

MEGACITY LOGISTICS

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Supply Chain Management: Driving Strategic Advantage
MIT Campus • January 8th, 2015

better logistics for cities.

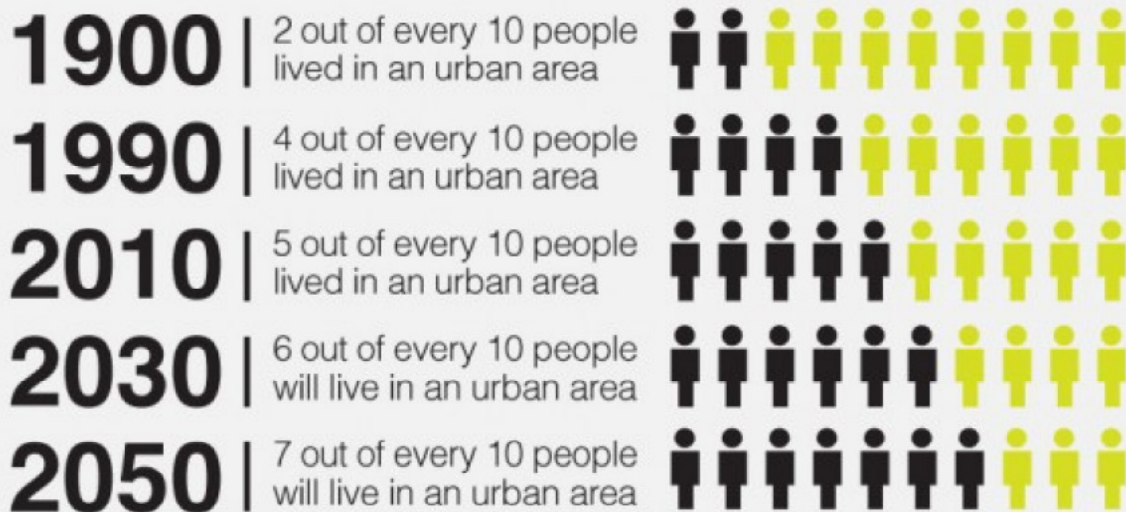
urban channel strategy
excellence in last-mile operations
high-resolution urban logistics design

better cities for logistics.

data-driven policy making
innovation in urban freight planning

THE RISE OF THE MEGACITY

Urbanization



Source: WHO, 2012. Urban area defined 100,000 or more inhabitants.
Infographic Source: http://catalystreview.net/wp-content/uploads/2012/09/infographic_urbanization.jpg

Megacities with population > 5M

1900s



(1)

London ~ 6.5M
 Osaka(?), New York ~ 4M
 Paris, Berlin ~ 3M
 Tokyo ~ 1.5

1950s



(5)

Tokyo ~ 13M
New York ~ 12M
Osaka ~ 9M
London ~ 8M
Paris, Shanghai ~ 5M

2000s



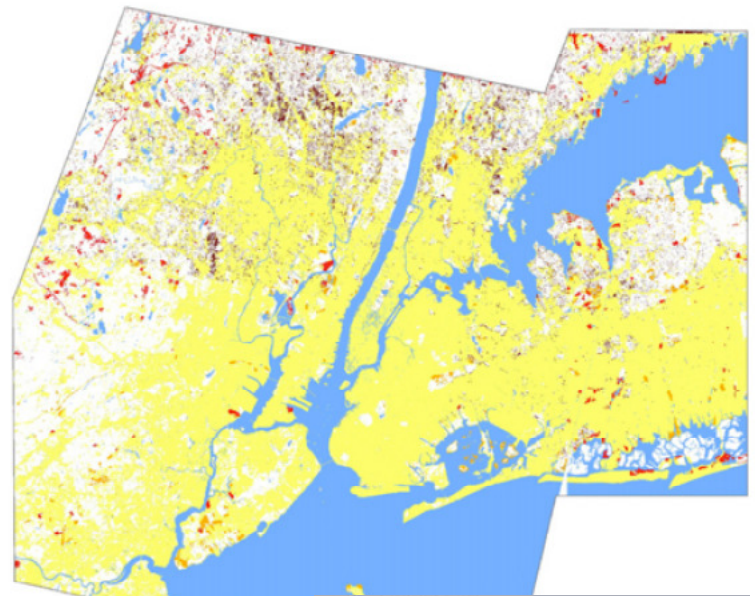
(78)

Tokyo ~ 35M
Mumbai, Mexico City ~ 20M
São Paulo, New York ~ 19M
Shanghai ~ 17M
Kolkata, Delhi ~ 16M
Beijing, London ~ 15M
LA, Buenos Aires ~ 12M
Rio, Paris, Manila ~ 11M
Moscow, Istanbul ~ 10M
 45 more

Source: E. Blanco (MIT) - MGI, Forbes, University of Cologne



Manila

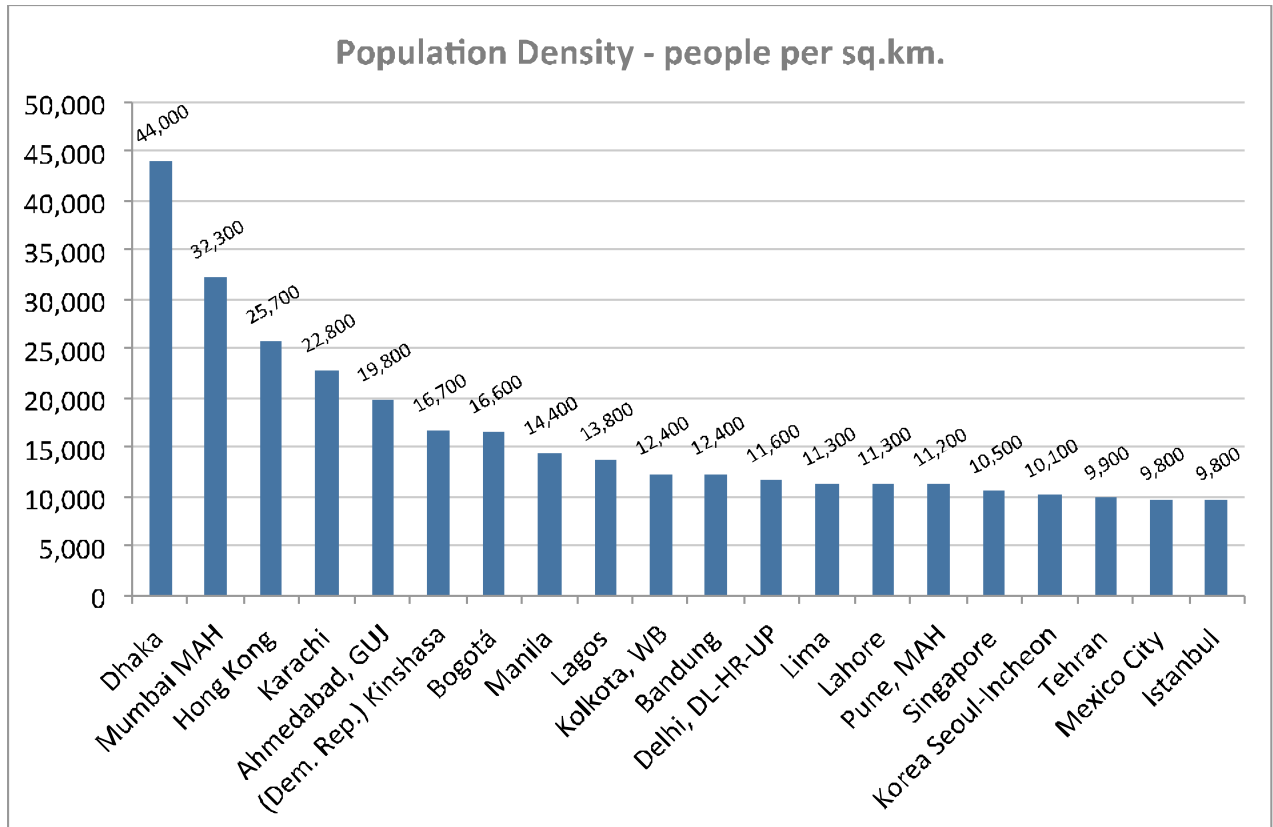


New York City



Source: Taubenböck, H. et al., 2012. Monitoring urbanization in megacities from space

