation and Logistics
IIM Ahmedabad



The focus of the discussion was on:

1. Regulatory policies
2. Manufacturing standards
3. Fleet management
4. Infrastructure
 - i. Drone terminals
 - ii. Charging infrastructure
 - iii. Service network
5. Cargo carrying capabilities
 - I. Payload, Range
6. Integration across modes
7. Pricing
8. Other tactical and operational areas

Key Takeaways: The panel discussion focused on urban air mobility and delved into the areas such as regulations for pilotless vehicles, airworthiness certifications, and the need for a pilot's licence. The importance of requisite infrastructure such as building of take-off and landing zones, parking lots, charging stations and vertiports were emphasised. The panellist discussed the need for air traffic management and a robust air traffic management system integrated with other modes of transports will facilitate the adoption. As far as safety is concerned, a flawless operational and mechanical safety record will help to build a better and safe future. Also, there is a need to address the psychological barriers related to flying in an unmanned aircraft. The complete ecosystem of aerial mobility which includes OEMs, operators, traffic manager (ATC, AUM), customers, investors, regulators need to be strengthened. Also, discussion on customer safety, pricing was deliberated.

CTL Research reports

The Centre focused on contemporary areas in transportation and logistics and dived deeper into specific industry relevant topics such as Internet of Things, Multi Modal Logistics Parks, Electric Vehicles, and post pandemic transformation in supply chains. This resulted in four research reports that are available to the IIMA community on the centre's website. These reports will be adopted in both regular and executive education programmes.

S. No. Research Reports

- 1 Exploring the role of IoT in worker safety and productivity
- 2 Impact of COVID-19 disruptions on the supply chain: Insights from India
- 3 Electric vehicles: Adoption challenges and the policy environment in India
- 4 Changing landscape of logistics in India with multimodal logistics parks

Exploring the role of IoT in worker safety and productivity by Ms. Tarini Goyal & Dr. Debjit Roy

This paper analyses the role of the Internet of Things in ensuring worker safety, improving productivity, and introducing better performance appraisal methods in the factory setup. It examines how IoT can be used to benefit both, the workers and the management, and strengthen the system of working in industrial plants. After reviewing literature on the topic, it can be observed that IoT helps in monitoring and controlling worker actions, optimising performance, and providing autonomy to employees in making decisions. Advanced methods of evaluating worker performance leveraging the applications of IoT and AI are explored as well.

Furthermore, analysing the case of workers at a steel plant in India, productivity levels are analysed on the basis of data collected from IoT tags and provide recommendations along with the further course of action. The study depicts how IoT can allow workers to perform tasks smoothly in their respective areas of expertise, along with a robust system of communication. By preventing accidents and boosting productivity, a win-win situation is created for the workers and their families, and for the factory owners and their clients.

Link: <https://web.iima.ac.in/assets/snippets/workingpaperpdf/35816286062022-06-02.pdf>



Ms. Tarini Goyal



Dr. Debjit Roy

Impact of COVID-19 disruptions on the supply chain: Insights from India by Mr. Apurva Shrey, Mr. Avi Dutt, & Dr. Debjit Roy

Supply Chains play a very important role in driving the economy of the country. The COVID-19 pandemic and subsequent lockdowns have disrupted the supply chains of various firms. It has been estimated that the total cost of supply chain disruption due to COVID-19 and geopolitical tensions is around USD 4 Trillion for US and European firms. This cost highlights the need to study the impact of COVID-19 on the supply chain function of companies and explore the efforts made by the firms to mitigate the same.

The objective of the paper is to examine the disruptions caused by COVID-19 pandemic in value chains of different sectors. It further aims to bridge the gap between the approach taken by the industry practitioners to mitigate the challenges faced by the COVID-19 pandemic and research work carried out by the academicians. The study examines the challenges faced by the industry and suggests opportunity areas where research can support efforts in industry to improve supply chain resilience.

Link: https://www.iima.ac.in/web/ctl/CTL.Report.2022_01.pdf



Mr. Apurva Shrey



Mr. Avi Dutt



Dr. Debjit Roy

Electric vehicles: Adoption challenges and the policy environment in India by Dr. Satyajit Mondal, Mr. Avi Dutt & Dr. Sandip Chakrabarti

Electric vehicle (EV) mobility is a promising global technique for reducing carbon emissions in the transportation industry. EV sharing is significantly increasing in many countries. Full battery electric or plug-in hybrid electric vehicles (PHEVs) are the two different EVs modes positioned as an alternative vehicle mode for achieving a sustainable road transportation system. EVs can help to substantially reduce fuel consumption and when powered by battery driven technology, can potentially reduce greenhouse gas emissions. Furthermore, EVs are pushing advancements in battery technology, which is a key challenge for industrial effectiveness in the clean energy transition. India is one of just a few nations to back the worldwide initiative, which aims for at least 30% of new vehicle sales to be electric by 2030. This transition to EV mobility needs an accessible and reliable network along with requisite infrastructure. The Indian government has implemented several initiatives to encourage the utilization of EVs and proposed various policies to establish EVs network and charging infrastructure. However, an appropriate approach is required to enable the effective and timely development of EV network and charging infrastructure that fits local requirements and is preferably integrated into the present transportation networks. The present study is carried out in the context of EV mobility in India, with a focus on technological, infrastructural, financial, behavioural, and external challenges. This study also highlights the current state of EV development and research in India. Additionally, the existing deployment of electric vehicles in India, as well as the challenges and possibilities in greater adoption are also summarized. This study will be a key addition to the policymakers, the government, and companies in India to assist the EVs mobility in order to reduce emission with minimal carbon footprints. The Indian government should contribute more capital on research and development of both EV and charging infrastructure. The central government should also play a key role in coordinating the actions of the states and EV-related organisations. Effective policies are required to manage upfront investment costs, encourage electric vehicle charging infrastructure, and ensure that charging demand is easily incorporated into power systems. With the groundwork for broad EV adoption being established in numerous global economies, there is a strong possibility that electric mobility will grow dramatically as a potential system of road transportation in the coming years.



Dr. Satyajit Mondal



Mr. Avi Dutt



Dr. Sandip Chakrabarti

Changing landscape of logistics in India with multimodal logistics parks by Mr. Avi Dutt, Mr. Apurva Shrey & Dr. Debjit Roy

Logistics costs in India account for a higher proportion of total value of goods compared to other developed countries. According to the Ministry of Road Transportation and Highways (MoRTH), it accounted for 13-14% of total value of goods in 2015 while for other developed countries it was approximately 7-8%. Another indicator of higher logistics cost is the difference in road freight cost per tonne per kilometre. For India, the cost is around INR 1.9 per tonne per km (almost double that of the cost incurred in the US). Lower speed of freight movement also increases the freight cost. In India, the average speed of freight movement is around 25-30 kmph which is around 60-70% lower than that of the US. Thus, overall logistics efficiency in India is affected due to multi-party coordination delays and infrastructure challenges. To address this challenge, India is developing Multimodal Logistics Parks (MMLPs) along with other initiatives.

This paper aims to study the concept of Multimodal Logistics Parks (MMLP) and recent steps taken to achieve the objective of improving the efficiency of logistics in India. It also elaborates on various efforts by the Government to promote the establishment of MMLPs. The case study of a recently proposed MMLP has been discussed and analysed taking into consideration key success factors crucial for MMLP. The paper also focuses on the policy formulation by State Governments with respect to Integrated Logistics Park (ILP) and Logistics Park (LP). The challenges and opportunities that lie in the domain of MMLP have been elaborated and some suggestions have been made regarding the same in the paper.



Mr. Avi Dutt



Mr. Apurva Shrey



Dr. Debjit Roy

Views from selected CTL faculty members

1. Dr. Poornima Varma

How can resilient supply chains be built in agriculture (seed to table)?

