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HUNTS POINT TERMINAL MARKET: THE DEMAND FOR WATERBORNE TRANSPORTATION AS A PART OF THE OUTBOUND DISTRIBUTION SYSTEM*

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Abstract

The goal of the study is to explore an alternative to the primary use of trucks for outbound delivery or pick-up of food products in the Metropolitan area from Hunts Point Terminal Market (HPTM). *The alternative proposed is the use of waterborne transportation (barges or freight ferries); as part of the outbound food distribution system. The study's objective is to quantify the potential demand for waterborne services from which vehicle mile savings is determined*. The waterborne

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vessel will be loaded with food products at HPTM and moved (self-propelled or pulled) to a strategically located predetermined site in the Metropolitan area. Retailers will pick up their preordered food products from this site, and the process starts all over again.

1. BACKGROUND

New York City's (NYC) roads and highways are congested, partly due to trucks delivering food products to/from Hunts Point Terminal Market (HPTM) located at the Hunts Point Peninsula. HPTM is the largest fresh food distribution center in the United States (U.S.), the source of 60% of the food distribution in the New York Metropolitan Area (NYMA). The daily food delivery in the NYMA is primarily via HPTM with 15,000 [1] truck moves of which 12,000 are outbound. These trucks increase traffic congestion, pollution, and wear-and-tear on the roads, which increases the cost of living in the City, commute time, medical problems and costs, and reduce' productivity.

Waterborne operation as part of the food distribution system reduces the number of truck trips and mile driven. These reductions reduce the demand for fuel, pollution and congestion. A waterborne distribution system could provide new opportunities, such as offsite distribution centers for outbound and inbound movement.

The goal of the research is to explore a waterborne transportation alternative to the primary use of trucks for outbound delivery of food products from HPTM in the NYMA (barges or freight ferries). The study quantifies the potential demand for waterborne services from which vehicle mile savings is determined. After the literature review and research methodology, the paper describes the food distribution system in the NYMA, HPTM's role, the benefits and challenges.

2. LITERATURE REVIEW

The literature review addresses wholesale produce distribution and the role of HPTM, which is almost exclusively by surface transportation. In general, the wholesale distribution system complies with storage and distribution requirements. Thompson and Kader [2] describe the factors for storage and transport of produce. Rogoff [3] addresses the importance of logistics and supply chain in food distribution for financial profitability. In a freight ferry study, de Cerreño, et.al, [4] "explores the feasibility of freight ferries as a potential intra-regional waterborne alternative for truck freight movements across the Hudson River/NY Harbor." DiNapoli [5] addresses the economic impact of HPTM on the food distribution. Freight rates are raised by NYCEDC [6], HPTM [1] provides some basic statistics of the facility, New York City Department of Housing and Development [7] discusses the land use of Hunts Point peninsula and future plans, Tarleton [8] addresses the future of HPTM, and Zalman [9] talks about the perishable business.

The NYC Plan for the next 30 years highlights the role of HPTM in the food supply [10] indicating that "Approximately 95% of the city's food travels into NYC by truck, via a limited number of access points (mainly bridges). …, nearly 30% of the truck traffic over the George Washington Bridge on any given day..." [10]. HPTM serves the intermediate and small stores via direct buying and/or direct outbound distribution. The literature review indicated that there was no study of outbound food distribution for HPTM.

3. RESEARCH METHODOLOGY

The research methodology was of data collection and analysis via survey and interviews. The

statistical analysis provided an estimated demand of services by zip code, which was the foundation for food distribution to the NYMA for direct and indirect impact of a waterborne delivery on the region. The amount of data collected indicates 95% confidence level or better.

4. FOOD DISTRIBUTION

Food consumption in the USA is about one ton per person [11]. NYC consumes more than 5.7 million tons of food annually [10]. The number of food establishments in NYC in 2014 (restaurants, bars and cafes) was 23,705 [12], of which 7,151 [13] were fast food. Food distribution takes a large amount of logistics and supply chain resources (Figure 1).