Urban density to new levels



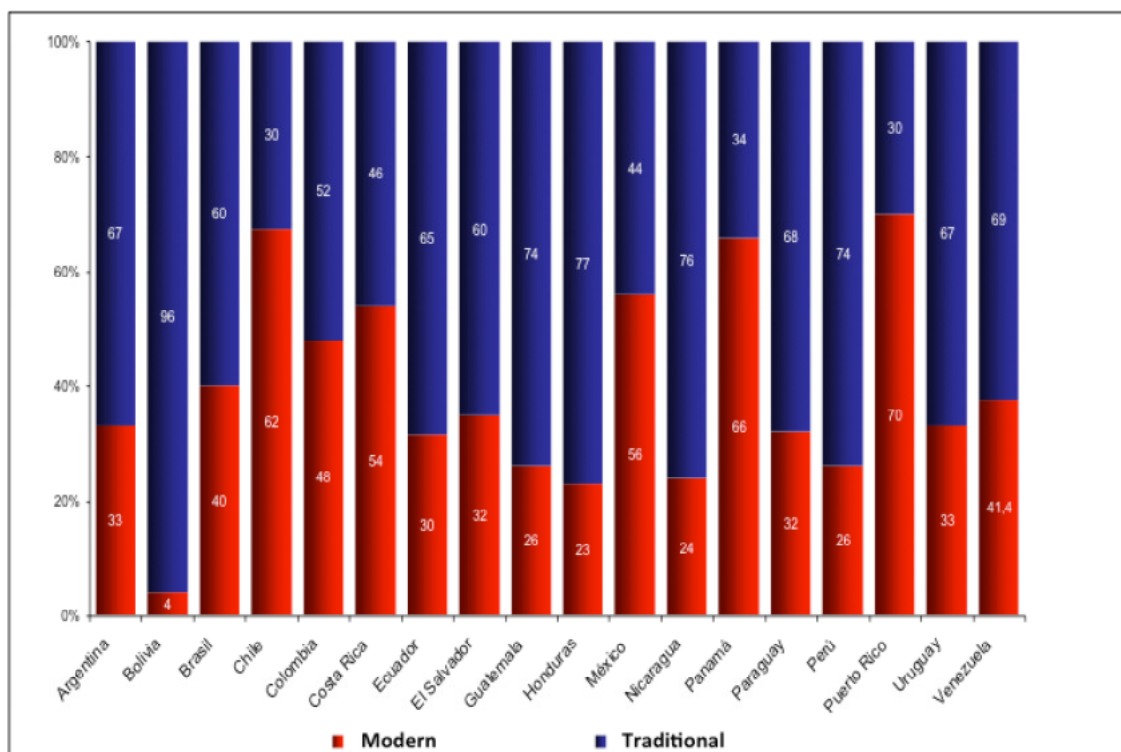
Source: MIT Megacity Logistics Lab. Demographia.



WHERE DO ALL THESE PEOPLE SHOP?

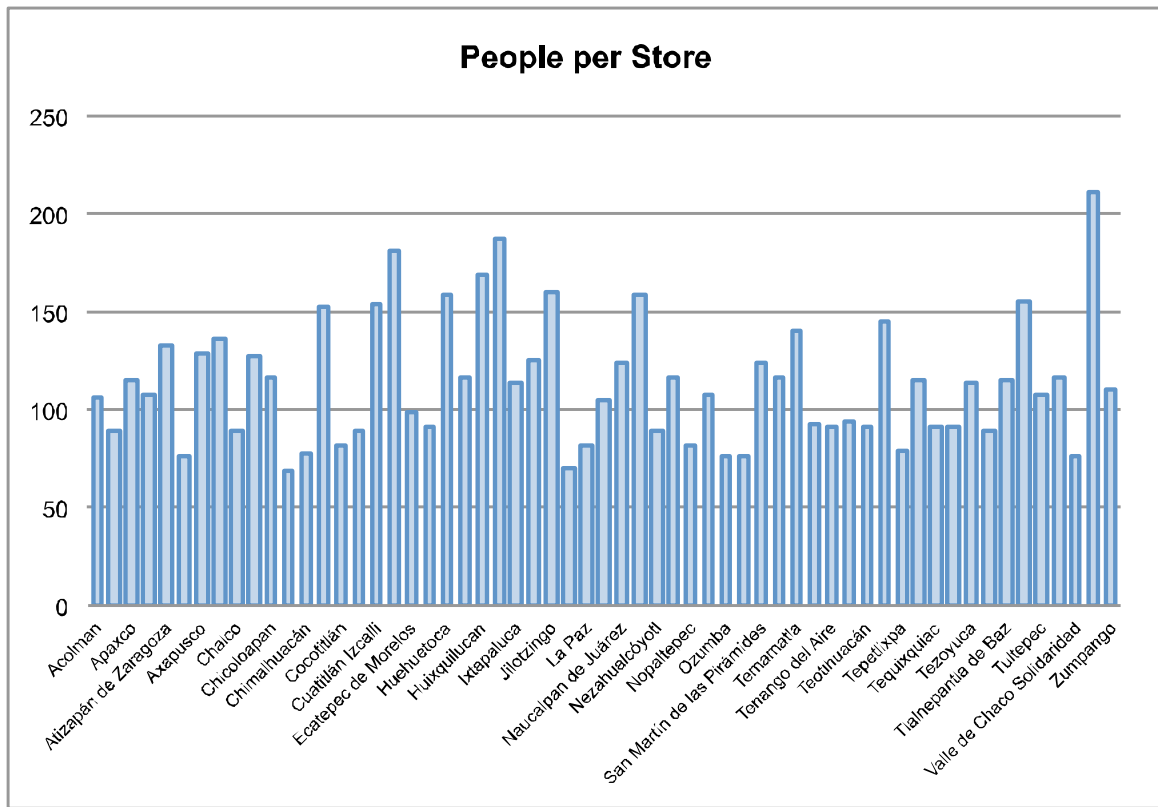
Retail dynamics in emerging market megacities

Traditional retail channel still dominant in most developing countries



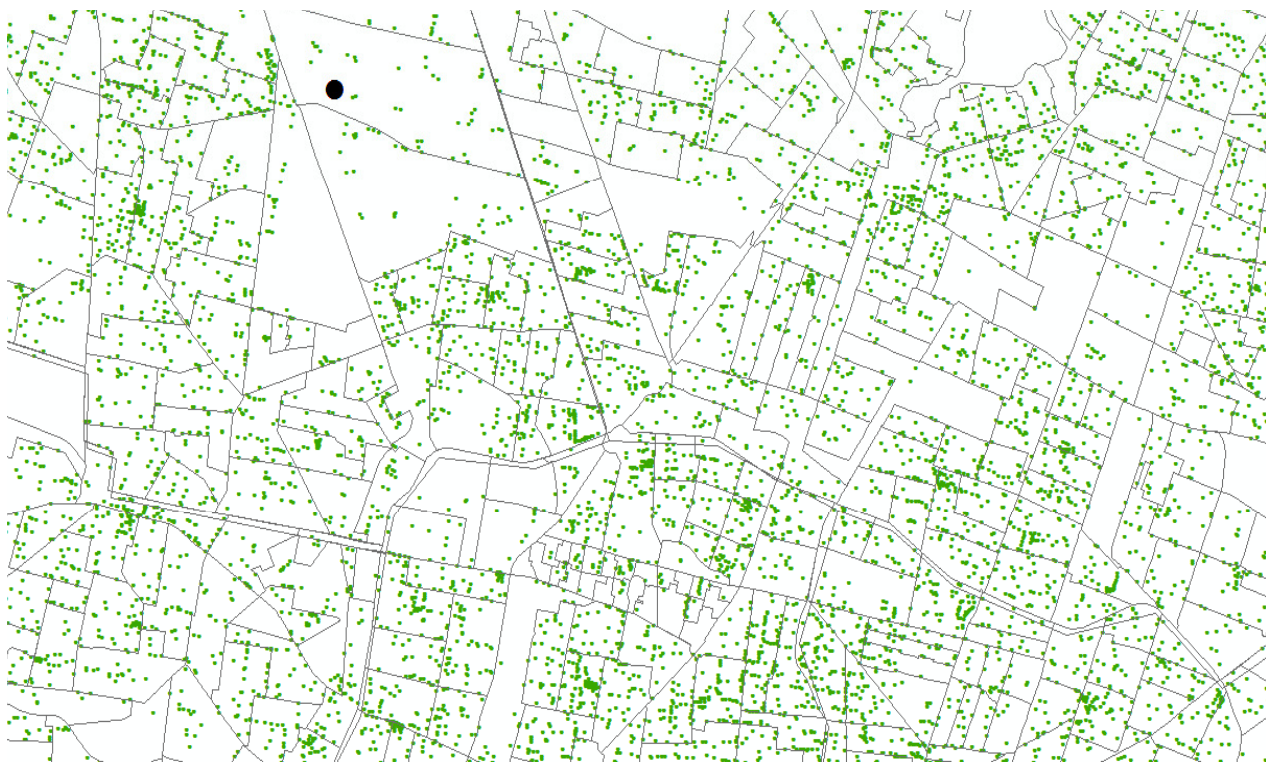
Source: Nielsen, LOGyCA

Nanostores in Mexico City



Source: INEGI 2012 & S.Caballero (ITESM)

