METAMORPHOSIS
FROM “BRICKANDMORTAR” TO
“CLICKANDMORTAR”
BUSINESS MODEL

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Competitiveness

Perspectives of competitiveness:
- Sales
- Logistics
- After-sale services
- Refund and replacement warranties
- Marketing
- Quality assurance

Goal of competition
- Highest level of customer satisfaction and convenience
- Lowest level of cost
- Sustaining and enhancing profits in the future
Customer Service

- Key element of competitive strategy

- Measuring customer service:
  - Delivery speed.
  - Cost.
  - Quality.
  - Customization.
  - Personal attention.
  - Product variety.
Customer Service

- In the retailing environment:
  - Delivery speed, pricing and product variety
  - Customer satisfaction

- An innovative distribution channel: INTERNET & WORLD WIDE WEB (WWW)

- New buzzwords:
  - Clickandmortar as opposed to brickandmortar
  - e-biz, e-trade, e-commerce, e-tail, dot-com, dot-biz
Logistics System

- Logistics System of a retailing company:
  - Acquisition of the goods,
  - Storage of goods,
  - Transfer of goods from warehouses to stores
  - Delivery of goods to the end customers [in some cases]

in short **Distribution Channels**
## Clicks and Bricks

<table>
<thead>
<tr>
<th>Brickandmortar</th>
<th>versus</th>
<th>Clickandmortar</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Web site, only <em>store site</em>.</td>
<td></td>
<td>Web site as an additional attractive show window of the <em>store site</em>.</td>
</tr>
<tr>
<td>No online transactions or orders, at most catalog sales or orders over the telephone.</td>
<td></td>
<td>Online transactions and orders.</td>
</tr>
<tr>
<td>Chiefly walk-in customers or customers who prefer catalog sales.</td>
<td></td>
<td>Both walk-in and online customers.</td>
</tr>
<tr>
<td>Goods rarely to be delivered.</td>
<td></td>
<td>Online orders to be delivered strictly within a <em>time window</em>.</td>
</tr>
</tbody>
</table>
From bricks to clicks…

When a company goes online...

- New warehouses.
- New delivery channels.
  - Lease vehicles.
  - Buy vehicles.
  - Outsource the deliveries of goods through a third-party company.

- Conversion of brick-and-mortar (BM) stores into click-and-mortar (CM) stores with both physical and virtual storefronts.
From clicks to bricks

When a pure Internet store wants to establish one foot in the old world.

- New warehouses

- Click-and-mortar stores to serve walk-in customers too, who still prefer personal interaction and physical presence during shopping.
Clicks supported by Bricks

The April 17th 2000 issue of the Wall Street Journal quotes David Court, a director at McKinsey & Co. management consulting firm:

1. “Companies who can put together a winning multichannel value propositions are going to get a higher share of wallet than a pure online business.”

2. “People who are ‘multichannel shoppers,’ buying both online and offline, spend significantly more than people who just buy online.”
Transition from bricks to clicks

OUR FOCUS

Development of a strategy to...

i. support this business model change, and...

ii. cope with the logistics problems faced by such brick-and-mortar retailers
Transition from bricks to clicks

Walk-in Customers of A BM Retailer

- Traditional customers
- Directly go to the stores.
- Do not expect delivery.
- Do not go to warehouses for shopping.
- Any store can accommodate arbitrary number of walk-in customers.
Transition from bricks to clicks

Walk-in Customers Around A Physical Store

- Physical store of the brick-and-mortar business model
- Walk-in customer’s residence
Transition from bricks to clicks

Online Customers of A CM Retailer

- Log on to the Web site of the retailer to place their orders.
- Expect prompt delivery \{thus: time restricted deliveries\}.
  - Time window constraints (Earliest/Latest)
  - Deadline constraints (Latest)
- Can be served either from a clickandmortar store or from warehouses directly, but not from a brickandmortar store.
- Delivery trucks, laden with online orders, visit the residence of one each online customer.
Transition from bricks to clicks

Online Customers Around A Given Facility

- Physical store of the brick-and-mortar business model
- On-line (delivery) customer

Dallas, November 18, 2000
Some Problems of Logistics

1. Time restricted vehicle routing problem
   \((VRP-TR\text{ or } VPR-TW)\)

2. Truck Fleet Problem
   - Insourcing versus outsourcing of the distribution activities through third-party delivery channel.
   - Truck capacities: sensitivity analysis of the VRP-TR.
Some Problems of Logistics

3. Pricing and Prioritizing
   - Customers having differential priorities.
   - Want faster delivery? Ready to pay more?
   - QoS \textit{(Quality of Service)} guarantees on deliveries.
   - A possible QoS guarantee in our problem could be:
     - Latest delivery or service completion time of each online customer
4. Multisource Location-Allocation Problem

We need to decide on:

i. Conversion of any brickandmortar stores into clickandmortar stores.

ii. Closure of any brickandmortar stores that are operating at present.

iii. Opening of new stores equipped and designed as clickandmortar stores.
4. Location-Allocation Problem (cont.)

iv. **Flow of goods** from warehouses to the stores.

v. **Assignment** of walk-in and online customers to the appropriate facilities
   - warehouses, BM stores, CM stores

At a later stage of this problem:

the decision on third-party rental spaces and stores for the display of goods to potential customers.
Some Problems of Logistics

A COLLECTIVE REPRESENTATION OF THE CITED PROBLEMS

- Rental place for distribution
- Distribution Center (Warehouse)
- Brickandmortar store evolving into a clickandmortar store
- Brickandmortar store to be closed
- Clickandmortar store to be opened
- Walk-in customer
- On-line customer
- Walk-in customer to be served by another facility
- On-line customer to be served by another facility
Research Methods

⇒ A comprehensive combined model for the first and the last of these logistics problems.