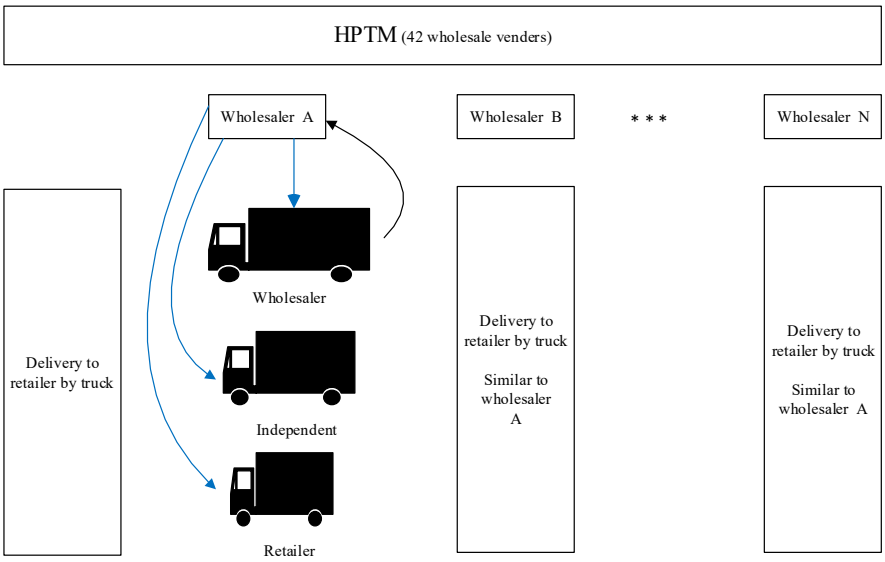

Figure 1: Contemporary Supply Chain Delivery

The outbound food wholesalers are: large, medium and small. Borderlines between the wholesalers' size categories are hard to identify due to lack of information. There are retailers who come directly to HPTM to purchase food products regularly.

- The large and intermediate wholesalers have in-house distribution facilities and own vehicles. Food products are shipped inbound directly to their distribution facilities mostly via surface transportation modes. The food products are shipped outbound from their own distribution facilities. Intermediate wholesalers, not located in HPTM, rely on HPTM to make up the differences for outbound distribution. The large firms supply at least 95% of the produce from their warehouse and use a facility such as HPTM, only in case they are short an item. Altogether, the HPTM wholesalers own about 100 trucks (boxcars and tractor-trailers), some of which are refrigerated.
- There are many small distribution firms or third party (3-P) brokers (at least 95%) that depend on HPTM to fill customers' orders. They might also visit large wholesalers.
- For an access fee of $25 annually a small retailer visits HPTM for its own business. Small retailers do not use brokers; they prefer to **S**ee, **F**eel and **T**ouch (SFT) the produce prior to purchasing. About 50% of the customers are SFT types.

5. RETAILERS DEMAND REQUIREMENTS AND SCHEDULING

The industry is **complex** and **competitive**. Its operation is dominated by wholesalers trying to accommodate the wishes of their customers (retailers) on-demand. A typical retailer: is small, following its own business model; has a limited amount of space, uses HPTM as its warehouse, places small orders at a high frequency (daily/twice a day/a few times a week); orders a mix of produce items at prime quality condition and lowest price; can reject produce at will; uses a 3-P broker delivery; is time sensitive; spot orders (no advance order).

Retailers are in command of the delivery schedule. The retailers expect on-demand and on-time delivery (2AM, 3AM, 6AM, 7AM or any time in between). There are retailers that require a second delivery in the PM hours as well. The delivery between wholesaler and retailer is carried out either by wholesaler, 3-P broker or the retailer itself.

Seventy to 80% of the retailers use a 3-P broker for ordering and/or delivering the produce. The retailer expects the 3-P broker to: check (SFT), buy, pick up and deliver the produce in good condition or it will be rejected and returned (5 to 10% of the time), deliver on time, and pay directly to the wholesaler unless other arrangements are made. Thus, for the 3-P broker to stay in business it must be fully accommodative and competitive.

6. HPTM Outbound Distribution

The total HPTM outbound produce distribution to six states is 210 million packages [1], an average of 67 packages/truck-trip/day for the 12,000 outbound truck-trips/day or 4.5 billion pounds [14] (an average of 22 packages/ pallet). The number of pallets of fruit and vegetables handled in a year is 9.6 million (6) (3.1 pallets/truck). Obviously, the outbound majority is in small parcels in small vehicles and not by pallet. Hence, an average of 40 packages/pallets is used.

The average number of outbound packages to 125 zip codes to New Jersey is 64.5% (Table 1). The weekly outbound average package distribution focus is on New York State (NYS) and its counties dominated by the Bronx (24%) (Table 2), due to its proximity to HPTM. Brooklyn had a 19% share and Queens 18%. The total outbound produce delivered to all NYC boroughs is 71%.