Nanostores in Mexico City



Source: INEGI 2012, MIT Megacity Lab

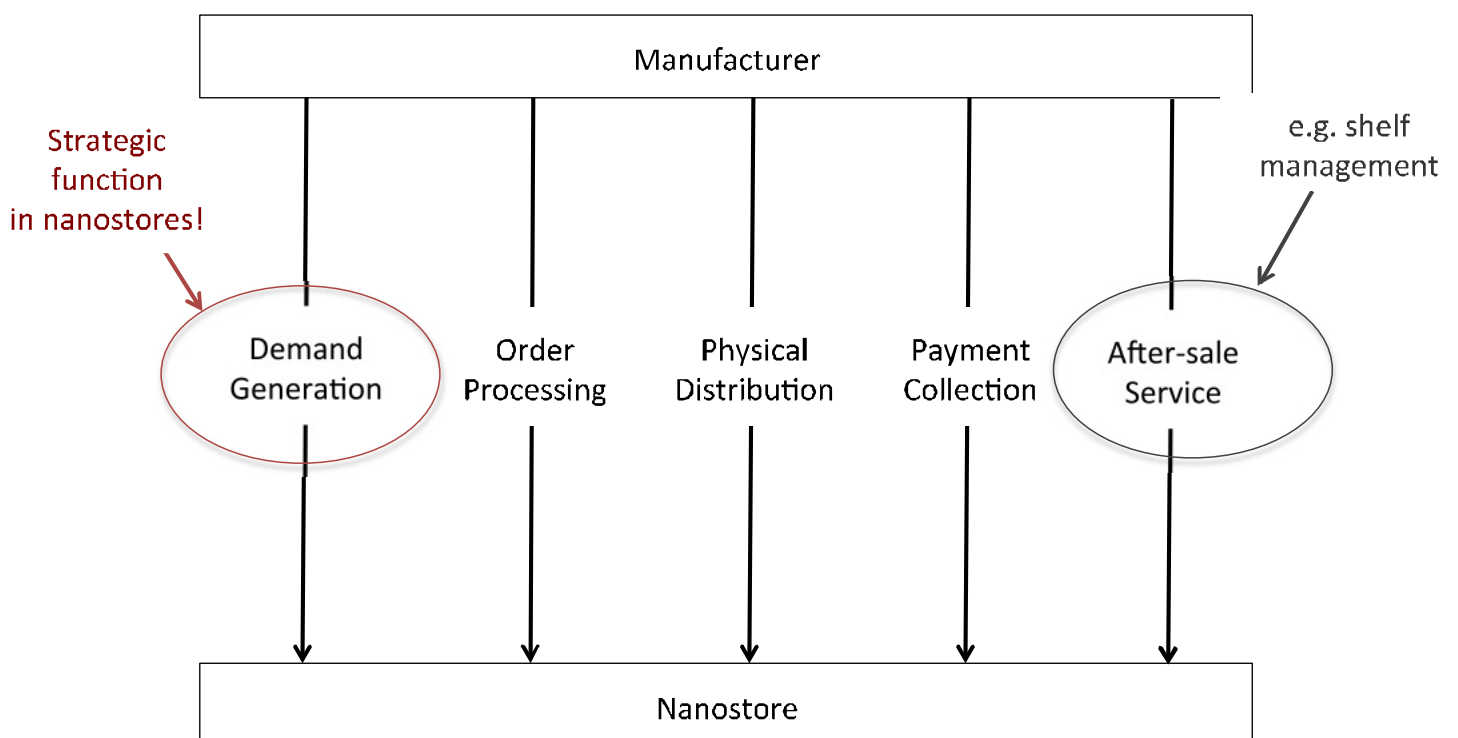
Why do nanostores survive?

- Convenience
- Limited access to transport by large part of the population
- Sales in small quantities
- Informal credit
- Low barrier of entry
- Interest of CPG manufacturers to have them survive (higher margin, growth)

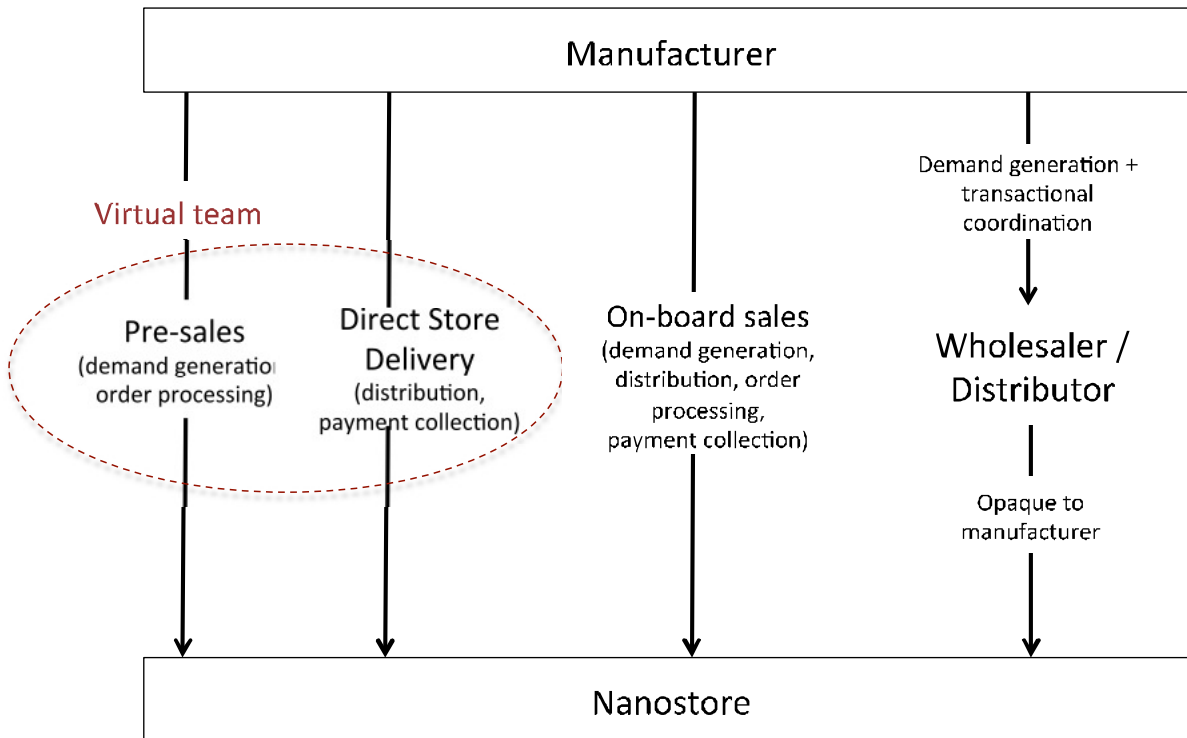
DESIGNING THE NANOSTORE SUPPLY CHAIN

	Modern Channel Supermarket	Traditional Channel Nanostore
Functions	Professionals, dispersed	Single store owner-operator, family
Logistics support	Distribution centers, cross-docks, 3PL	None
Financial flow	Formal credit, bank transfers	Cash, relationship-based credit
Line items	Full case packs to store, pallets to retailer DC	Consumer units, mixed case packs
Number of SKUs	Thousands to tens of thousands	Hundreds
Category depth	Half dozen to dozens	Single or double
Number of consumers served per store	Tens of thousands	A few hundred
Technology	Enterprise systems, POS scanning, EDI	Personal mobile phone
Marketing Strategy	Brand, advertising, central merchandising	Community, convenience, high-service

Channel Functional Decomposition



Source: Blanco & Fransoo (2012)



Source: Blanco & Fransoo (2012)

Pre-sales activity



- Customer service
- Demand generation
 - Relationship based
 - “Trust”
 - Promotions
- Order processing
- Product presentation
- Next day delivery

- LatAm: 70-90 nanostores per day



- Physical Distribution
- Payment collection
 - Order reconciliation
- Shelf management
- After-service
 - Expired/Excess/Returns
- “Conflict” resolution

