SMU SINGAPORE MANAGEMENT UNIVERSITY | School of Information Systems

Collaborative Urban Logistics – Challenges, Current Practices and Future Research

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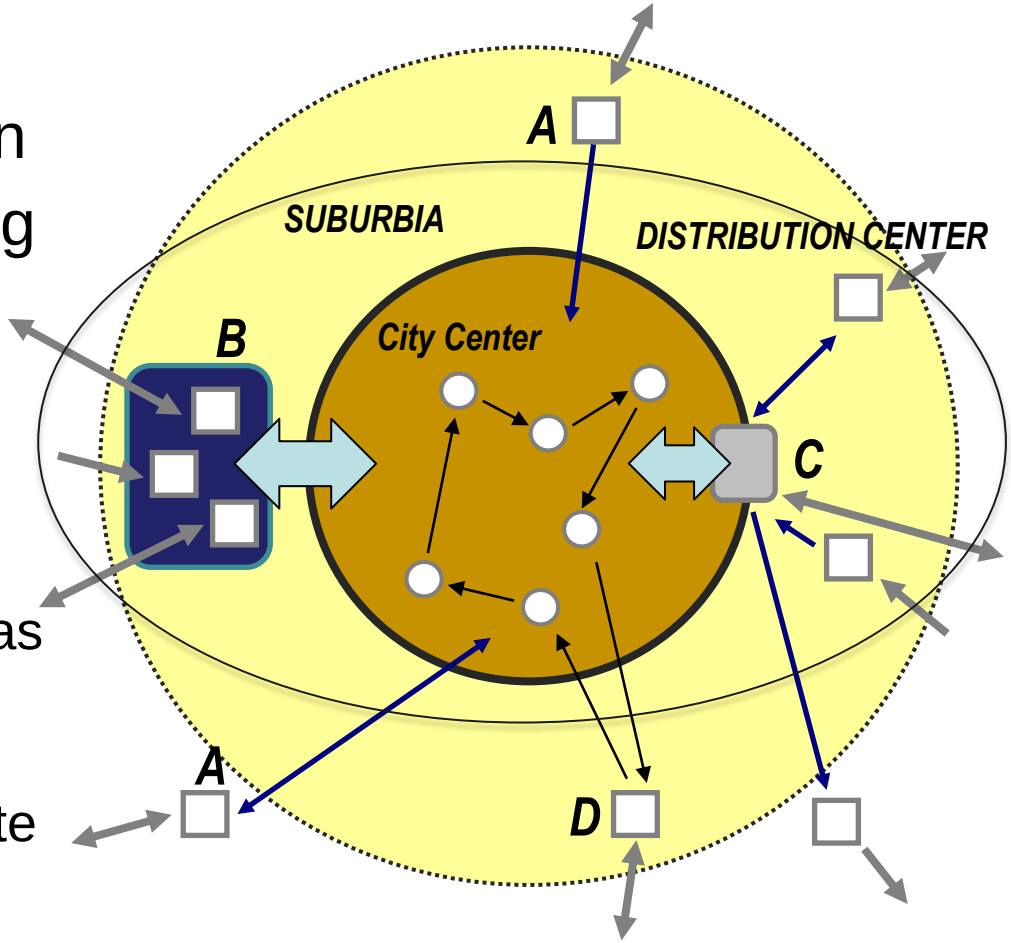
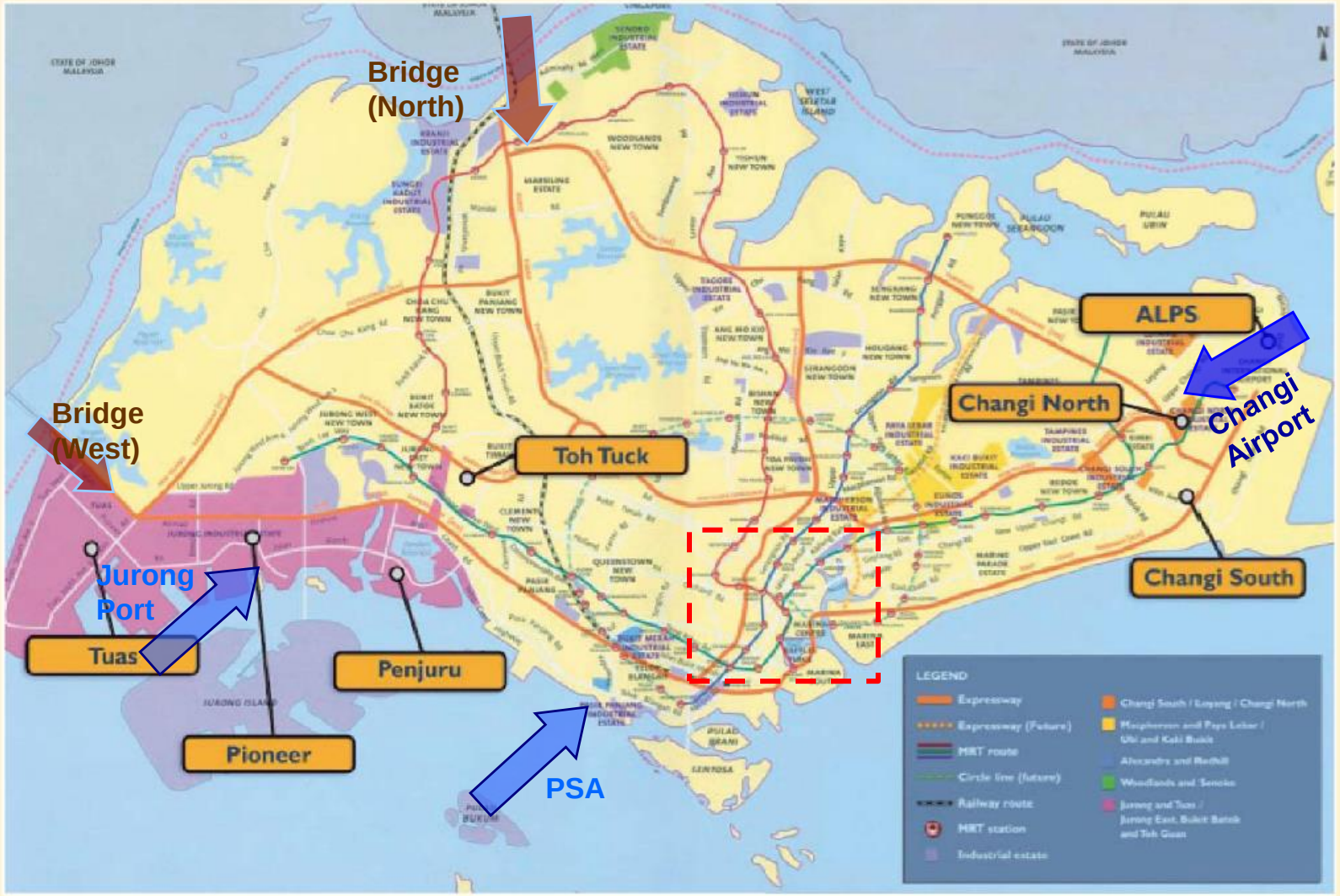
Last Mile Urban Logistics