Table 1: Estimated Average Produce Outbound by Box Share and by Zip Code Distribution

STATE	Weekly average number of packages	Relative share	Number of zip codes	Relative share	Relative share of vehicle trips by state
Connecticut	354,595	8.8%	23	6%	1,054
Massachusetts	146,193	3.6%	11	3%	434
Maryland	199,795	4.9%	7	2%	594
New Jersey	2,605,237	64.5%	125	33%	7,741
New York	681,496	16.9%	200	52%	2,025
Pennsylvania	51,144	1.3%	15	4%	152
Totals	**4,038,462**		**381**		**12,000**

7. CLUSTER DEVELOPMENT ANALYSIS

Using the HPTM outbound data, clusters by zip code east of the Hudson River (EH) were developed (excluding the Bronx) to determine potential waterfront sites for waterborne operation and the number of packages and truck trips (Table 2). There are a few operating waterfront landing

sites in Brooklyn that are ready to go (Navy Yard Basin, Red Hook, Atlantic Basin and Erie Basin). Other sites could be developed to accommodate a waterborne outbound distribution, including: Bowery Bay, Flushing Bay (120,702; 338 vehicles); Newtown Creek for Brooklyn and Queens; Manhattan (61,368 packages; 181 vehicle trips); Erie, Navy Yard, Red Hook and Atlantic Basins (132,619 packages; 373 vehicle trips); Westchester County (44,094 packages; 121 vehicle trips); Manhasset Bay or Hempstead for Nassau (73,094 packages; 198 vehicle trips) and/or Suffolk Counties (26,264 packages; 69 vehicle trips).

Table 2: Weekly Produce Package Distribution by NYS Counties

County	Weekly average observed	% from NYS	Weekly average estimated*	% from NYC
Albany	8,278	4%	26,398	
Bronx	50,309	24%	160,433	33%
Brooklyn	41,587	19%	132,619	28%
Manhattan	19,244	9%	61,368	13%
Nassau	22,921	11%	73,094	
Queens	37,850	18%	120,702	25%
Rockland	7,353	3%	23,448	
Staten Island	1,910	1%	6,091	1%
Suffolk	8,236	4%	26,264	
Westchester	13,827	6%	44,094	
Other	2,190	1%	6,984	
Total NYC	**150,900**	**71%**	**481,214**	**100%**
Total NYS	**213,705**		**681,496**	

*Estimate was extrapolated using 210 million packages a year reported before [1]

8. OUTBOUND TRUCK-TRIP ESTIMATES

Outbound distribution and vessel size from HPTM are derived from retailer order size, frequency of delivery, and location. Based on driver market survey ratio, 80% of outbound truck traffic from HPTM [7] or 12,000 outbound vehicle trips/day are distributed between six states (Table 1). The estimated distribution between three categories of vehicle sizes is as follows:

- The **boxcars** moved **50%** of the produce (trucks of 10ft to 28ft). Some are refrigerated.
- The **small vehicles** moved **31%** of the produce (vans, pickup trucks).
- The **tractor-trailer** truck moved **19%** of the produce (28ft to 53ft). Some are refrigerated.

The study focus is on NYS EH. Table 1 shows NY's relative share of vehicle trips for a total of 2,025 vehicles, of which 1,856 (Table 3, Column 2) travel from HPTM to EH counties and boroughs (15.5% of total truck trips).

A few scenarios are estimated to capture various possible distribution alternatives EH:

1. The outbound traffic from HPTM to the Bronx retailers is only by boxcar and van.
2. Outbound deliveries for long distances from HPTM are primarily by tractor-trailer.
3. Tractor-trailers come in different sizes; however, 40ft is used.
4. A tractor-trailer of 40ft can load 20 pallets or equivalent in packages (minimum of 16 pallets).
5. An average boxcar 20ft in size can load 10 pallets.
6. A van takes a maximum of 2 pallets (high load is 1.5 pallets). It is most likely loaded with an equivalent one pallet or less. Vans are frequently loaded with packages, not pallets.

Table 3: Estimated Outbound Vehicle Distribution for New York East of the Hudson River

County/ Borough	% of NYS (1)	Relative share by county (2)	Tractor-trailer share (3)	Van share (4)	Boxcar share (5)
			19%	**31%**	**50%**
Bronx	23.5%	477	91	148	238
Brooklyn	19.5%	394	75	122	197
Manhattan	9.0%	182	35	57	91
Nassau	10.7%	217	41	67	109
Queens	17.7%	359	68	111	179
Staten Island	0.9%	18	3	6	9
Suffolk	3.9%	78	15	24	39
Westchester	6.5%	131	25	41	66
Totals	**91.7%**	**1,856**	**262**	**428**	**690**

Outbound distribution based on driver market survey is estimated daily EH (Table 3) from the data. For example, the number of van trips to Brooklyn at a van share of 31% is 122.