- 40-90 nanostores per day

author authorization

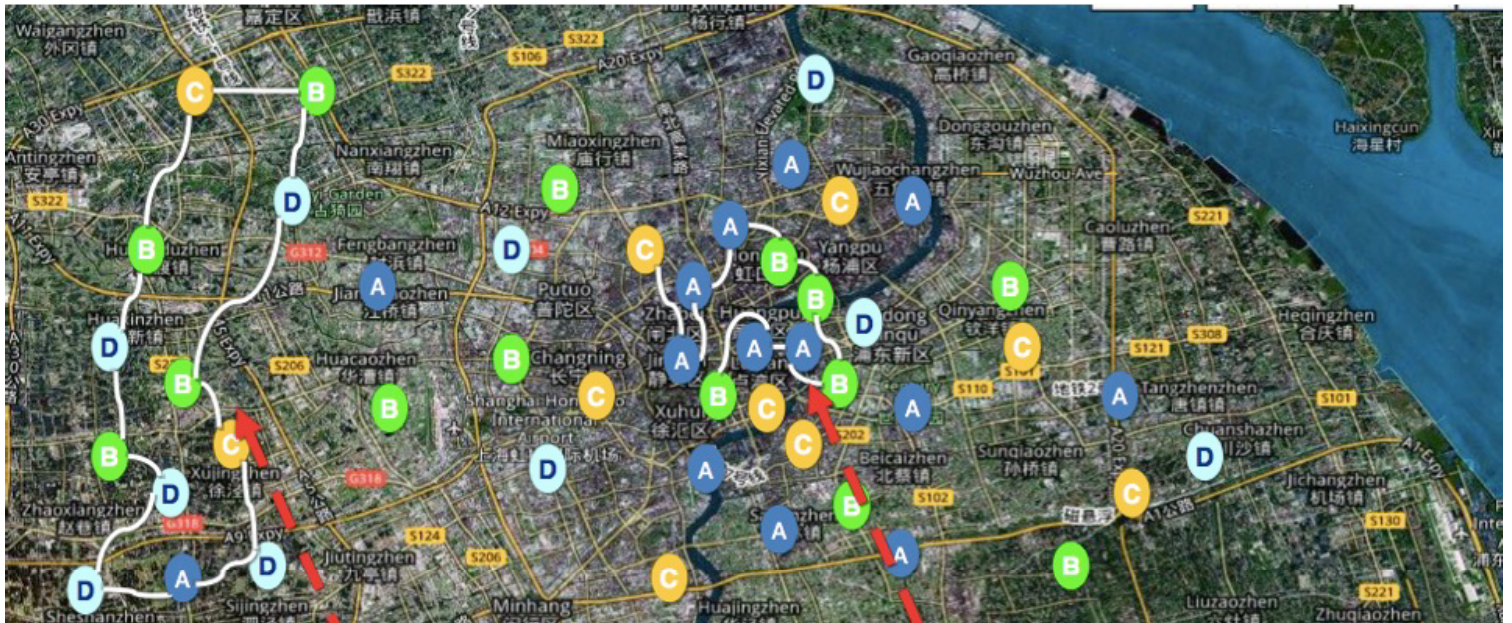
35

On-Board/Van Sales

- Customer service
- Demand generation
- Order processing
- Physical Distribution
- Payment collection
- Shelf management
- After-service
- 30-70 nanostores per day



Ex: different strategies within a few blocks of the same urban area!



van seller

pre-seller

Which is the best design to use?

- Sales conversion rates
 - Impact on order-to-cash cycle
 - Cultural context
- Product characteristics
 - Complexity
- Productivity
 - Store density, packaging design, shelf management
- Assortment strategy
 - Number of SKUs
 - Promotional
- Competitive landscape

THE LAST-MILE REVOLUTION

customer is king

Same-Day Delivery Coverage: **East Coast & Midwest**



Boston

02127, 02128, 02210, 02118, 02116, 02110, 02113, 02111, 02109, 02115, 02114, 02108, 02199, 02446, 02215, 02129, 02143, 02139, 0214
02150, 02151, 02155, 02474, 02476, 02478, 02152, 02138, 02140, 02144, 02134, 02201, 02186, 02170, 02169, 02171, 02122, 02136, 0213
02493, 02481, 02465, 02458, 02472, 02163, 02460, 02462, 02466, 02453, 02452, 02451.

Chicago

60004, 60005, 60006, 60007, 60008, 60009, 60016, 60017, 60018, 60019, 60022, 60025, 60026, 60029, 60035, 60043, 60053, 60056, 6006
60138, 60139, 60141, 60143, 60148, 60153, 60154, 60155, 60160, 60161, 60162, 60163, 60164, 60165, 60171, 60176, 60181, 60191, 6020
60455, 60456, 60457, 60458, 60459, 60480, 60482, 60499, 60501, 60513, 60514, 60515, 60516, 60517, 60521, 60522, 60523, 60525, 6052
60609, 60610, 60611, 60612, 60613, 60614, 60615, 60616, 60618, 60622, 60623, 60624, 60625, 60626, 60629, 60630, 60631, 60632, 6063
60655, 60656, 60657, 60659, 60660, 60661, 60664, 60666, 60668, 60669, 60670, 60673, 60674, 60675, 60677, 60678, 60680, 60681, 6068
60706, 60707, 60712, 60714, 60803, 60804, 60805.

Greater Washington D.C. and Ball

21162, 21128, 21220, 21236, 21221, 21234, 21286
21225, 21229, 21244, 21060, 21227, 21228, 21061,
20740, 20770, 20784, 20721, 20904, 20905, 20832,
20011, 20015, 20878, 20814, 20852, 20815, 20817,
22201, 20147, 22030, 22314, 20171, 20148, 22207,
22180, 22046, 22153, 22181, 22206, 22315, 22205,
22151, 20166, 22044, 22213, 22026, 22027, 22211,
22066.

Indianapolis

46032, 46033, 46037, 46038, 46040, 46052, 46055,
46207, 46208, 46209, 46211, 46214, 46216, 46217,
46253, 46254, 46255, 46256, 46259, 46260, 46262,

New York City (and parts of New J

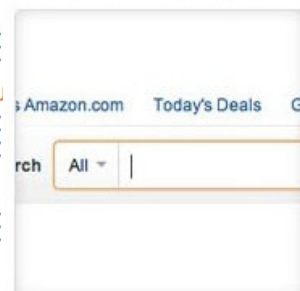
07030, 07302, 07304, 07305, 07306, 07307, 07310,
10030, 10031, 10032, 10033, 10034, 10035, 10036,
10124, 10128, 10151, 10152, 10153, 10154, 10155,
10286, 10292, 11101, 11211, 11222, 11201, 11215,

Philadelphia

08002, 08007, 08030, 08031, 08033, 08034, 08035,
19013, 19014, 19015, 19016, 19018, 19020, 19021,
19066, 19070, 19072, 19074, 19075, 19076, 19078,

Find Same-Day Delivery Items in Three Easy Steps...

1 Search for items



Choose from millions of items, including electronics, home and office supplies, and baby necessities.

2 Filter your results



Use the "Get it Today" filter on the left to view and purchase items eligible for Same-Day Delivery.

3 Get it today!



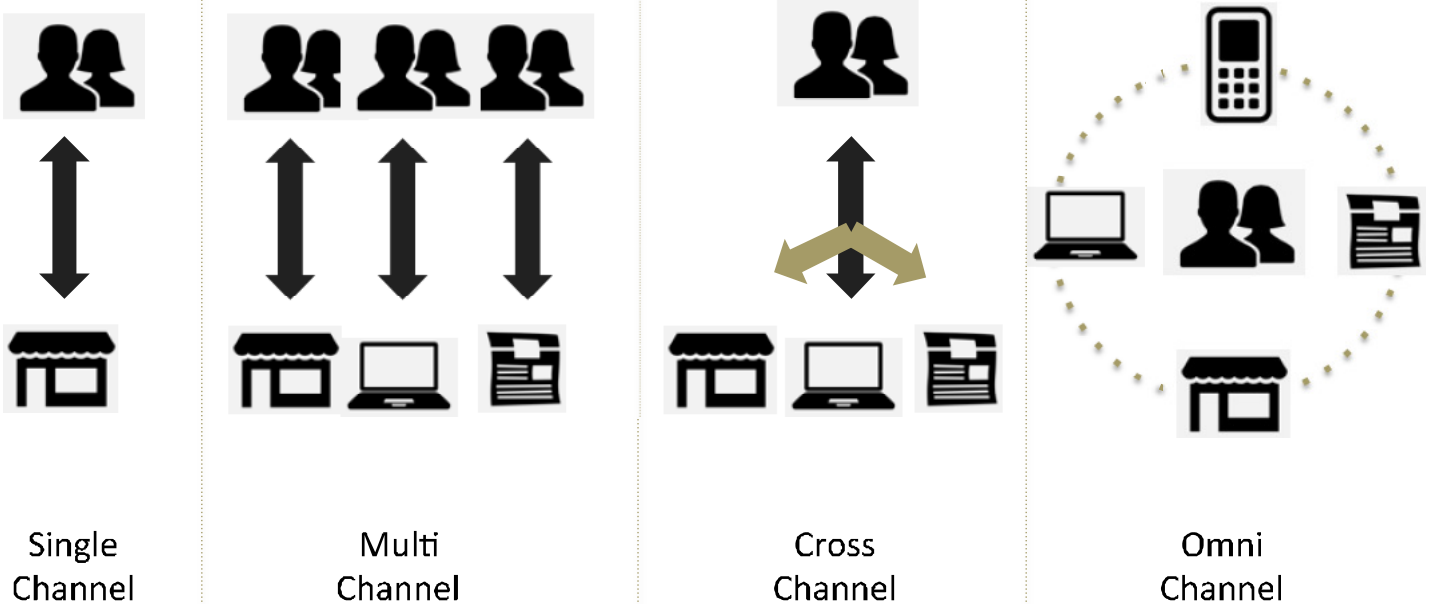
All Same-Day Delivery orders will arrive by 9PM.