⇒ Both the VRP-TR and the location-allocation problem are *NP-hard* combinatorial problems.

⇒ State-of-the-art solution methods required:
  
  ➤ Heuristic techniques
  
  ➤ Lagrangean Relaxation
  
  ➤ *Multi-objective optimization* (*Cost* vs. *Distance*)
Description Of A Comprehensive Mathematical Model

VRP-TR and location-location problem united into one comprehensive problem.

- The model integrates location-allocation decisions into a multi-depot vehicle routing problem with delivery deadlines.
Description Of A Comprehensive Mathematical Model

» Simplifying assumptions:
  - All data given a priori and known exactly.
    - All fixed and variable costs
    - Set of alternative locations for new CM stores
    - Set of present service facilities comprising warehouses and BM stores.
    - Service requirements of customers:
      - demands and delivery deadlines
  - Hence, the VRP-TR is handled as a static problem.
Description Of A Comprehensive Mathematical Model

Simplifying assumptions (cont.):

- Click-and-mortar or brick-and-mortar store serve both walk-in and online customers.

- Warehouses are restricted to deliver only to online customers and to the stores.

- Third party’s rental spaces are not taken into consideration.
Description Of A Comprehensive Mathematical Model

- Simplifying assumptions (cont.):
  - Any currently operating brick-and-mortar store can be closed at a fixed cost.
  - A new click-and-mortar store’s opening is associated also with some fixed cost.
  - If a brick-and-mortar store is to serve online customers as well, it must be converted to a click-and-mortar store at a certain fixed cost.
  - Other operational costs of the facilities are ignored.
Description Of A Comprehensive Mathematical Model

- Simplifying assumptions (cont.):
  - Unlimited storage and delivery capacities at the facilities.
  - Tardiness or earliness of deliveries are not penalized.
    - Latest delivery time OR time window constraints are hard constraints taking care of unfavorable timing.
The Static Click-and-mortar
Business Model [CMBM-S]

Constraints summarized:

(i) Service requirements of walk-in customers,
(ii) Service requirements of online customers,
(iii) Balance between goods transferred from warehouses to the stores and goods delivered to online customers and sold to walk-in customers from these stores,
(iv) No service to any customer from a CM store that has not been opened, or from a BM store that has been closed,
Constraints summarized (cont.):

(v) **No service to the online customers from a BM store that has not been converted to a CM store,**

(vi) **Constraints preventing flow of goods from CM and/or BM stores that will not be in service,**

(vii) **Time restricted vehicle routing constraints in accordance with the previous allocation-location constraints,**

(viii) **Nonnegativity and Integrality Constraints.**
The Static Click-and-mortar Business Model [CMBM-S]

Components of the Comprehensive Objective Function summarized:

Minimize

\[ Z = \text{Comp}_1 + \text{Comp}_2 + \text{Comp}_3 + \text{Comp}_4 + \text{Comp}_5 + \text{Comp}_6 + \text{Comp}_7 \]
The Static Click-and-Brick Business Model [CMBM-S]

Where:

Comp_1 = Cost of converting BM stores to CM stores,

Comp_2 = Cost of opening new CM stores at a set of potential location,

Comp_3 = Cost of closing BM stores currently operating,

Comp_4 = Traveling costs of walk-in customers to BM and CM stores,

Comp_5 = Cost of transporting goods from warehouses to the stores,

Comp_6 = Cost of converting BM stores to CM stores,

Comp_7 = Fixed costs of vehicle acquisitions at the warehouses as well as at CM and BM stores.
The Static Clickandmortar Business Model [CMBM-S]

A picture visually exhibiting a feasible solution to the problem ECBM-Static

- ◆ : Walk-in customer
- x  : Online customer
- : Vehicle route to an online customer
- : Driving path of a walk-in customer
- : Transfer of goods from warehouses to stores
Expected Contributions

- Change strategy from *brickandmortar* to *clickandmortar* business model.

- Combination of the interdependent subproblems of logistics.

- Outsourcing of the distribution activities
  - Outsourcing would obliterate the VRP-TR subproblem of the comprehensive model.
Future Research Directions

Real-Time Strategy Making

- Dynamic arrivals of orders from online customers.
- Unexpected traffic disturbances in the extreme case.
- Assignment of vehicles to customers and deliveries of their orders on a real time basis.
Future Research Directions

Real Time Multi-Period Strategy Making

In addition to the real time model:

- A real time planning horizon of multiple periods.
  - The decisions that are made in a previous period affect the decisions to be made in the next period.
Recently: Amazon.com vs. Walmart.com

Amazon.com isn’t what it was used to be even a year ago...
Recently: \hspace{1cm} \textbf{vs.} \hspace{1cm} Walmart\textsuperscript{*}com

Selling kitchen utensils and cookware???

Wait a minute!
You want to compete with someone else too?
Motivation of the Quest

Thus, the problem of the METAMORPHOSIS FROM “BRICKANDMORTAR” TO “CLICKANDMORTAR” BUSINESS MODEL will be pursued in the arena of the new economies…
...as long as teleporting is not an option...
What do you want to ask today?

I see it, I see something called the INTERNET...

What is it used for?

Can't see yet; the connection is a little bit slow...

Courtesy of Cartoonist Selçuk Erdem