Vehicle trip distribution, assuming high density, is the average daily retailers' demand for produce (3,123 pallets of 40 packages/pallet). Applying the high-density assumptions (4, 5, & 6), the total potential daily number of vehicle trips needed is 878 (Table 4).

Modifying vehicle size trip distribution, the tractor-trailers' share in the delivery is in the "% of tractor–trailer" column with assumptions 5 and 6, based on interviews of 3-P brokers from HPTM. Table 4 shows vehicle sharing between the three vehicle types: 8 tractor-trailers carrying 128 pallets (16 pallets/truck), 1,182 pallets to 1,182 vans (1 pallet/van), and 604 boxcars carrying 1,813 pallets (3 pallets/boxcar) for a total of 1,794 vehicles (3,123 pallets).

In short, vehicle distribution to each county and borough EH provides alternatives with shortcomings. Scenario III with 3 pallets/boxcar is the most reliable with a total of 1,794 vehicles.

Table 4: Scenarios Summary

County/ Borough	Scenario 1 (Table 3)	Scenario 1I	Scenario 1II			
			(3.5 pallets per boxcar)	% of tractor-trailer	(3 pallets per boxcar)	(2.5 pallets per boxcar)
Bronx	477	225	474	0%	496	527
Brooklyn	394	186	355	25%	373	399
Manhattan	182	86	172	0%	181	193
Nassau	217	103	189	46%	198	212
Queens	359	170	321	28%	338	362
Staten Island	18	9	17	0%	18	19
Suffolk	78	37	65	64%	69	73
Westchester	131	62	115	38%	121	130
Totals	**1,856**	**878**	**1,708**		**1,794**	**1,915**

9. WATERBORNE OPERATION: PROPOSED

Using a barge as an example, it is loaded at HPTM and hauled to a discharge site. After discharge the barge is hauled back to HPTM for the next round of operations (Figure 2). The

proposed operation model (Figure 2) requires that many wholesalers collaborate.

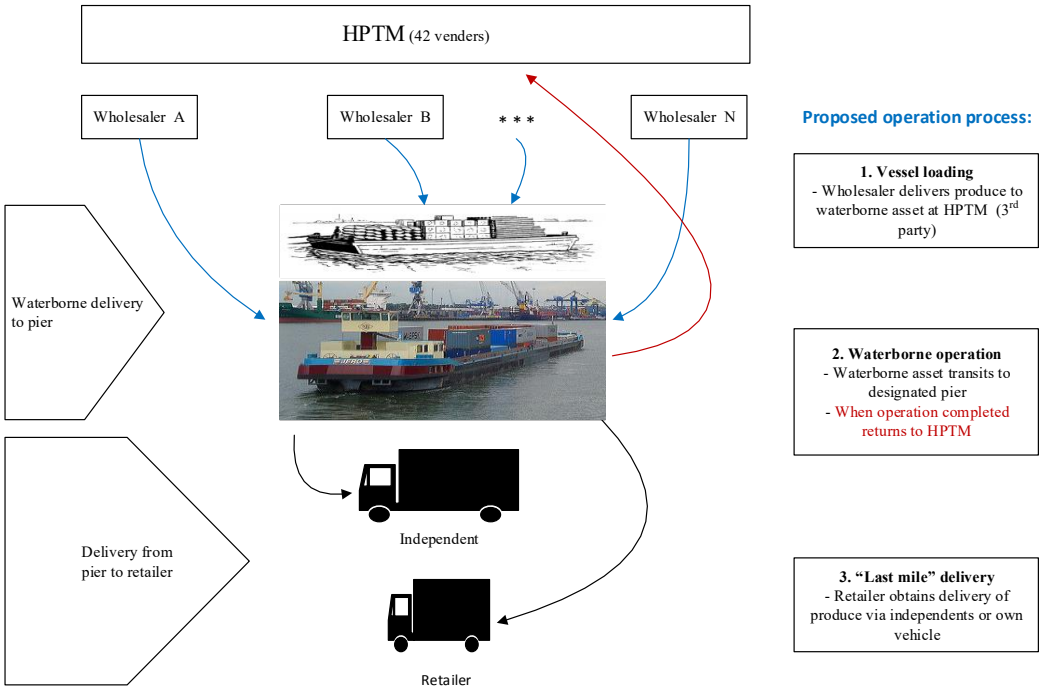

Figure 2: Proposed Supply Chain Operation.