- The "last mile problem“: Last leg of the supply chain is least efficient, comprising up to 28% of the total logistics cost
- Challenge of last-mile logistics
  - making deliveries in urban areas (shopping malls, hotels and restaurants, offices in a central business district often contribute to congestion, pollution and safety problems.



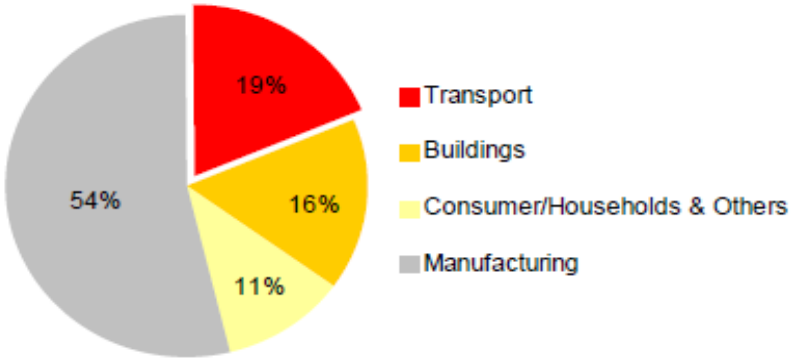
Urban Logistics in Singapore



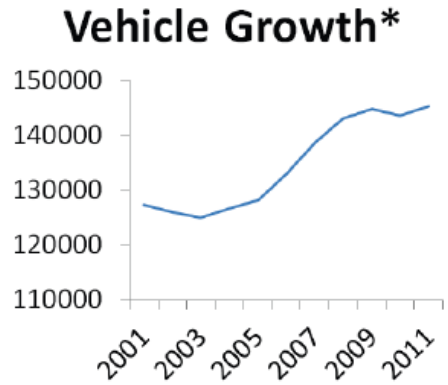
Source: Accessed from www.colliers.com/Singapore November 2009.

Statistics about Urban Freight in Singapore

- Last-mile transit of urban freight from the distribution centers to the city center (malls, offices and homes) amounts up to 75% of total logistics costs in Singapore.
- 19% of the CO_2 emission is caused by transportation, and freight contributes about 50% of the pollution, even though freight transport takes up only 17% of total traffic volume.
- Growth of goods vehicles



Source: Singapore Land Transport Authority



*: for Goods and Other Vehicles
Source: Land Transport Authority, Singapore

Challenges in Last-Mile Logistics

- Urbanization
- E-Commerce
- Sustainability
- Manpower crunch
- Uncoordinated Urban Freight

Government

1. Road congestion and mobility
2. Environmental pollution
3. Safety

Businesses

1. Sustainability (corporate social responsibility)
2. Safety stock prediction
3. Service level and reliability

Getting Stakeholders to Collaborate

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
- Design innovative solutions that further increase productivity

Collaborative Urban Logistics (Project funded by A*STAR)

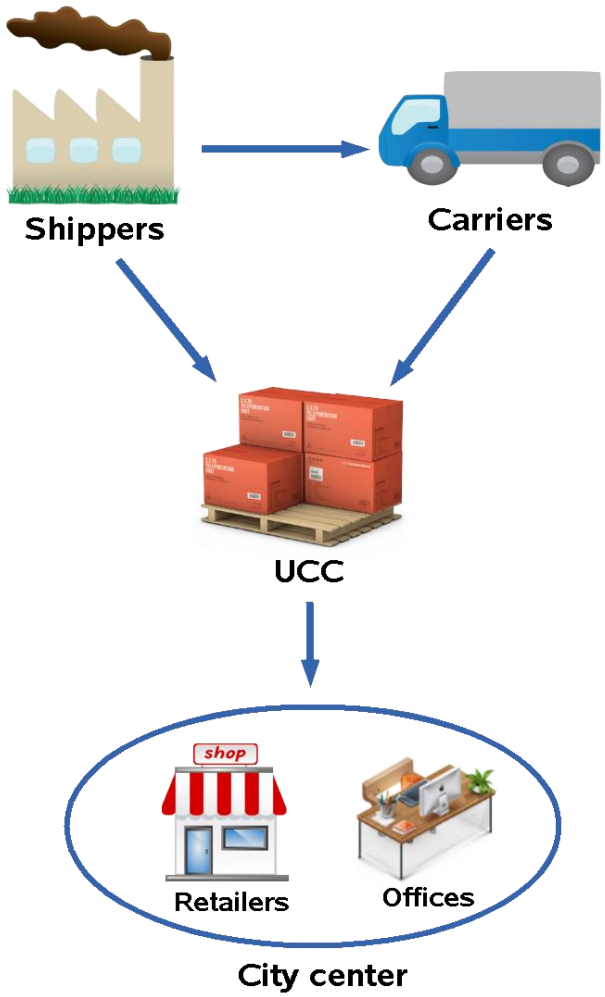
Institute for Infocomm Research A*STAR | SIMTech A*STAR | SMU Singapore Management University | The Logistics Institute Asia Pacific