What role does technology play in the agri-supply chain?

There are plenty of opportunities for digital interventions in the supply chain of the agricultural sector. On the production front, farm machinery automation is useful in reducing the man power use wherever there is a shortage of labour. Several electronic devices are getting developed to provide real time information regarding crop cultivation to farmers. Such accurate information helps farmers in the judicious and timely application of inputs and enables maximisation of yield. Using sensors is also useful as such devices can collect the information regarding the minimum temperature, maximum temperature, soil moisture content and so on. Smart farming through precision agriculture is also another important scope through which sustainable use of resources can be encouraged. To achieve this, information and communication technologies (ICT) are incorporated into various production equipment and sensors by making use of large datasets on various aspects.

On the marketing front, the Indian Council for Agricultural Research Central Tuber Crops Research Institute (ICAR-CTCRI) has developed an online platform called HOMS i.e. Horticulture-crops Online Marketing System (<http://www.ctcritools.in/homs>). This aids the online marketing of fruits, vegetables and tuber crops. Different stakeholders such as farmers, input suppliers, logistic service providers and procurement agencies can register at this online platform for free and sellers can upload information related to various products, quantity, price, etc.¹ The registration of individual farmers, consumers and other supply chain members are free of cost. Sellers can upload their product's information, quantity, price etc.

One of the inefficiencies in the supply chain is the inability to accurately forecast price, and hence arises the difficulty in deciding how much to produce, when to produce, where to sell and when to sell. Farmers will often cultivate a higher quantity of output based on the prices that have prevailed in the previous year. Increased production can result in the lowering of prices through excess supply. Therefore, digital interventions that forecast future demand can be made possible, and supply can be adjusted accordingly. Based on forecasts developed using large data sets, farmers can decide when to produce, how to produce and which crop they should cultivate, and so on. Information dissemination through digital interventions can be used as a powerful tool to reduce supply chain inefficiencies.

What role can the transportation sector play in promoting sustainable agriculture — reducing the carbon footprint, providing farm-gate linkage, agri-warehousing services?

Transportation has a significant impact within the food and beverage sector because food is often shipped for long distances, and frequent transportation can contribute to exacerbating the carbon footprint. A shift away from cereal consumption to non-cereal consumption, along with a growing preference for packaged and processed food has created immense pressure on transportation to meet food consumption demand. Food production, storage and distribution has increased the transportation related carbon footprint, especially in a food and a context when agricultural value chains are getting vertically and horizontally integrated at a faster rate globally. An overall improvement in the food distribution system is required. Well, transportation is an unavoidable step. So careful planning is required with respect to various modes of transportation, the potential carbon emissions with respect to distance, storage as well as the size of packaging and the frequency of travel. It is possible that better storage facilities can reduce the number of transportation requirements. So a comparison between the two options in terms of carbon emission intensity can also be useful. India's international trade expansion is also increasing the production and exports of carbon emission intensive goods. The data available from the Organisation for Economic Co-operation and Development (OECD) shows that India is one of the leading exporters of carbon emissions embedded products and there is a steady increase in the total carbon emissions embedded in exports. China is the largest exporter of carbon emission embedded products, followed by India. India's carbon emission exports increased from 47 million tonnes at the time of joining the WTO in 1995, to 370 million tonnes in 2018.

What are the practical challenges especially with respect to last mile delivery of public distribution systems? How can the leakages in the existing PDS system be plugged?

In the Indian context, certain production inefficiencies due to policy distortions are also creating problems. For example, relatively water scarce states such as Punjab and Haryana are producing and transporting rice for the rest of the Indian population and thereby meeting around 90% of rice consumption demands of the rest of the country. The procurement of rice is also largely concentrated in these few states which are major producers. The procured grain is then distributed by the Food Corporation of India (FCI) to various ration shops in the country. Localised and decentralised procurement can be used to avoid the skewness in production at the cost of water, and can also be useful in reducing the carbon footprint that takes place through intra country transportation of grains. Such long distance transportation can also lead to higher leakages. The local food concept — producing and consuming locally as much as possible — can also be an effective way, in lieu of food travelling from far off places (food miles) to reach our plate, which increases the carbon footprint.

¹ Report on a Plan to Expand and Modernise Supply Chains in Agriculture in Kerala, 2021



Dr. Poornima Varma

2. Dr. Prahalad Venkateshan

What are the key research areas for scaling logistics — mainly through technology (large-scale optimisation, vehicle routing etc.)?

In order to scale logistics models so that they are usable in practice, good and reliable data availability are key. For instance, while data between locations are easily available using GPS technology, depending on context, the waiting time at different customer locations due to extraneous factors may not be available. Lack of such data may at times end up creating solutions which may not be easily implementable

How can adoption of optimisation techniques in logistics reduce the environmental impacts of the transportation system?

Fuel emission data are available and many logistics service providers especially in the maritime shipping industry use these data to design routes that attempt to optimise on the total emissions as well.

What are the new research areas in last-mile connectivity, mainly for the FMCG industry or white goods industry?

In the Indian context, we see a lot of repeat deliveries (multiple delivery personnel within the same day, each delivering a single product). There is a lot of scope for optimisation by consolidating these deliveries into a single delivery. This is also related to the previous question.

How can education institutions facilitate technology and open-source software adoption for industry, especially small firms?

I feel that in some cases, the availability of these logistics tools and methodologies may not be known. So, there is scope for increase of outreach from both sides. Secondly, in many cases, it takes significant time and effort to create tailored solutions for the unique problems that face small firms. Addressing this challenge is harder.



Dr. Prahalad Venkateshan

3. Dr. Prashant Das

Transportation and Real Estate

Debates on land ownership are almost as old as our civilization. Plato's (400 BC) disposition opposed private ownership as it may lead to "social divisiveness." His disciple Aristotle contended, arguing that private ownership promotes "prudence and responsibility." Barring some exceptions, however, land ownership and private interests can no more be alienated today. Nevertheless, land continues to remain a contentious issue in different facets of social sciences. For example, while accounting standards consider land value to be permanent, others have demanded a provision to record depreciation in land value primarily due to economic obsolescence (Blackmore, 1943).

To appreciate the debates related to land valuation -of which ownership interest is an essential part- we need to understand the nature of the asset first. Appraisers use the "residual method" for land valuation. Consider a built asset combining its land tenure. The difference between market value of the asset in excess of what it cost to develop it is the value of the land tenure. This method positions land as a rather abstract asset; an asset that derives its value from what is built on it. Land does not seem to hold any value by itself. Indeed, Nobel Laureate Paul Samuelson and his colleague Henry McKean paved the way for valuing land as a derivative (i.e. a perpetual warrant) that gives its owner an option to delay developing it until an optimum market value is achieved in the market. Inevitably, the decision to delay -and hence the value of a land parcel- must be a function of its attributes. These attributes must be relevant to the highest and best use (HBU) of the land parcel. In other words, the value of land depends on its HBU, not on what an owner decides to do with it purely on her whims.

If the HBU determines the value of a land parcel, the valuation must incorporate all factors that determine the appeal of its use. Effective land use, on the other hand, depends on infrastructure: Transportation, in particular. Residential, retail, educational and office buildings must be well-connected. A farmland requires easy access to transportation hubs. Offices need access to long-distance transportation infrastructure. The better the transportation network, higher the land value. The two asset classes are so closely intertwined that many projects (e.g. Bengaluru-Mysore Corridor) have a joint positioning, both as real estate and infrastructure projects (John, 2005). What role can the transportation sector play in promoting sustainable agriculture — reducing the carbon footprint, providing farm-gate linkage, and agri-warehousing services?