10. GENERAL OUTLINE OF THE WATERBORNE OPERATION

For a waterborne operation to succeed, various issues need to be addressed, including: a dedicated party to load/discharge (HPTM vender or an independent); temperature required per product during loading and transit; products segregated as required; waterborne crew dedicated to the operation; waterborne asset duration scheduled for load/discharge; schedule for departure from and return to HPTM (including tugboat operator); transit time to discharge location, taking into account currents; maintenance schedule and contingency plans during maintenance; security awareness and security plan; training of crews (loading, discharge, and transit); contingency plans for various weather conditions (emergency, snow, storms, ice, etc.); chain of responsibility.

11. OUTBOUND WATERBORNE DISTRIBUTION SYSTEM AND CHALLENGES

Moving from a single wholesaler operation (Figure 1) to a shared operation (Figure 2) requires **consolidation** in the stowage plan which is driven by **segregation, temperature,** and **destination**. A waterborne operation should be economical providing **economies of scale** and reduce costs via a large system and wholesalers cooperation; thus, it will: reduce the number of trucks on the road, reduce the HPTM wholesalers' transport cost, and encourage wholesalers' participation in an outbound waterborne distribution.

Many of the present and waterborne distribution challenges (produce segregation, temperature control, timing of delivery, wholesalers working together, etc.) are the same. In addition, there are requirements of waterborne hardware and vessel design, new system supply chain management

(waterborne vessel loading priority and schedule, produce storage requirements, routing), landing sites' locations and designs, operations finance, community concerns, and others.

Wholesalers' support implies sharing delivery information, which is not the norm between HPTM wholesalers because of **distrust**. Trust needs to be established for an outbound waterborne delivery system to work. A "Third Party Waterborne Delivery Provider" (3PWDP) needs to be a part of the new operation. Thus, professional and impartial performance measures by the 3PWDP should be incorporated into the operation matrix, including:

- **Arbitration**. An arbitration system should follow a manual and protocol guideline and be available at the operation's start. A dispute automatically involves arbitration.
- **Transparency**. In the effort to reduce tension and business operation disruption, transparency is paramount and should be regularly reported by the 3PWDP.

12. OUTBOUND WATERBORNE RETAIL DELIVERY

The proposed waterborne distribution system (Figure 2) has a 3PWDP buffer, with strict schedules of each of the three parties along the supply chain. The wholesaler delivers the produce to the pier at HPTM on schedule. The 3PWDP would be required to a schedule of: (1) loading, (2) transiting to the discharge location, and (3) transiting back to HPTM. Finally, the retailer's pickup would be at a scheduled time at the pier.

A waterborne distribution system will reemphasize the "**last mile**", i.e., from the waterborne landing site to the retailer's business site. Developing friendly landing sites with community input is vital to minimize the Not-In-My-Back-Yard (NIMBY) resistance.

13. CONCLUSION AND RECOMMENDATIONS

An outbound waterborne distribution system benefits NYC in reducing traffic congestion, pollution, wear-and-tear of roads and bridges, the cost of living, commute time, and medical problems and costs (increase in productivity). Implementing an outbound waterborne distribution require stakeholders' (wholesalers, retailers, and government officials) cooperation and support.

Findings: A system which completely replaces the present system would have a net effect of:

- savings of 39,500 miles/day (10.3 million/year)
- emissions reduction of 37,300 pounds of carbon dioxide/day (9.7 million pounds/year)
- savings of 2,076 gallons/day (540,000 gallons/year and $1.35 million at $2.50 per gallon)
- time saving close to 1,500 hours/day or 390,000 hours/year or 260 working days

A fully implemented waterborne operation of moving 125,000 packages/day (3,123 pallets) would have a total of 1,280 vehicle trip savings/day.

The challenges to obtain a reliable outbound, waterborne operation system includes overcoming:

- **distrust** among HPTM wholesalers to obtain high volume
- **on-demand** delivery schedules (24/7). Altering schedules might present a problem.
- The immediate and unconditional **produce rejection** and return.
- The **door-to-door** delivery service from the wholesaler/broker to the retailer. The "**last mile**" operation might be a new challenge for some wholesalers, retailers, and brokers.
- The retailer's **spot order**.
- The NIMBY **concerns** of increased traffic, noise, emissions, and other factors.
- The inability to monitor **service quality and customer relations**

- The **toll revenue** reduction from fewer bridge crossings.
- The 3PWDP **definition, role, and function.**
- The Coast Guard compliance requirements of **security regulations** and public access.

Recommendations: Implement an outbound 3PWDP waterborne distribution system slowly, starting in Brooklyn. Brooklyn has the facilities in place for this type of operation and, after the Bronx, it is the largest consumer of produce from HPTM. Furthermore, address the fully implemented waterborne distribution impact on the local added traffic to mitigate its effect and all the other challenges outlined above. It is difficult to envision these challenges resolved soon.

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