- Goal: Develop technology that enable stakeholders (shippers, carriers, service providers and receivers) to collaborate on last-mile delivery through an e-marketplace
- Singapore as a living laboratory for experimentation with innovative urban concepts and paradigms

SMU's Collaborative Last-mile Logistics Research

- Mechanism design and Optimization for getting business stakeholders (shippers, carriers, retailers) to collaborate to improve last mile delivery operations
  - enables multiple parties to bid/negotiate on delivery jobs and coordinate timings of deliveries while respecting their individual constraints and statutory requirements of city authorities
  - seeks win-win solutions
    - environmentally and economically sustainable
    - operationally efficient and cost effective

Urban Consolidation Center (UCC)



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:

1. Consolidation
2. Warehousing
3. Cross docking
4. Last-mile delivery

UCC :
Current Practices and Future Prospects

UCC : Examples

- **Carrier-Led UCC**
  - Tokyo Station (Japan)
  - Tenjin Joint Distribution System (Japan)
  - La Petite Reine (Paris)
- **Receiver-Led UCC**
  - Binnenstadservice.nl (Netherlands)
  - Heathrow Airport (UK)
  - Westfield Stratford City Shopping Mall (UK)

UCC Challenges

- Operational
  - Carriers/suppliers lose direct contact with their customers
  - Scale: Service area too small to show significant results
  - Poor UCC location (too far from the service area)
  - Biasness towards certain carriers or retailers

- Economic / Financial
  - Financial viability of UCC
  - Unfair distribution of cost and benefits for different stakeholders
  - Unwillingness to participate in the scheme due to lack of incentives
  - Poor revenue management

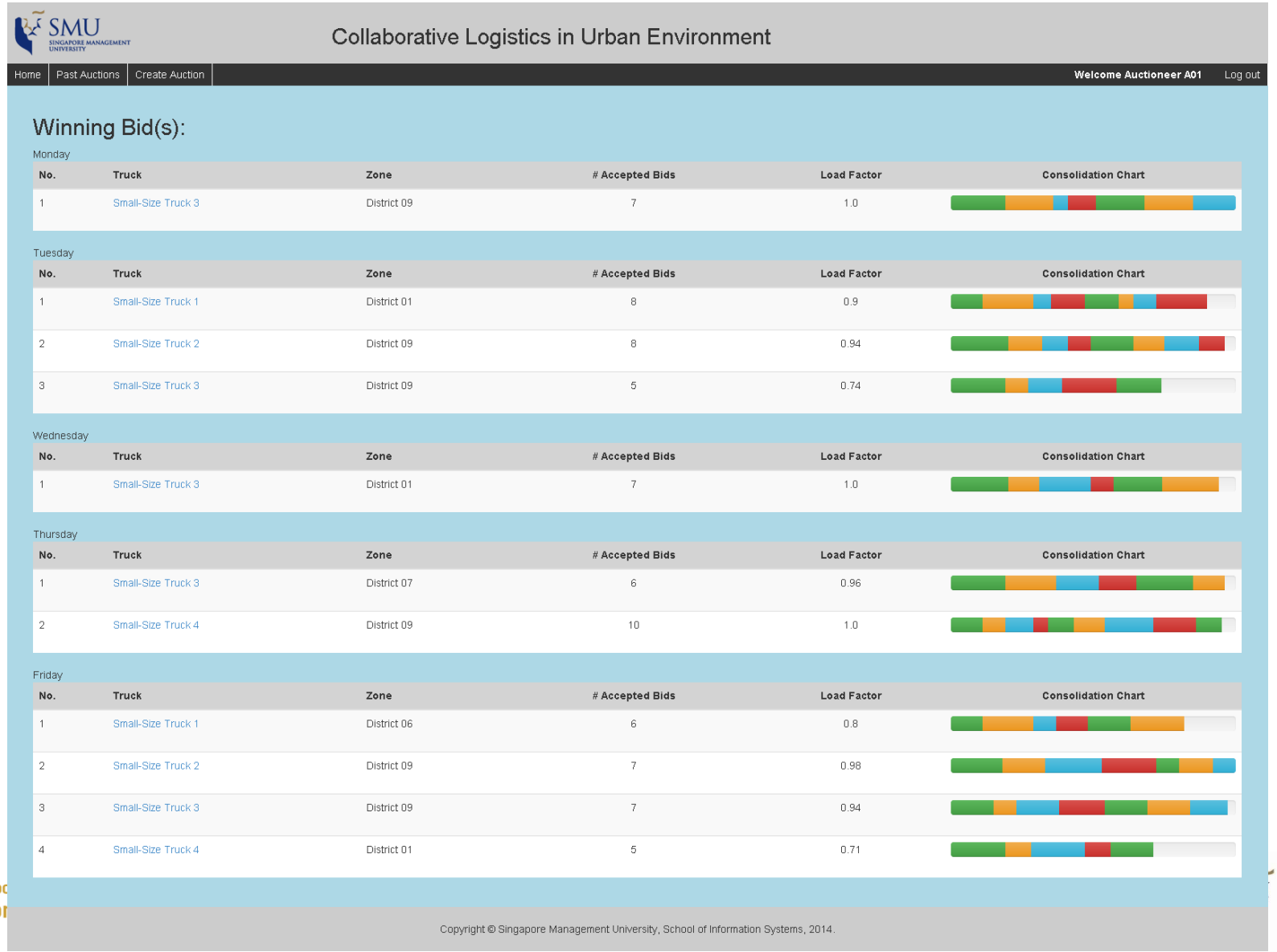
Solution: Market-based Coordination Mechanisms