Amazon Tests Bike Messengers for One-Hour Delivery in New York City

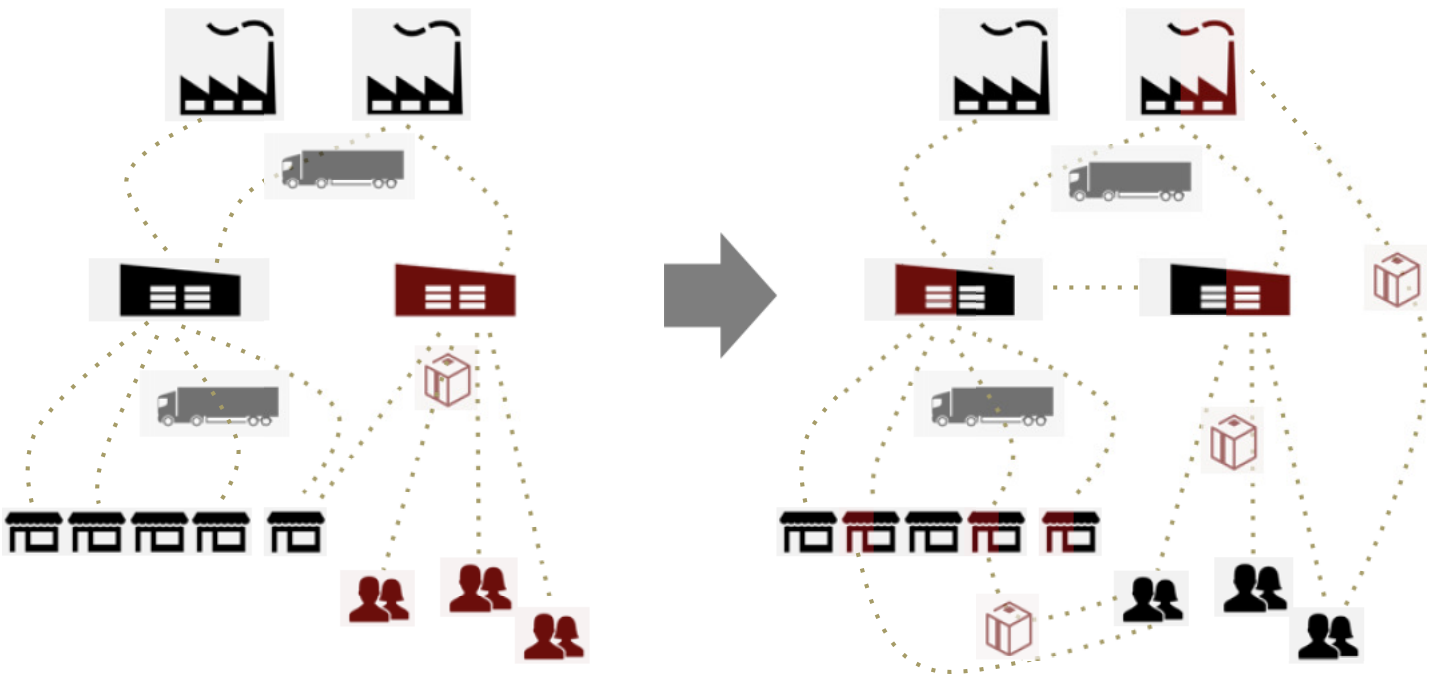
New Project Called Amazon Prime Now and Mimics Immediacy of In-Store Shopping

The service first became available in the Manhattan neighborhood where Amazon previously leased a brick-and-mortar building near the Empire State Building.

Urban Channel Strategy: Omni Channel, the retail evolution ...



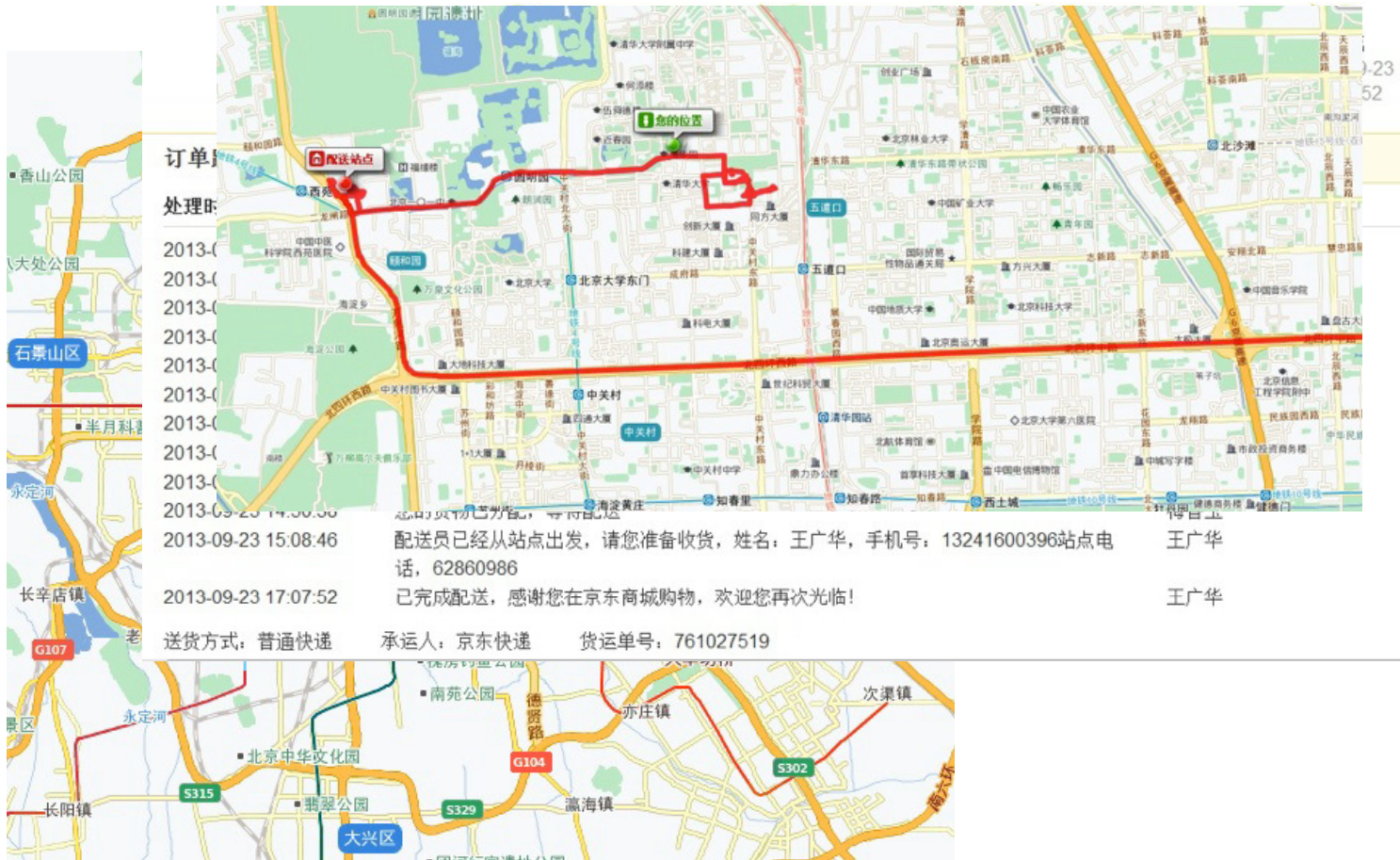
... and the underlying supply chain that supports it



delivery. shortened.

Participating Stores

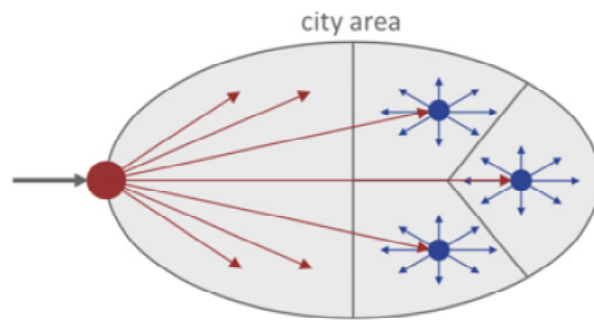
1-800flowers.com	ALSCO SEEDS	AVEDA	BANANA REPUBLIC	Blue Bird
BHINDI	BOSE	BOSSINI	Brooks Brothers	Brookstone
CACHÉ	Canvas Camera	CARLTON HAIR	catimini	Chantal Sullivan
charlotte russe	CHICO'S	Chocolate Obsession	Cabtree & Eschyl	Crate&Barrel
CMB	ecco	eCosway	EPIC Menswear	ETON
eva varro	Foot Locker	FRANCO LICOMI	FRETTE	FL
Gigoles Wines	GO GRAPHICS	GODIVA	BOSS HUGO BOSS	Green Leaf



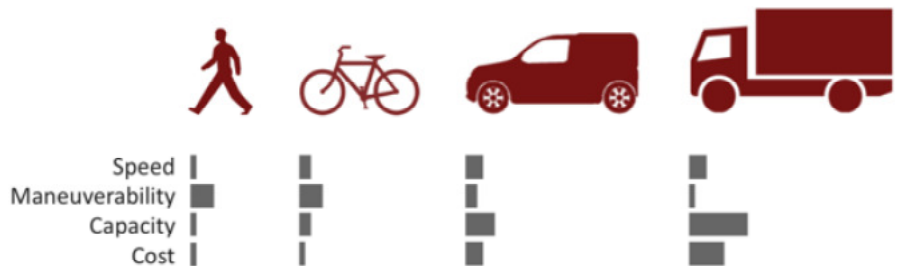
Optimization & Simulation Model Conceptual Design