Transportation has a significant impact within the food and beverage sector because food is often shipped for long distances, and frequent transportation can contribute to exacerbating the carbon footprint. A shift away from cereal consumption to non-cereal consumption, along with a growing preference

in developed nations, the interdependence of these asset classes is well-documented and quantified. For example, in Washington DC, apartment rents fall by around 25% per mile distance from Metrorail stations (Sirmans & Benjamin, 1991). In Toronto, housing values are most sensitive to their distance (i.e. associated with a 2% fall per mile) from the subway stations (Haider & Miller, 2000). Similar findings were reported for housing in Oslo: Homes lose value by over 20% if located more than 200 meters away from the railroad track (Strand & Vagnes, 2001). In Luxembourg, land prices were shown to be more sensitive to their distance to CBD's (2% fall per mile), than their distances to other hubs; and were also sensitive to how far are the parcels located from road, bus stations, and train stations (Glumac et al., 2019).



Dr. Prashant Das

More recently, similar findings were reported in New Delhi (Tyagi & Singhal, 2018): Proximity to Metro rail enhances real estate valuation. At IIM Ahmedabad, we launched ISALPI, an Agri Land Price Index². We analyzed land listings data provided by SFarmsIndia (Hyderabad). The index methodology, as discussed earlier, posits land value as a function of its attributes. Among other variables, we tested the impact of infrastructure on Agri Land valuation (Das, 2022). Irrigated land parcels enjoy a 15% price premium. Parcels closer to international airports enjoy up to a 30% price premium. Agri Land values fall by nearly a percent per km distance from the nearest town and the airport.

End Note

Digitalization is blurring the boundaries between traditional silos of research communities. As more data is generated by human activity, we are able to better quantify numerous constructs that were earlier considered to be abstract. For example, we can now not only estimate the price impact of whether a land parcel is closer to or distant from a transportation hub, we can also estimate accurately how the value diminishes with distance. Our policy goals have appreciated the important role played by infrastructure and real estate sectors in the economic growth. By marrying the two disciplines together, and through data-driven quantitative research, we hope to help achieve the policy goals more effectively.

While the real estate assets continue to be dominated by private ownership, they share a symbiotic relationship with transportation infrastructure, a public good. Both Aristotle and Plato were right, we reckon.

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² <https://plato.stanford.edu/entries/property/>

Research updates from selected CTL faculty members

Addressing EV fleet operational challenges

The global EV market is expected to grow over four-times to reach an estimated global market size of about USD 1 trillion by 2026. While there are over 6.7 million plug-in light EV units in usage globally, the adoption is still believed to be at initial stages and several technical and infrastructural challenges such as limited range and durability of the vehicles, infrastructural challenges such as shortage of charging stations and unavailability of the reliable electricity, limits its usage.

CTL faculty Dr. Sriram Sankarnarayan has developed an optimisation model to minimise EV operational costs. The research project uses bilevel conic optimisation and multi-objective optimisation to find a balance between the electricity cost and travel time. The project provide an insight on the optimal routing and charging strategies of the electrified transportation fleet can support power networks to reduce nodal prices via demand response. The research provides a decision support system to evaluate the adoption of EV fleet and promotes faster electrification of transportation fleet along with reduced carbon emissions.

You can read more about the project here
<https://www.sciencedirect.com/science/article/pii/S0360544222007113?via%3Dihub>
<https://ieeexplore.ieee.org/document/9737327>



Locating facilities with risk considerations



Dr. Sachin Jayaswal, focuses on solving the facility location problem with economies and dis-economies of scale. The project proposes bi-level formulations and exact method for solving facility location problems in which facilities exhibit economies of scale in their operation up to a point and dis-economies of scale beyond that point.

Another critical part of any supply chain is the network of distribution centres and the hubs. These play a critical role in mitigating the risks involved in the value chain. The project investigates 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. Further, the model considers different classes of shipments that require different levels of service. One of the noteworthy discoveries of this study, which is counter-intuitive, is that providing priority service to a bigger part of the customer base does not always come at a cost. Instead, it could even lower the cost.

Vehicle routing with time considerations

Slotted e-commerce deliveries where multiple orders can be delivered in a time window is here to stay. The route optimization ensures that the company meets the promised delivery times with minimal delivery attempts, better vehicle utilization and hence, enhancing end consumer experience.

CTL faculty Dr. Prahalad Venkateshan focuses on the reverse logistics aspect of the last mile delivery using a symmetric vehicle routing formulation with simultaneous pickup and deliveries. The project has led to discovery of more effective and efficient ways of solving difficult problems where vehicles are required to not only deliver items from a warehouse to different customers, but also pickup items from the same customer locations to bring back to the warehouse. These challenges are crucial to managing e-commerce returns, gas cylinder deliveries/pickups from different client sites, and bottled drinks deliveries/pickups from retail establishments, amongst others. You can read more about the project here:

<https://onlinelibrary.wiley.com/doi/full/10.1002/net.22069>



Managing congestion at ports



With trade imbalance and resource crisis at the ports, managing traffic at the landside of container ports has become a significant concern. Containers arriving or departing by trains, barges or trucks are handled on the landside of a container terminal. Multiple trains and several thousand external trucks are handled daily at the ports. One of the issues pertaining specifically to the Los Angeles Port was the service of external trucks which were subjected to significant delays. What leads to the container handling delays and how resource flexibility can be leveraged to mitigate delays?

CTL faculty Dr. Debjit Roy leads projects to address the congestion at the container terminals (landside and seaside). These models can be adopted to analyse the terminal performance trade-offs rapidly. The insights gathered from this project reveals that at the landside, internal congestion could be accounted for due to the shortage of chassis but also interaction and sharing of resources between train and external truck containers matter.

Using a stochastic stylised semi-open queuing network model with bulk arrivals (of containers on trains), shared stack crane resources, and multi-class containers, the research examined the effects of priority on such delays. The findings demonstrate that external truck container handling times at shared stack cranes may be greatly reduced when compared to linked versus decoupled transport vehicles. You can read more about the project here:

<https://www.sciencedirect.com/science/article/pii/S0191261522000893>

Facilitating car-to-transit switches among aspirational urbanites

As planners and policymakers in cities around the world struggle to attract and retain public transit users, CTL faculty Dr. Sandip Chakrabarti explores strategies to promote transit adoption in contexts where the odds are stacked against transit. This study examines the preference for intra-urban (metro) rail over personal car for commute trips within a particular population sub-group that is rapidly adopting the personal car and leaving the transit market using travel behaviour data from India's National Capital Region, one of the world's most congested metropolitan areas that is experiencing unprecedented growth in personal vehicle ownership and plummeting transit ridership. The objective of this mode choice analysis that employs both logistic regression modelling and the propensity-score matching technique is to identify multi-modal service quality/performance factors that determine metro rail vs. car choice, and thereby recommend efficient and effective interventions for inducing car-to-transit switches in addition to retaining existing transit riders. According to the findings, metro rail may be preferred over a car in the study setting if its journey times are more competitive with those of a car (especially for long-distance commuters), it operates more frequently, it is safer, and the cost of parking at the destination is increased. You can read more here:

<https://www.sciencedirect.com/science/article/pii/S0967070X21003395?via%3Dihub>



CTL faculty research accomplishments

These are selected research papers from CTL faculty members pertaining to the transportation and logistics area.

