Global Challenges in Smart Logistics
- innovation driving supply chain control

Coordination of Last-Mile Delivery in Urban Cities – a review of current practices and future prospects

Hoong Chuin LAU
Singapore Management University
SMU Urban Management Analytics Lab

**THEME:** Understanding, optimizing, and coordinating flows & interactions in urban settings

**URBAN LOGISTICS**
Improving Freight Flow
* e.g. last-mile multi-party delivery coordination in a mega city

**URBAN MOBILITY**
Improving Passenger Flow
* e.g. last-mile passenger share-riding at bus/MRT stations

**URBAN TOURISM**
Improving Visitor Flow
* e.g. crowd coordination/control at theme parks, trade events, expos, etc

**URBAN HEALTHCARE**
Improving Patient Flow
* e.g. dynamic queue control at hospital emergency departments

**URBAN SAFETY & SECURITY**
Enforcement and Surveillance
* e.g. deployment of patrols and inspectors at crowded places
Urban Tourism: Dynamic Logistics Management in Theme Parks via Coordination and Incentives
(Project with Resorts World Sentosa)*

*This work is supported by the National Research Foundation of Singapore, in collaboration with Carnegie Mellon University under LARC.
From Coordinating Crowds to Coordinating Freight

Collaborating Companies:
DHL Supply Chain (Singapore), Deutsche Post DHL
Yamato Transport
Urban Logistics

- **Key Factors**: Economic, Environment, Congestion, Energy
- Urban freight makes 10% of the traffic, but 40% of the pollution and noise, about 25% (road x hours) road usage space
- **The last mile**: transit of urban freight from the distribution center(s) to the city center (malls, offices and homes)
- Last mile amounts to between 13% to 75% of total logistics costs in Singapore

**Government**
1. Mobility
2. Environmental pollution
3. Safety and livability
4. Tourism

**Businesses**
1. Sustainability (CSR)
2. Service level improvement
Urban Logistics Stakeholders

Getting stakeholders (authorities, customers, providers) to collaborate to improve urban logistics operations

**Urban Logistics ...**

- ... aims to
  - **reduce costs** of goods distribution in urban areas
  - **increase** flexibility, speed and service level and supporting adding additional value creation
  - **improve** city's social & environmental situation
    .....through the use of business & decision analytics
- ...addresses city's & industry's needs
- ...leverages city and government authorities as major supporters
- ...promotes **innovative and best-practice solutions** across the industry

**Stakeholders**

**Authorities**

.....as enablers
- Implement policies to reduce city challenges, e.g. pollution, congestion
- Support urban logistics through regulations or incentives, e.g., city toll, delivery restrictions, etc.

**Business owners**

.....as customers
- Implement products to reduce cost, increase flexibility, speed and service level
- Implement solutions that increase the value add for the customer

**Service Providers**

.....as partners
- Implement optimized and collaborative services
- Innovative solutions that further increase productivity
Singapore Shopping District
Collaborative Urban Logistics  
(National Project funded by A*STAR)

• Logistics - fragmented and relatively unregulated industry in Singapore

• Goal: getting stakeholders (shippers, carriers, service providers and receivers) to collaborate on last-mile delivery through an e-marketplace

• Key Challenges:
  • Address the implicit and explicit complexity of last mile logistics
  • Model the behavior of shippers, carriers and receivers
  • Coordinate multiple parties (agents) for system efficiency and cost effectiveness
  • Harmonize data for real-time decision support
  • Integrate and synchronize through an e-marketplace system
E-Market for Last Mile Delivery Coordination

- Higher Truck Load Factor
- Lower Transportation Cost
- More Environment Friendly
- Less Congestion
- Improved Reliability

Carriers
(Logistics Service Providers and Transportation companies)

Customers in City

Shippers
(Sources of shipment)

E-Market
(Cloud-based Platform)

Common Route Schedule
(Available Capacity vs ETA)

ETAs – Estimated Time To Arrival
LSP – Logistics Service Provider
TLF – Truck Load Factor
S – Supplier

ETAs

ETA 1

ETA 2

ETA 3

Timings of Delivery

Bidding & Negotiation

Pull Capacity

LSP A

LSP B

LSP C

S1

S2

S3

City Hall Demand Point

Bugis Demand Point

Store A

Store B

Store C

Carrier A

Carrier B

Carrier C

TLF: 0.9
TLF: 0.9
TLF: 0.9

TLF: 0.9
TLF: 0.9
TLF: 0.9

TLF: 0.65
TLF: 0.3

TLF: 0.95
TLF: 0.75

TLF: 0.9

Higher Truck Load Factor - Lower Transportation Cost - More Environment Friendly - Less Congestion - Improved Reliability
Freightbook Singapore (www.freightbook.com.sg)

- Launched online portal on 14th June 2013 with focus in Singapore only
- Online portal that connects business owners, freight forwarders and carriers and offers different accounts for each category of users
- Business owners can post their loads and indicate the origin and destination
- Freight forwarders can obtain sales leads, freight tariffs and sailing schedules
- **RFQ model**: Freight forwarders will respond with relevant quotes and business owners will decide on the appropriate quote that meets their requirement
Urban Consolidation Centre

• A facility in which freight flows from outside the city are consolidated with the objective to bundle inner-city transportation activities so as to reduce volume of distribution activities in the city

• Primary functions
  – consolidation of freight flowing into the city
  – transhipment/cross docking

• Types:
  – Single party: Cross-docking
  – Multi-party: Beyond cross-docking - Coordination of shippers, logistics service providers, carriers, and customers
UCC: Shipment and Information Flows

Shipments Flow & Direction

Information Flow & Direction

Suppliers / Shippers

Carriers / Providers

UCC

Receivers / Retailers

National Government

Local Authority / Landlord
UCC : Regulations

• Vehicle-based restrictions, e.g. types, sizes, weights, etc.
• Zone-based restrictions, e.g. zones for certain vehicles, zones for night delivery, dedicated zones for (un)loading, etc.
• Time-based restrictions, e.g. time windows for transit, delivery, (un)loading periods at destination, etc.
• Access charges based on specific times or environmental circumstances, e.g. toll fees, parking fees, etc.
UCC : Examples

• Carrier-Led UCC
  • Tenjin Joint Distribution System (Japan)
  • Tokyo Station (Japan)
  • La Petite Reine (Paris)

• Receiver-Led UCC
  • Binnenstadservice.nl (Netherlands)
  • Heathrow Airport (UK)
  • Westeld Stratford City Shopping Mall (UK)
UCC Coordination Mechanisms

• UCC serves as exchange, allowing shippers to buy and carriers to sell capacity
  – Carriers post capacity, and shippers bid
  – Shippers post loads (demand) and carriers bid

• UCC owns fleet
  – Sends RFQs to interested shippers in batch (dynamic pricing)

• Enable multiple parties to bid and negotiate on delivery jobs: synchronize timings of deliveries, consolidate loads while respecting their individual constraints and requirements of city authorities
Peer-to-Peer Collaboration Mechanisms

• Shipper-Shipper
  – consolidate multiple small loads across shippers
  – goal: better pricing from carriers

• Carrier-Carrier
  – consolidate LTL shipments
  – goal: at reducing empty truck movements