Shipment Strategy Direct vs. indirect shipment

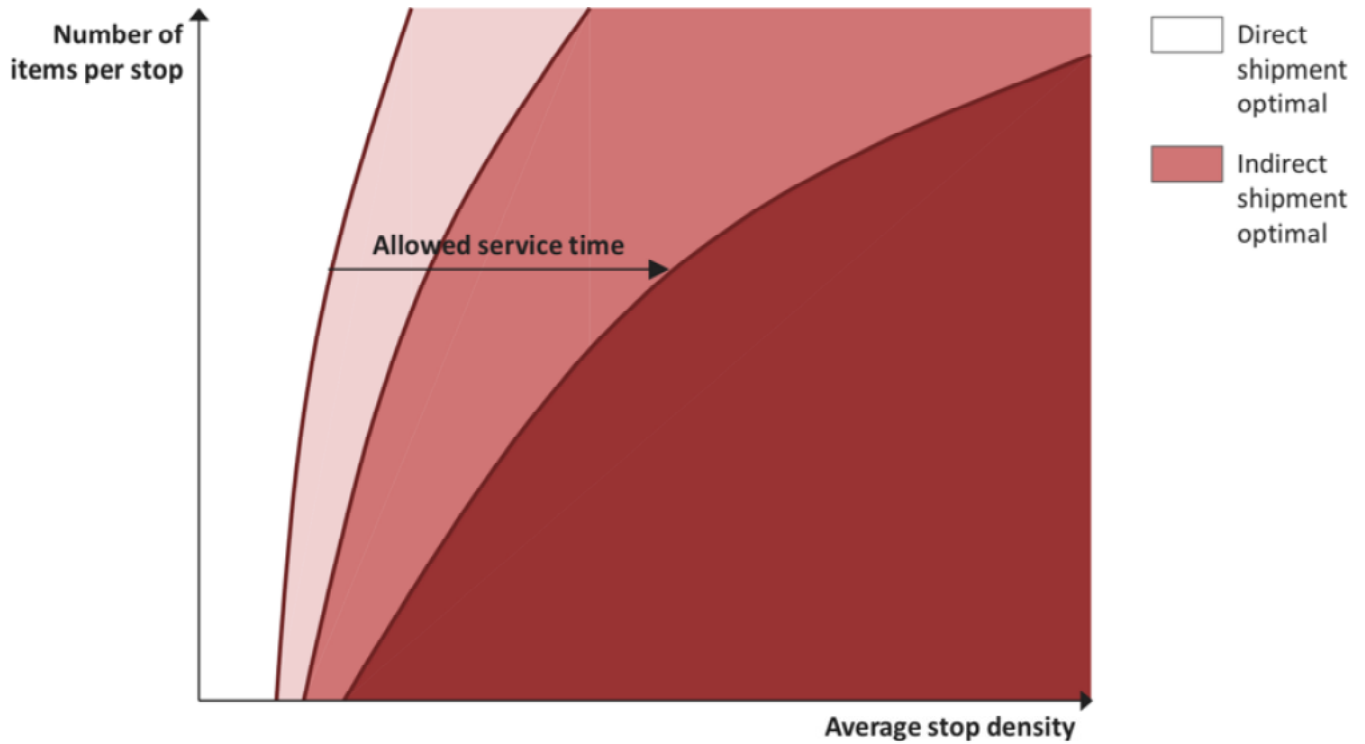


Modal Choice Various competing vehicle technologies



Quality of Service Various possible service time requirements





Note

- Analysis based on stylized city with homogeneous demand
- Only binary decision b/w direct-shipment-only and indirect-shipment-only regime allowed

THE CITY PERSPECTIVE

People vs. Boxes

The City Policy Dilemma: People vs. Boxes

Good for People

Mixed economic activity, more public transport, less vehicles

More public transport, less roads

More pedestrian, less roads

Bad for Boxes

More people, more boxes

More consolidation of logistics activities

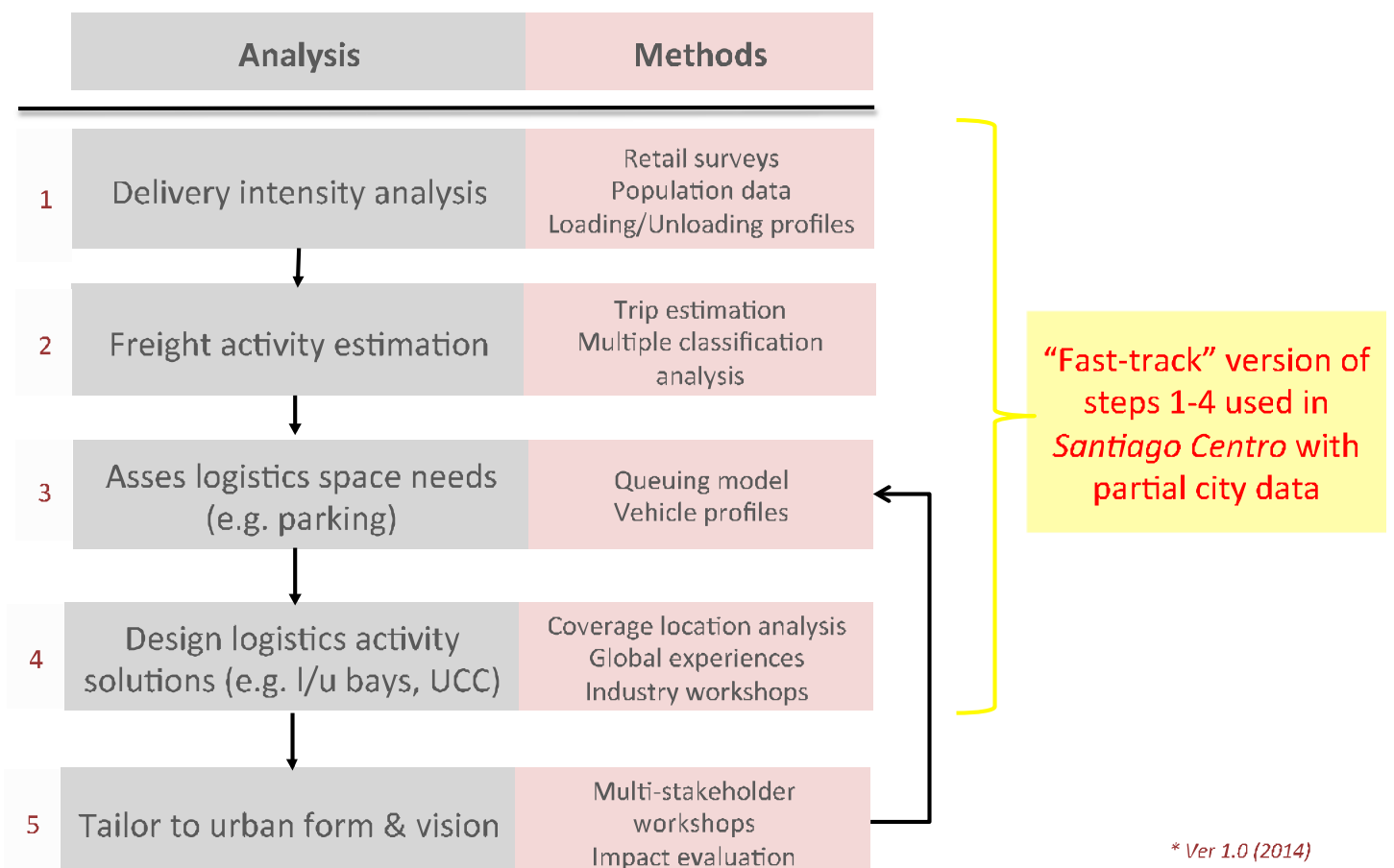
Bigger warehouses, bigger trucks of incoming products

Pushed out

Smaller trucks in, with less roads

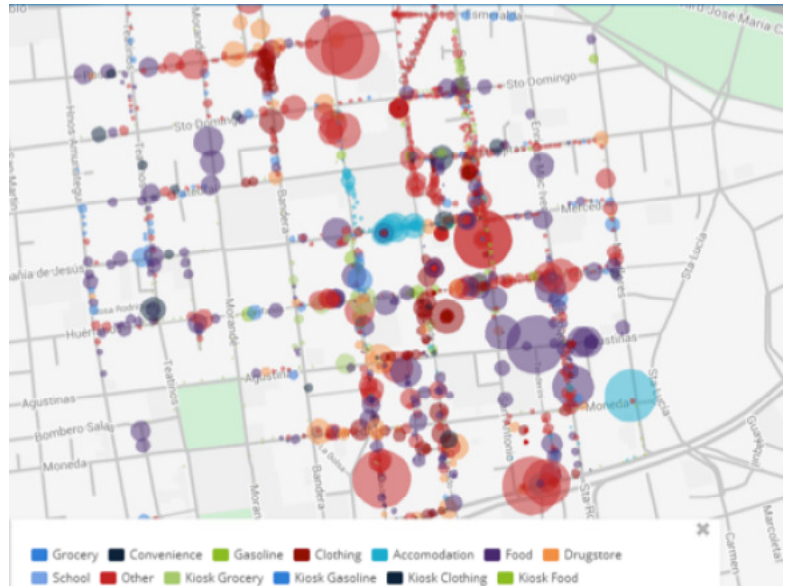
Sources: Blanco (2014), Giuliano et. al. (2013),