Thematic Areas	Research Papers
Airlines and railways	<ul style="list-style-type: none"> Tiwari, R., Jayaswal, S., & Sinha, A. (2021). Competitive hub location problem: Model and solution approaches. <i>Transportation Research Part B: Methodological</i>, 146, 237–261. https://doi.org/10.1016/j.trb.2021.01.012 Narayanaswami, S. (2019). Optimal allocation of rolling stock in scheduled transportation services. <i>International Journal of Logistics Systems and Management</i>, 34(3), 327–351. https://doi.org/10.1504/IJLSM.2019.103087 Narayanaswami, S. (2018, December). A Novel Learning Heuristic Applied for Computationally Hard Managerial Decision Making and Transportation Operations Control. In <i>2018 International Conference on Production and Operations Management Society (POMS)</i> (pp. 1–7). IEEE. https://doi.org/10.1109/POMS.2018.8629467 Natesan, S., Singh, C., & Dutta, G. (2019). Utility function for airline travel in Nepal and its comparison with India. <i>International Journal of Revenue Management</i>, 11(1-2), 23–45. https://doi.org/10.1504/IJRM.2019.103010 Narayanaswami, S. (2018). Digital social media: Enabling performance quality of Indian Railway services. <i>Journal of Public Affairs</i>, 18(4), e1849. https://doi.org/10.1002/pa.1849 Narayanaswami, S. (2018). Water ATMs of Indian railways: Causing a silent revolution. <i>Vikalpa</i>, 43(2), 115–120. https://doi.org/10.1177/0256090918775497
E-commerce order fulfilment	<ul style="list-style-type: none"> Kandula, S., Krishnamoorthy, S., Roy, D. (2021). A prescriptive analytics framework for efficient e-commerce order delivery https://doi.org/10.1016/j.dss.2021.113584 Bansal, V., Roy, D. (2021). Stochastic modelling of multiline orders in integrated storage-order picking system https://onlinelibrary.wiley.com/doi/10.1002/nav.21978
Electric vehicles	<ul style="list-style-type: none"> Dong, Y., Koster, R., Roy, D., Yugang, Yu (2022). Dynamic vehicle allocation policies for shared autonomous electric fleets https://doi.org/10.1287/trsc.2021.1115 Subramanian, V., Feijoo, F., Sankaranarayanan, S., Melendez, K., Das, T. (2022). A bilevel conic optimisation model for routing and charging of EV fleets serving long distance delivery networks https://doi.org/10.1016/j.energy.2022.123808 González, S., Feijoo, F., Basso, F., Subramanian, V., Sankaranarayanan, S., Das, T. (2022) Routing and charging facility location for EVs under nodal pricing of electricity: A bilevel model solved using special ordered set https://doi.org/10.1109/TSG.2022.3159603
Facility location	<ul style="list-style-type: none"> Agarwal, Y.K., Aneja, Y.P., Jayaswal, S. (2022). Directed fixed charge multicommodity network design: A cutting plane approach using polar duality. <i>European Journal of Operational Research</i>, Volume 299, Issue 1. https://doi.org/10.1016/j.ejor.2021.08.043 Bhatt, S., Jayaswal, S., Sinha, A., Vidyarthi, N. (2021) Alternate second order conic program reformulations for hub location under stochastic demand and congestion https://doi.org/10.1007/s10479-021-03993-6 Vatsa, A. K., & Jayaswal, S. (2021). Capacitated multi-period maximal covering location problem with server uncertainty. <i>European Journal of Operational Research</i>, 289(3), 1107–1126. https://doi.org/10.1016/j.ejor.2020.07.061 Venkateshan, P. (2020). A Note on “The Facility Location Problem with Limited Distances”. <i>Transportation Science</i>, 54(6), 1439–1445. https://doi.org/10.1287/trsc.2020.0992 Tiwari, R., Jayaswal, S., & Sinha, A. (2019). Alternate solution approaches for competitive hub location problems. https://doi.org/10.1016/j.ejor.2020.07.018

Thematic Areas	Research Papers
Ocean freight transportation	<ul style="list-style-type: none"> Roy, D., Ommeren, J., Koster, R., Gharehgozli, A. (2022). Modeling landside container terminal queues: Exact analysis and approximations https://doi.org/10.1016/j.trb.2022.05.012 Gharehgozli, A., Roy, D., Saini, S., Ommeren, J. (2022). Loading and unloading trains at the landside of container terminals https://doi.org/10.1057/s41278-022-00219-9 Kumawat, G. L., & Roy, D. (2020). AGV or Lift-AGV? Performance trade-offs and design insights for container terminals with robotized transport vehicle technology. IISE Transactions. https://doi.org/10.1080/24725854.2020.1785648 Roy, D., De Koster, R., & Bekker, R. (2020). Modeling and design of container terminal operations. Operations Research. https://doi.org/10.1287/opre.2019.1920
Smart and sustainable infrastructure	<ul style="list-style-type: none"> Anjos, M.F., Feijoo, F., Sankaranarayanan, S (2022). A multinational carbon-credit market integrating distinct national carbon allowance strategies. Applied Energy https://doi.org/10.1016/j.apenergy.2022.119181 Vishwanathan, S., Garg, A., Tiwari, V., Kapshe, M., Tirthankar, N. (2021). SDG implications of water-energy systems transitions in India, for NDC, 2 °C, and well below 2 °C scenarios. Environmental research letters https://doi.org/10.1088/1748-9326/ac08bf Shah, A., Garg, A., Mishra, V. (2021). Quantifying the local cooling effects of urban green spaces: Evidence from Bengaluru, India. Landscape and urban planning https://doi.org/10.1016/j.landurbplan.2021.104043 Sarkar, P., Sahu, S. G., Patange, O. S., Garg, A., Mukherjee, A., Kumar, M., & Singh, P. K. (2021). Impacts of changes in commercial non-coking coal grading system and other coal policies towards estimation of CO2 emission in Indian power sector. Carbon Management, 12(1), 69–80. https://doi.org/10.1080/17583004.2021.1876529 Avashia, V., & Garg, A. (2020). Implications of land use transitions and climate change on local flooding in urban areas: An assessment of 42 Indian cities. Land Use Policy, 95, 104571. https://doi.org/10.1016/j.landusepol.2020.104571 Avashia, V., Parihar, S., & Garg, A. (2020). Evaluation of Classification Techniques for Land Use Change Mapping of Indian Cities. Journal of the Indian Society of Remote Sensing, 48(6), 877–908. https://doi.org/10.1007/s12524-020-01122-7 Bizikova, L., Nkonya, E., Minah, M., Hanisch, M., Turaga, R. M. R., Speranza, C. I., Karthikeyan, M., Tang, L., Ghezzi-Kopel, K., Kelly, J., Celestin, A. C., & Timmers, B. (2020). A scoping review of the contributions of farmers' organisations to smallholder agriculture. Nature Food, 1(10), 620–630. https://doi.org/10.1038/s43016-020-00164-x Gupta, D., & Garg, A. (2020). Sustainable development and carbon neutrality: Integrated assessment of transport transitions in India. Transportation Research Part D: Transport and Environment, 85, 102474. https://doi.org/10.1016/j.trd.2020.102474 Malik, A., Bertram, C., Despres, J., Emmerling, J., Fujimori, S., Garg, A., Kriegler, E., Luderer, G., Mathur, R., Roelfsema, M., Shekhar, S., Vishwanathan, S., & Vrontisi, Z. (2020). Reducing stranded assets through early action in the Indian power sector. 15(9), 094091. https://doi.org/10.1088/1748-9326/ab8033 Schaeffer, R., Köberle, A., van Soest, H. L., Bertram, C., Luderer, G., Riahi, K., Krey, V., van Vuuren, D. P., Kriegler, E., Fujimori, S., Chen, W., He, C., Vrontisi, Z., Vishwanathan, S., Garg, A., Mathur, R., Shekhar, S., Oshiro, K., Ueckerdt, F., Potashnikov, V. (2020). Comparing transformation pathways across major economies. Climatic Change, 162(4), 1787–1803. https://doi.org/10.1007/s10584-020-02837-9 Avashia, V., Garg, A. (2020). Implications of land use transitions and climate change on local flooding in urban areas_ An assessment of 42 Indian cities Elsevier Enhanced Reader. (n.d.). https://doi.org/10.1016/j.landusepol.2020.104571 Sugathan, A., Malghan, D., Chandrashekar, S., & Sinha, D. K. (2019). Downstream electric utility restructuring and upstream generation efficiency: Productivity dynamics of Indian coal and gas based electricity generators. https://doi.org/10.1016/J.ENERGY.2019.04.107