- Enable multiple parties to bid and negotiate on delivery jobs: synchronize timings of deliveries, consolidate LTLs while respecting their individual constraints and requirements of city authorities
- 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
  - Bidders must be able to specify their preferences and constraints
  - Other UCC operational constraints (e.g. regulatory constraints)

UCC Mechanism Design

1. Shippers bid for the last-mile delivery slots
   - Estimated arrival time
   - Delivery due date
   - Location
   - Consignment details (volume, weight)
   - Price
2. Carriers collaborate through
   - Order sharing
   - Capacity sharing

Illustration of Solution



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Collaborative Logistics in Urban Environment

Home | Past Auctions | Create Auction | Welcome Auctioneer A01 | Log out

Winning Bid(s):

Monday

No.	Truck	Zone	# Accepted Bids	Load Factor	Consolidation Chart
1	Small-Size Truck 3	District 09	7	1.0	

Tuesday

No.	Truck	Zone	# Accepted Bids	Load Factor	Consolidation Chart
1	Small-Size Truck 1	District 01	8	0.9	
2	Small-Size Truck 2	District 09	8	0.94	
3	Small-Size Truck 3	District 09	5	0.74	

Wednesday

No.	Truck	Zone	# Accepted Bids	Load Factor	Consolidation Chart
1	Small-Size Truck 3	District 01	7	1.0	

Thursday

No.	Truck	Zone	# Accepted Bids	Load Factor	Consolidation Chart
1	Small-Size Truck 3	District 07	6	0.96	
2	Small-Size Truck 4	District 09	10	1.0	

Friday

No.	Truck	Zone	# Accepted Bids	Load Factor	Consolidation Chart
1	Small-Size Truck 1	District 06	6	0.8	
2	Small-Size Truck 2	District 09	7	0.98	
3	Small-Size Truck 3	District 09	7	0.94	
4	Small-Size Truck 4	District 01	5	0.71	

Conclusion: Ongoing Research@SMU

- Application to Jurong Gateway Retail Precinct Management
- Mobile crowdsourcing as an alternative form of urban logistics

(Maps powered by streetdirectory.com)