MIT “Better Cities for Logistics” Design Methodology*



Retail Density

1,801
establishments/km²



Density of retail store with establishment sizes.
Source: MIT MegacityLab Urban Logistics Atlas 2013

Main Retail Categories

Main retail categories	# Establishments	% of Total
Food Service	316	18 %
Clothing and fashion	267	15 %
Grocery Stores	260	14 %
Drugstores & pharmacies	75	4 %

Delivery Intensity



4,000
deliveries per km²
excludes office supplies & home deliveries • projected at 7,000 for Centro Santiago area

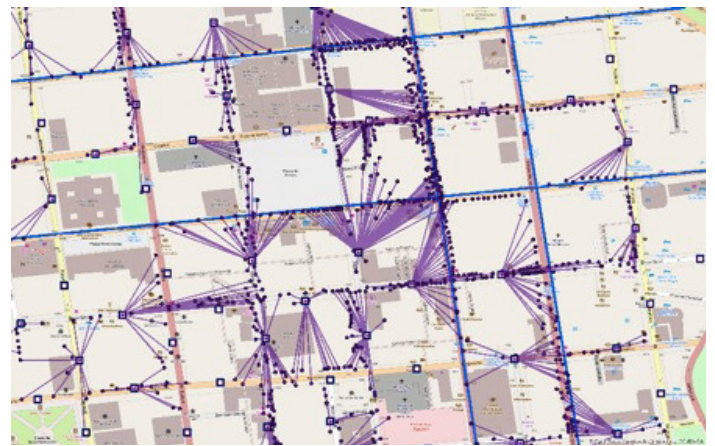
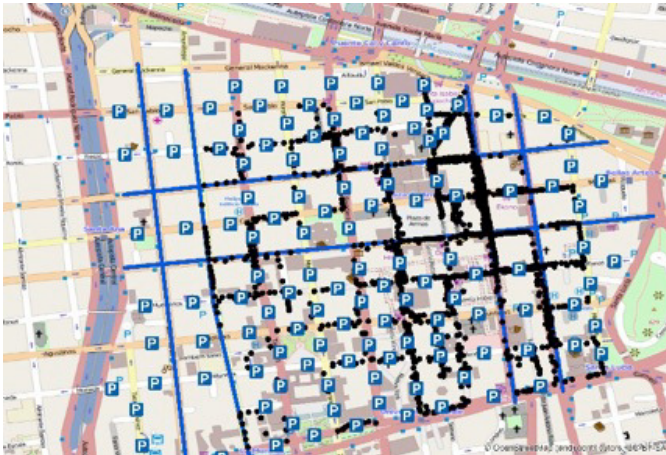
Retail delivery intensity (by category)

Location of minimum Loading/Unloading Spaces

Step 1: Locate 60 candidate locations along suitable road links or **1 I/u space per block**

Step 2: Verify walking distance constraints (150m by law). 60 I/u space can cover 100% of stores

- Restricted access
- Retail establishment
- P** Hypoththesized freight parking location



FINAL THOUGHTS

better logistics for cities.

urban channel strategy
excellence in last-mile operations
high-resolution urban logistics design

better cities for logistics.

data-driven policy making
innovation in urban freight planning

A global network of collaborators

megacity lab: bangkok

megacity lab: bogota

megacity lab: santiago

megacity lab: madrid



megacity logistics lab

better logistics for cities. better cities for logistics.

megacity lab: mexico city

megacity lab: sao paulo

megacity lab: beijing

- local capabilities & context
- common research platform
- shared tools & methodologies
- student & faculty exchange
- annual workshop @ MIT
- joint events & publications