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Urban mobility and passenger transportation	<ul style="list-style-type: none"> Chakrabarti, S. (2022). Passively wait for gridlock, or proactively invest in service? Strategies to promote car-to-transit switches among aspirational urbanites in rapidly developing contexts. https://doi.org/10.1016/j.tranpol.2021.11.018 Avashia, V., Garg, A., Dholakia, H. (2021). Understanding temperature related health risk in context of urban land use changes https://doi.org/10.1016/j.landurbplan.2021.104107 Prabu, A., Maruthasalam, P., Roy, D., Venkateshan, P. (2021). Modelling driver's reactive strategies in e-hailing platforms: an agent-based simulation model and an approximate analytical model. https://doi.org/10.1080/00207543.2021.1987554 Giuliano, G., & Chakrabarti, S. (2020). Analyzing intra-metropolitan variation in highway traffic performance in Los Angeles using archived real-time data. Transportation Planning and Technology, 43(8), 751–770. https://doi.org/10.1080/03081060.2020.1828931 He, S. Y., Chakrabarti, S., & Cheung, Y. H. Y. (2020). A time-use perspective of out-of-home activity participation by older people in Hong Kong. Asian Geographer, 0(0), 1–23. https://doi.org/10.1080/10225706.2020.1808488
Vehicle routing	<ul style="list-style-type: none"> Agarwal, Y., Venkateshan, P. (2021). New valid inequalities for the symmetric vehicle routing problem with simultaneous pickup and deliveries. https://doi.org/10.1002/net.22069
Warehousing	<ul style="list-style-type: none"> Lamballais, T., Merschformann, M., Roy, D., de Koster, M.B.M., Azadeh, K., Suhl, L. (2022). Dynamic policies for resource reallocation in a robotic mobile fulfillment system with time-varying demand. European journal of operational research https://doi.org/10.1016/j.ejor.2021.09.001 Bansal, V., & Roy, D. (2021). Stochastic modelling of multiline orders in integrated storage-order picking system. Naval Research Logistics (NRL), 68(6), 810–836. https://doi.org/10.1002/nav.21978 Bansal, V., Roy, D., & Pazour, J. A. (2021). Performance analysis of batching decisions in waveless order release environments for e-commerce stock-to-picker order fulfillment. International Transactions in Operational Research, 28(4), 1787–1820. https://doi.org/10.1111/itor.12921 Dutta, G., Naik, A., Gosai, D., & Ghosh, P. (2021). A mathematical model for predicting length of postoperative intensive care requirement following cardiac surgery in an Indian hospital. OPSEARCH, 58(2), 330–350. https://doi.org/10.1007/s12597-020-00480-7 Kaika, N., Dutta, G., Das, D., & Banerjee, S. (2021). Time-of-use pricing of electricity in monopoly and oligopoly. OPSEARCH, 58(1), 1–28. https://doi.org/10.1007/s12597-020-00465-6 Kumawat, G. L., & Roy, D. (2021a). A new solution approach for multi-stage semi-open queuing networks: An application in shuttle-based compact storage systems. Computers & Operations Research, 125, 105086. https://doi.org/10.1016/j.cor.2020.105086 Kumawat, G. L., & Roy, D. (2021b). AGV or Lift-AGV? Performance trade-offs and design insights for container terminals with robotized transport vehicle technology. IISE Transactions, 53(7), 751–769. https://doi.org/10.1080/24725854.2020.1785648 Kumawat, G. L., Roy, D., De Koster, R., & Adan, I. (2021). Stochastic modelling of parallel process flows in intra-logistics systems: Applications in container terminals and compact storage systems. European Journal of Operational Research, 290(1), 159–176. https://doi.org/10.1016/j.ejor.2020.08.006 Venkateshan, P., Szmerekovsky, J., & Vairaktarakis, G. (2020). A cutting plane approach for the multi-machine precedence-constrained scheduling problem. Annals of Operations Research, 285(1), 247–271. https://doi.org/10.1007/s10479-019-03212-3 Agarwal, Y. K., & Venkateshan, P. (2019). New Valid Inequalities for the Optimal Communication Spanning Tree Problem. INFORMS Journal on Computing, 31(2), 268–284. https://doi.org/10.1287/ijoc.2018.0827 Krishnamoorthy, S., & Roy, D. (2019). An Utility-Based Storage Assignment Strategy for e-Commerce Warehouse Management. 2019 International Conference on Data Mining Workshops (ICDMW). https://doi.org/10.1109/ICDMW.2019.00144

*Reference Research and Publications, IIMA _ <https://www.iima.ac.in/web/rnp/journal-publications>

Thought leadership articles

Thematic Areas	Newspaper	OpEd Title
Smart and sustainable infrastructure	Indian Express	Reforms farming needs by Dr. Poornima Varma, Dr. Nikita Gupta
Airlines and railways	The Times of India	Cargo drones and the future of logistics by Dr. Debjit Roy, Dr. Sandip Chakrabarti, Mr. Ajay Antonney, Mr. Avi Dutt
E-commerce order fulfilment	Indian Transportation and Logistics News	Workshop- TSL Informs E-commerce Logistics Workshop (13- 15 Dec): 11 major logistics, supply chain, e-commerce trends that will shape 2022
Facility location	The Hindu	Managing the medical oxygen supply chain in India by Dr. Debjit Roy, Dr. Michigan
Road freight transportation	The Economic Times	India's Covid-19 Vaccination Program: Looming uncertainty, and strategies to overcome capacity, shortage and distribution hurdles by Dr. Debjit Roy & Dr. Sandip Chakrabarti
Smart and sustainable infrastructure	The Financial Express	Sowing a bitter harvest? Indian farmers need more market access, not more markets by Dr. Poornima Varma, Dr. Gurpreet Singh
Warehousing	International Business Times	Warehousing protocols must change with COVID-19; vital suggestions by Dr. Debjit Roy
Road freight transportation	International Business Times	Majority of trucks have no drivers amid Coronavirus lockdown; smart operating models explored by Dr. Debjit Roy
Smart and sustainable infrastructure	The Wire Science	Will COVID-19 Lockdowns Generate Public Support for Climate Change Mitigation? by Dr. Rama Mohana R. Turaga
Road freight transportation	Thomson Reuters Foundation News	OPINION: Keep cities moving during the global COVID-19 pandemic by Dr. Sandip Chakrabarti

Reforms farming needs: Strengthening APMCs will improve access, give bargaining power to farmers

Published on February 23, 2022 in Indian Express by Dr. Poornima Varma and Dr. Nikita Gupta



Reforms farming needs

Strengthening APMCs will improve access, give bargaining powers to farmers

POORNIMA VARMA AND NIKITA GUPTA

THE REPEAL OF the central government's three contentious farm laws, which sparked more than a year of farmers' protests across the country, has finally cleared the way for a shift back in focus to the much-needed APMC (Agricultural Produce Market Committee) reforms. It is irrefutable that the APMC markets need a revamp and an overhaul. While the APMC model Act of 2003 and APLM (Agricultural Produce and Livestock Marketing) Act of 2017 have partially resulted in the opening of alternative marketing channels for farmers, several shortcomings still exist. Our field visits to three APMCs in Maharashtra (one of the first states to adopt and implement the APMC Model Act, 2003 in 2006), shed light on several crucial areas that require attention.

First, is the need to increase the number of markets. At present, the country has about 2,477 principal regulated markets and 4,843 sub-market yards. As per the recommendations made by the National Commission on Farmers in 2004, the country needs approximately 41,000 markets to enhance market access to farmers. The density of regulated markets also varies considerably across the country, from 18.78 sq km in Punjab to 112.15 sq km in Meghalaya. The commission recommends that a regulated market should be available to farmers within a radius of 5 km. Currently, farmers travel on an average of 50-

100 km to sell their produce. Second, improve the infrastructure facilities. Most markets are riddled with a large number of middlemen and multiple layers like *kachcha arhatiyas* and *palkar arhatiyas*. The commission is levied for merely mediating, without providing any grading or sorting facilities to farmers. In principle, quality testing in laboratories is available for online transactions. However, only a very small fraction of the total produce is assessed in labs. The rest of the quality testing takes place through traditional methods of examining the produce by hand. Therefore, APMCs should adopt artificial intelligence machines for quality testing in order to hasten the testing process.

Third, ensure effective and transparent functioning of e-NAM. Currently, 1,000 markets located in 21 states and three union territories (UTs) are integrated into the e-NAM network. But this e-NAM is in shambles, and the market integration to it is limited, with no benefits accruing to farmers. A significantly lower share of trade in APMCs takes place on e-NAM. It is the traders themselves who trade in both online and offline platforms. The government website clearly mentions that markets must have laboratories with computers, crop testing machines and trained professionals to operate them. After getting registered in a market at gate entry, a farmer has to get his lot weighed, the sample crop tested and then wait

for e-NAM prices to be declared to her/him. She/he need not have any knowledge of digital media to benefit from the perks of online trading. It is clear that it is the commission agents who benefit from e-NAM.

Digital interventions and training services are needed to increase farmers' integration into e-NAM-enabled markets. Otherwise, e-NAM will be limited to traders who trade in both online and offline platforms in the form of intra-market trading. While the comparison of e-NAM vs offline auction price data might show more price realisation on e-NAM, such an analysis is flawed: Most e-NAM-enabled APMCs tend to report the auction price of the high-quality lot as the e-NAM price.

Fourth, ensure the minimum support price (MSP) as the starting price for bidding. In principle, while bidding in these APMCs is supposed to start at the MSP for products that are covered under the MSP programme, in practice, traders manipulate and exhibit a tendency to fix a price below the MSP, citing poor quality. To mitigate this, some mechanisms to ensure that the prices do not fall below MSP by a certain percentage, or strict adherence to quality checks, need to be implemented.

In several APMCs, farmers do not need to pay any fee or commission to the commission agents; traders have to pay commission agents. Though this seems as though it would come as a relief to farmers, the fact is that the traders

who have to pay the commission can further depress the price margin received by farmers through collusion.

Fifth, implement reforms within APMCs with direct selling provision. The farmers' decision to sell outside the APMC is largely dependent upon the price difference between the two and bears eloquent testimony to farmers using the APMC as a bargaining chip. The greater number of marketing options are partly the result of APMC model acts, rather than the three farm laws that would have resulted in bypassing the existing APMCs. The direct selling provision of the model acts, without undermining the importance of APMCs, provides an edge to farmers.

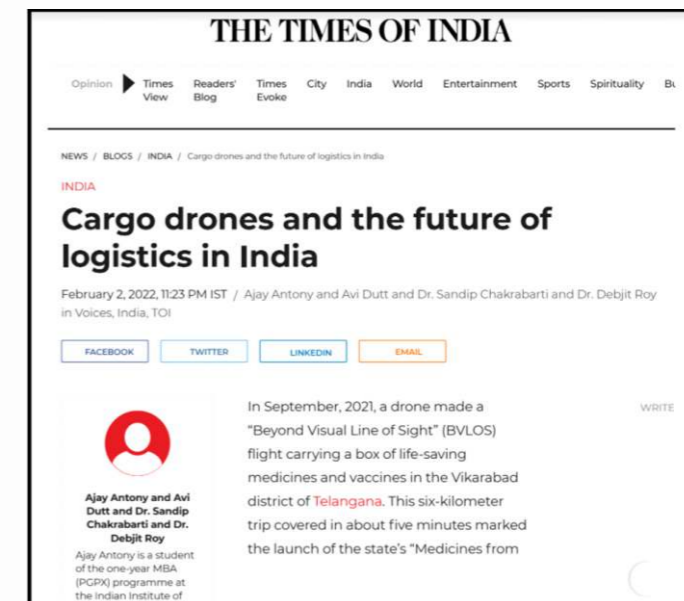
As a way forward, there is a need to encourage and facilitate direct selling by farmers without necessarily routing it through APMCs, complemented by the establishment of an effective regulatory infrastructure through APMCs. Such a strengthening of the system will counterbalance the existing imperfect market structure by providing farmers with an effective bargaining chip—the APMCs—for negotiation and price realisation.

Varma is a faculty and chairperson at the Centre for Management in Agriculture, IIM Ahmedabad. Gupta is a doctoral student at the Centre for Management in Agriculture at IIM Ahmedabad. Views are personal

Link: <https://www.iima.ac.in/web/ctl/assets/img/news/Reforms%20Farming%20Needs.pdf>

Cargo drones and the future of logistics in India

Published on February 02, 2022 in The Times of India by Mr. Ajay Antonney, Mr. Avi Dutt, Dr. Sandip Chakrabarti and Dr. Debjit Roy



Link: <https://timesofindia.indiatimes.com/blogs/voices/cargo-drones-and-the-future-of-logistics-in-india/>

Workshop - TSL Informs E-commerce Logistics Workshop (13-15 Dec): 11 major logistics, supply chain, e-commerce trends that will shape 2022

Published on January 17, 2022 in Indian Transport & Logistics News by Dr. Debjit Roy and Dr. Sandip Chakrabarti



Link: <https://www.itln.in/11-major-logistics-supply-chain-e-commerce-trends-that-will-shape-2022>

Professors Debjit Roy and Sandip Chakrabarti, who co-chair the IIMA Centre for Transportation and Logistics (CTL)

Oxygen cylinder - Detailed article on oxygen cylinder: Managing the medical oxygen supply chain in India

Published on June 15, 2021 in Business Line, The Hindu by Dr. Debjit Roy and Dr. Anand Nair



Link: <https://www.thehindubusinessline.com/opinion/columns/managing-the-medical-oxygen-supply-chain-in-india/article34819519.ece>

COVID - ET - Covid Supply Chain article in ET: India's Covid-19 Vaccination Program: Looming uncertainty, and strategies to overcome capacity, storage, and distribution hurdles

Published on June 01, 2021 in Health world, The Economic Times by Dr. Debjit Roy and Dr. Sandip Chakrabarti



Link: <https://health.economictimes.indiatimes.com/news/industry/indias-covid-19-vaccination-program-looming-uncertainty-and-strategies-to-overcome-capacity-storage-and-distribution-hurdles/83139144>

Sowing a bitter harvest? Indian farmers need more market access, not more markets

Published on October 02, 2021 in Financial Express by Dr. Poornima Varma and Dr. Gurpreet Singh



Link: <https://www.financialexpress.com/opinion/sowing-a-bitter-harvest/2096282/>

Warehousing protocols must change with COVID-19; vital suggestions

Published on May 30, 2020 in International Business Times by Dr. Debjit Roy



Link: <https://www.ibtimes.co.in/warehousing-protocols-must-change-covid-19-vital-suggestions-821160>

Majority of trucks have no drivers amid Coronavirus lockdown; smart operating models explored
Published on May 23, 2020 in International Business Times by Dr. Debjit Roy



The coronavirus-led lockdown has had a severe impact on the trucking sector due to the shortage of truck drivers. This article talks about how two-third of the trucks in India are idling, which is a serious cause for concern.