channel demand

Km²



urban logistics atlas

lastmile

COMPASS



logistics-driven GPS analysis

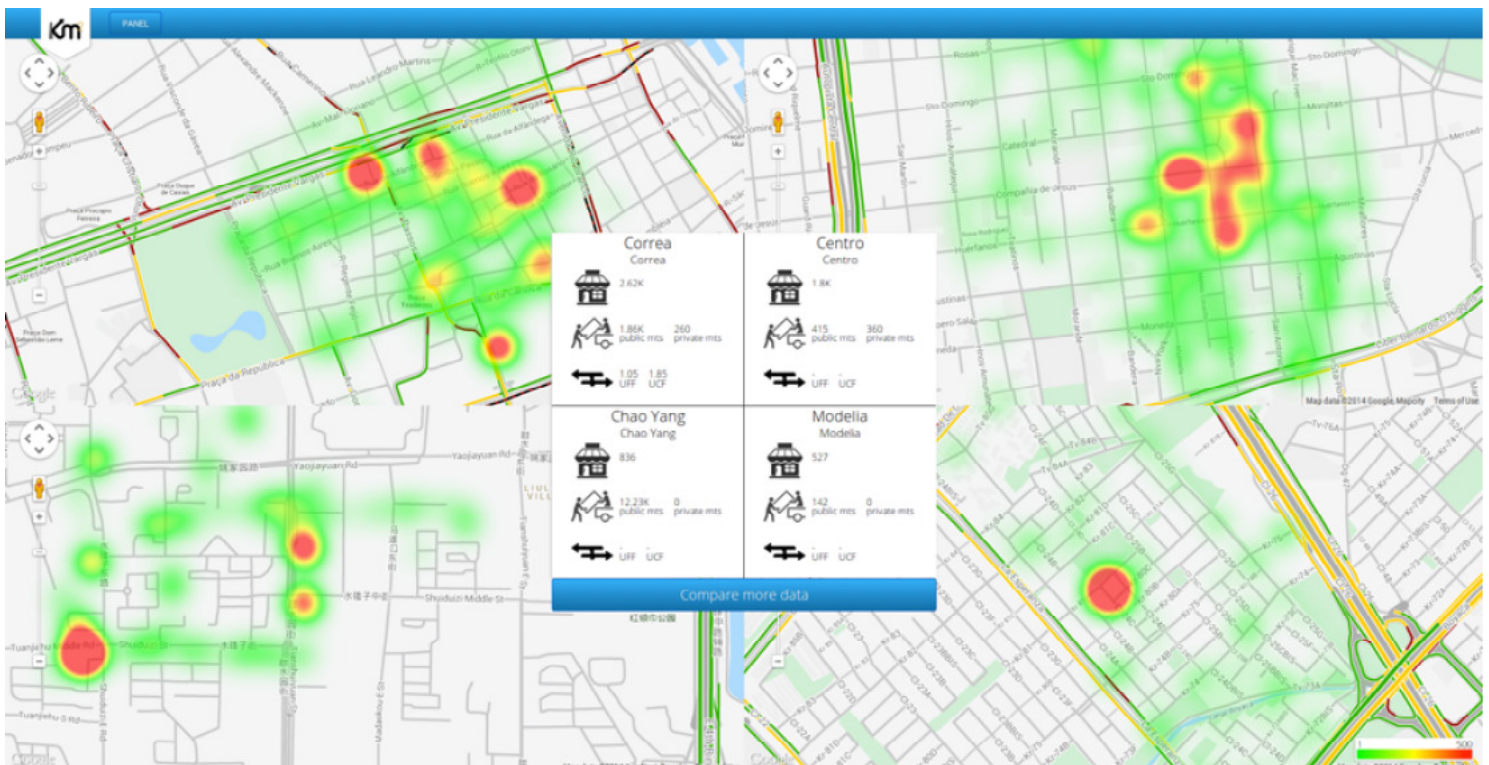
GeoSense

large-scale urban geographical data

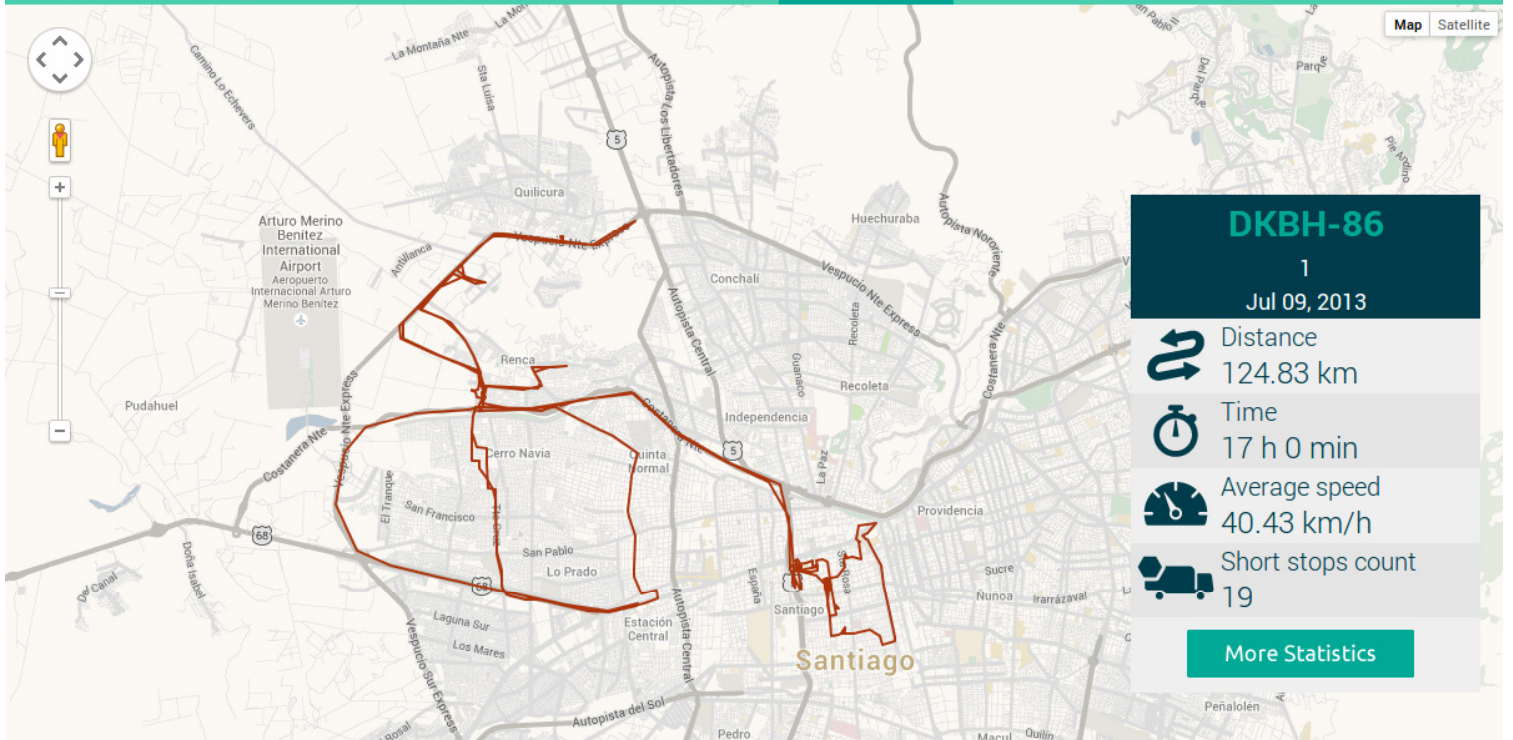
© 2015 MIT Megacity Logistics Lab. Do not quote without author authorization

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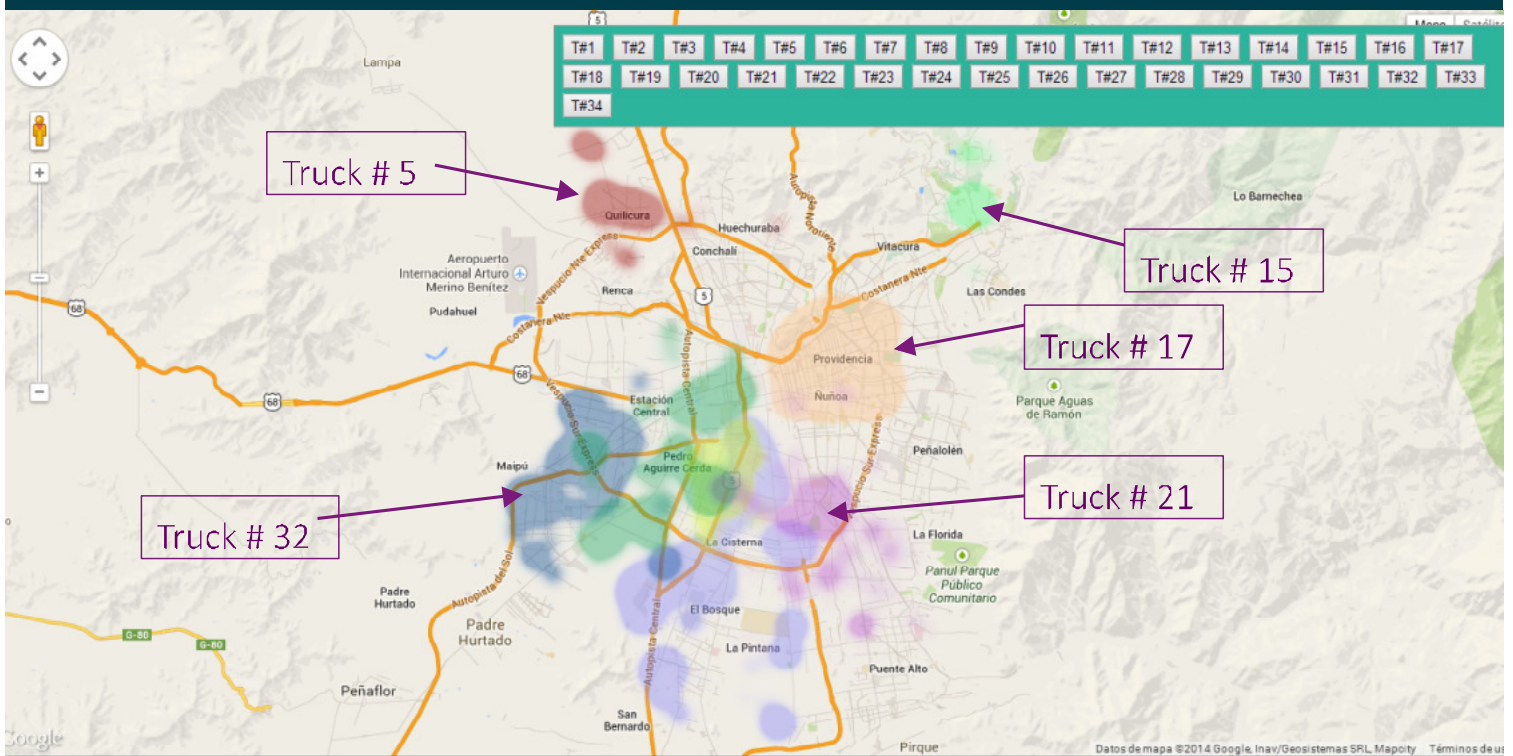
Building an urban logistics atlas



Source: MIT Megacity Logistics Lab



Finding delivery areas



High-resolution urban logistics design



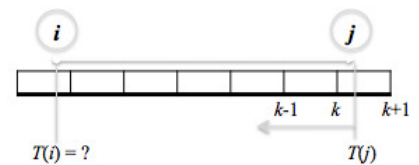
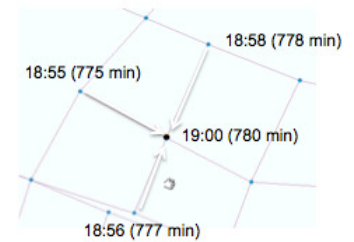
Average speed (31 Km/h) vs. Variable speed
(Min: 5 Km/h, Max: 100Km/h)

Modified Reverse Dijkstra

```

Algorithm Modified Reverse Dijkstra;
Begin
  S := ∅; U := N;
  d(i) := 0 for each node i ∈ N;
  d(o) := Arrival time and ant(o) := 0;
  while |S| < n do
  begin
    let j ∈ U* be a node for which d'(j) = max(d'(k): k ∈ U*);
    S := S ∪ {j};
    U := U - {j};
    for each (i, j) ∈ A(j) do
      if d'(i) < Dep_time(d'(j), (i, j)) then
        d'(i) := Dep_time(d'(j), (i, j)) and
        ant(i) := j;
    end;
  end;

Function Dep_time(d'(j), (i, j));
  Res_length := l(i,j);
  let k ∈ {0, 1, 2, ..., V} be an index for which f(i,j) ≤ d'(j) < f(i,j)+1;
  Res_length := Res_length - v(i,j) × (d'(j) - f(i,j));
  while Res_length > 0 do
  begin
    k := k - 1;
    Res_length := Res_length - v(i,j) × (f(i,j)+1 - f(i,j));
  end;
  Arr_time := f(i,j) - Res_length / v(i,j);
Return;
  
```



Closing Thoughts

- Citizens vs. Consumers
 - Logistics is the enabler of quality of life
- Know your (mega)city
 - People vs. Boxes
 - Make it a better place for logistics...
 - Collaborate to drive public policy
 - Share data
- Go nano!
 - Nanostores matter
 - High resolution data
- “Omni-channel” urban trends
 - It’s all about density & real estate

THANKS!

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