by Debjit Roy
May 23, 2020 17:19:47

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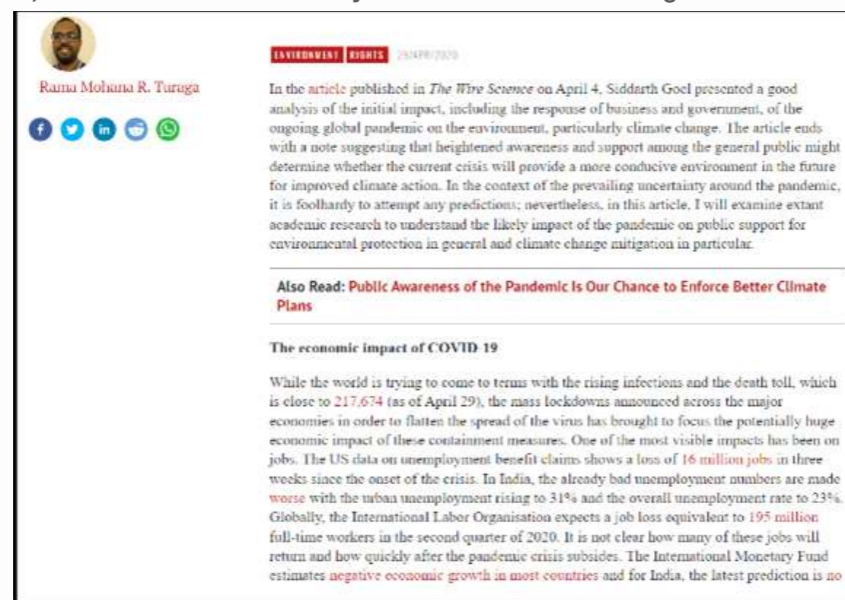
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4,000 migrant workers gather at Bengaluru's Palace Grounds to register and return home amid lockdown

The pandemic stopped almost everything except the movement of essentials. The truck drivers were at the core of the freight movement mission across the nation. Much before the

Link: <https://www.ibtimes.co.in/50-lakh-trucks-have-no-drivers-amid-coronavirus-lockdown-smart-operating-models-explored-820643>

Will COVID-19 Lockdowns Generate Public Support for Climate Change Mitigation?
Published on April 29, 2020 in The Wire Science by Dr. Rama Mohana R. Turaga



ENVIRONMENT RIGHTS 29 APR 2020

Rama Mohana R. Turaga

In the article published in *The Wire Science* on April 4, Siddarth Goel presented a good analysis of the initial impact, including the response of business and government, of the ongoing global pandemic on the environment, particularly climate change. The article ends with a note suggesting that heightened awareness and support among the general public might determine whether the current crisis will provide a more conducive environment in the future for improved climate action. In the context of the prevailing uncertainty around the pandemic, it is foolhardy to attempt any predictions; nevertheless, in this article, I will examine extant academic research to understand the likely impact of the pandemic on public support for environmental protection in general and climate change mitigation in particular.

Also Read: Public Awareness of the Pandemic Is Our Chance to Enforce Better Climate Plans

The economic impact of COVID-19

While the world is trying to come to terms with the rising infections and the death toll, which is close to 217,674 (as of April 29), the mass lockdowns announced across the major economies in order to flatten the spread of the virus has brought to focus the potentially huge economic impact of these containment measures. One of the most visible impacts has been on jobs. The US data on unemployment benefit claims shows a loss of 16 million jobs in three weeks since the onset of the crisis. In India, the already bad unemployment numbers are made worse with the urban unemployment rising to 31% and the overall unemployment rate to 23%. Globally, the International Labor Organisation expects a job loss equivalent to 195 million full-time workers in the second quarter of 2020. It is not clear how many of these jobs will return and how quickly after the pandemic crisis subsides. The International Monetary Fund estimates negative economic growth in most countries and for India, the latest prediction is no

Link: <https://thewire.in/environment/covid-19-lockdown-public-support-climate-change-mitigation>

OPINION: Keep cities moving during the global COVID-19 pandemic
Published on April 27, 2020 in Thomson Reuters Foundation News by Dr. Sandip Chakrabarti



OPINION: Keep cities moving during the global COVID-19 pandemic

by Sandip Chakrabarti & Andy Hong | [@DrSChakrabarti](https://twitter.com/DrSChakrabarti)
Monday, 27 April 2020 13:10 GMT

ABOUT OUR CORONAVIRUS COVERAGE

We show how coronavirus is impacting the lives of vulnerable people globally.

* Any views expressed in this opinion piece are those of the author and not of Thomson Reuters Foundation.

These four urban transportation strategies can mitigate hardship caused by coronavirus and future pandemics

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Dr. Sandip Chakrabarti is Assistant Professor in the Public Systems Group at the Indian Institute of Management Ahmedabad.

Dr. Andy Hong is Lead Urban Health Scientist at Nuffield Department of Women's & Reproductive Health and PEAK Urban researcher at University of Oxford.

Link: <https://news.trust.org/item/20200427112438-npvo/>

Impact on policy and practice

PM Gati Shakti event representation from the Centre



PM Gati Shakti would solve past difficulties by instituting comprehensive planning for key infrastructure projects with all stakeholders. Rather than planning and designing in silos, the initiatives will be created and implemented with a shared vision. Bharatmala, Sagarmala, inland waterways, dry/land ports, UDAN, and other infrastructure plans of different Ministries and State Governments will be included. To strengthen connectivity and make Indian enterprises more competitive, economic zones such as textile clusters, pharmaceutical clusters, defence corridors, electronic parks, industrial corridors, fisheries clusters, and agro zones would be covered. It will also make substantial use of technology, including as spatial planning tools based on ISRO images produced by BiSAG-N (Bhaskaracharya National Institute for Space Applications and Geoinformatics).

PM Gati Shakti is built on the following six pillars:

1. **Comprehensiveness:** A single centralised gateway will include all existing and planned projects from all Ministries and Departments. Every department will now have visibility into the actions of the others, giving important information for project planning and execution.
2. **Prioritisation:** Through cross-sectoral contacts, various Departments will be able to prioritise their initiatives.
3. **Optimisation:** Following the identification of significant gaps, the National Master Plan will aid various ministries in planning initiatives. The plan will aid in the selection of the most efficient route in terms of time and cost for the delivery of products from one location to another.
4. **Synchronisation:** Ministries and departments frequently operate in isolation. There is a lack of cooperation in the project's planning and implementation, resulting in delays. PM GatiShakti will ensure that the operations of each department, as well as the many levels of governance, are synchronised in a holistic way by guaranteeing work coordination between them.
5. **Analytical:** The plan will bring all of the data together in one location, using GIS-based spatial planning and analytical tools with 200+ levels, giving the executing agency improved visibility.
6. **Dynamic:** Through the GIS platform, all Ministries and Departments will be able to visualise, review, and monitor the development of cross-sectoral projects, since satellite imagery will provide on-ground progress on a regular basis and project progress will be updated on a regular basis on the portal. It will aid in the identification of critical actions for the master plan's enhancement and update (Prime Minister launched PM GatiShakti on October 13, 2021).

The PM Gati Shakti event was attended by Shri. Bhupendra Patel, Chief Minister of Gujarat and other ministers. A total of 16 ministers were present in the event to discuss framework, policies and execution of the Gati Shakti model. The Ministry of Electronics and Information Technology presented a national master plan for multi modal connectivity which makes the system transparent and enhances collaboration among different stakeholders.



Key Takeaways by Dr. Debjit Roy's Presentation:

Dr. Roy talked about the vision of Centre for Transportation and Logistics. He emphasized on the work done by the Centre in the field of the transportation, warehouses and container terminals. He focused on logistics cost (13-14% of GDP) and also deliberated on how the PM Gati Shakti can help to reduce it. One of the components of this logistics cost is inventory carrying cost and he focused on why the inventory holding cost is so high. He further elaborated that a reason for this could be quality of infrastructure, transportation cost and multiple handling of the products. Therefore, he suggested to focus on warehousing and improving the transportation modes.

Dr. Roy further delved deeper into the challenges faced by warehousing on two fronts such as infrastructure and labour. He further discussed the case of Starbucks and how it decides on setting up of the outlets. He suggested the use of data to determine the facility location and PM Gati Shakti can facilitate to achieve this mission. While discussing challenges faced by the ports, he emphasised on speed of doing business. Real time data mapping to make the whole system intelligent was one of the ways suggested by him to enhance speed of doing business. He also suggested the mapping of strategic data with real time operational data.

Dr. Roy further suggested development of the resting hubs for the drivers. In conclusion, he elaborated on Asset Mapping along with Facility Mapping and emphasized about the following pointers:

- Not just the facility
- Real-time capacity availability
- Type of assets/ equipment
- Optimising flows

He further elaborated on augment strategic location data with operational data and also focus on inter-ministry collaboration.

Dr. Roy further emphasised on the mapping of customer or product journey as a need of the hour. The product flow has to be mapped so that one can know where the gaps are and those gaps can be filled using digital PM Gati Shakti Plan.

Dr. Roy further proposed validation of cost components by monitoring the performance through the data generated from PM Gati Shakti Plan at component level (Performance Analysis and Monitoring movement of Logistics Cost Components) with focus on the three pointers:

- Benchmarking
- Regional variation
- Monitoring components

In conclusion, Dr. Roy mentioned that PM Gati Shakti plan provides a golden opportunity to gather relevant data.

Praise for Dr. Debjit Roy's Presentation:

Shri. Rajvardhan Singh Dattigaon (Cabinet Minister - Industry Policy and Investment Promotion, Government of Madhya Pradesh) praised the efforts of IIMA in MMLP. Particularly said "IIM Ahmedabad's gentlemen did a great job".

Unified logistics interface platform

Mr. Avi Dutt supported the ULIP (<https://logixtics.nldsl.in/>) initiative of government of India as key task-force member. Unified Logistics Interface Platform (ULIP) is designed to enhance efficiency and reduce the cost of logistics in India by creating a transparent, one window platform that can provide real-time information to all stakeholders. It was also emphasized that the solution should have the visibility of multi-modal transport, and all the existing systems of various ministries, governing bodies, and private stakeholders should be integrated with the ULIP system.

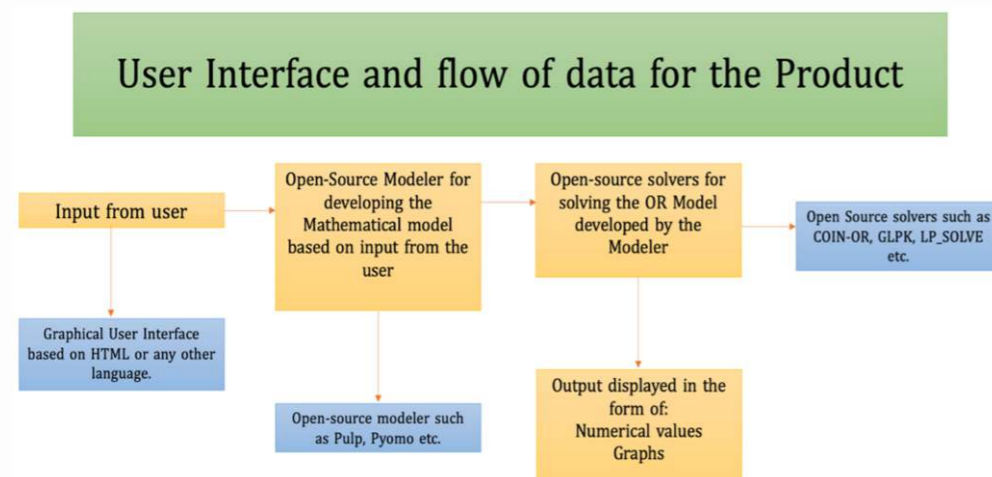
Plan for the future

Educational Products

The Centre is planning to develop educational product (web-based or app-based) for teaching purposes to explain Operations Research (OR) concepts. The product's focus would be on the ease of use, access and understanding of the concepts taught in the class. The preliminary focus is on OR problems such as:

- Traveling Salesman Problem/Vehicle Routing Problem
- Assignment Problems
- Manufacturing Problems etc.

The sample idea for user interface:



SRF Workshop

The Centre for Transportation and Logistics' research mandate is achieving sustainable road freight. In this regard, the focus of the Centre is on Truck Platooning. As the name implies, "Truck Platooning" is the formation of a platoon of trucks on highways following each other at established close distances by communicating with each other through smart automated vehicle technologies. It is a promising strategy to not only reduce the workload of truck drivers but also to increase the efficiency of freight transportation. A truck platoon is a set of virtually linked trucks that drive closely behind one another using automated driving technology. Semi-automated driving technologies, collectively referred to as Cooperative Adaptive Cruise Control, enable trucks to drive very close together as a platoon. Trucks in a platoon are virtually linked and communicate with each other through wireless communication technology. The leading truck is manually driven at the first position of the platoon and automatically followed by one or more following trucks. This means that the following trucks automatically brake, steer and accelerate/decelerate based on the actions of the leading truck. However, in automated driving technology, all the truck are connected to each other and move as a string with minimum spacing in between. Automated driving has been successfully deployed in closed environments in various logistics and freight transportation settings such as port terminals, warehouses and factories. Truck platooning can be considered as a first step towards automated freight transportation in an open and uncontrolled environment.

Truck platooning is considered as an "energy-efficient vehicle control solution" for the future of the freight transportation industry. It has the following benefits:

- Cost savings
- Reduced emissions
- More efficient use of road capacity

Industry consortium

CTL plans to build an industry consortium, which will foster collaboration between industry, regulators, and academia.

CTL foresees the following benefits to the CTL faculty and associated affiliates:

- Interaction with practitioners on specific transportation and logistics issues from their organisation
- Networking and exchanging knowledge with representatives of some of the leading fleet operators, e-commerce service providers, ports, mobility companies, OEMs, 3PL providers and logistics service providers

CTL foresees the following benefits to industry representatives:

- Privileged access to CTL workshop series, panel discussions, member-specific events
- Contribute to the larger IIMA knowledge ecosystem

CTL will continue to organise periodic research seminars, workshops, and panel discussions on contemporary issues of relevance to practice and policy. Some of the upcoming events are panel discussions on multi-modal logistic parks, quick commerce and real estate.

Several universities have industry consortiums based on a fixed membership fee. Both faculty and researchers benefit from the consortium in terms of access to industry members and listening to their problems, and potential research collaborations.

- CTL aims to initiate a new industry practitioner lecture series about the state-of-practices in the domain of transportation and logistics. CTL may invite leaders of companies and government agencies to discuss their accomplishments, plans, challenges, and how academia can help them improve productivity and achieve their goals.
- CTL will partner with consulting organisations, companies, government agencies, and educational institutions to jointly write white papers in order to explore challenges in the domain and identify research questions or problems. CTL has already initiated conversations with KPMG, Ola Mobility, and Delhivery to write thoroughly researched joint papers on a range of topics in aviation, urban mobility and logistics.
- CTL will advertise its postdoctoral research program more widely to attract better applications. Postdoctoral research support is key to advancing its agenda of contributing to the expansion of scholarship in transportation and logistics in the country. CTL will engage with its RAC to attract bright applicants.





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