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# THE EMERGING PORT

## INLAND LOGISTICS OF AMAZON

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### PORT-CENTRIC LOGISTICS E-BOOK

#### E-COMMERCE AS AN EMERGING RETAIL PARADIGM

The emergence of e-commerce has allowed for new forms of logistics and freight distribution that are starting to have noticeable impacts on ports and terminal operations. This digitalization of retail required the setting of physical distribution components relying on home deliveries, which include several facilities designed and positioned to answer demand promptly. E-commerce is a distributional form of consumption since demand is dependent on the available distribution capabilities, particularly its timeliness and reliability. The setting of e-commerce supply chains involves not only the procurement (inbound) aspects of logistics but as well the final distribution dimension of home deliveries. Logistics becomes essential for e-commerce because the consumer is directly exposed to its performance.

Supporting this new distribution system required new types of facilities to fulfill roles such as processing and packaging orders, sorting large volumes

of parcels by geographical destinations, and decomposing shipments for final delivery routes. While parcel deliveries companies have developed segments of this distribution system for the last few decades, e-commerce incited its expansion in scale and scope to levels not seen before. The online retailer Amazon epitomised this paradigm, accounting for 38% of all online retail sales in the US and 4% of total retail sales. It commands substantial volumes and can dictate how the parcels generated by e-commerce will be handled through distribution channels that are increasingly under its direct control.

#### E-COMMERCE DISTRIBUTION CHANNELS

Three distribution channels have been set to support Amazon's logistics, each relying on distinct logistical facilities (Figure 1):

- Procurement (first stage) provides the required inventory that is handled first by inbound cross-docking (ICD) facilities that are the point of entry of hinterland logistics. ICD facilities are functionally like transloading facilities found nearby

large container terminals, but service exclusively e-fulfillment centers. On one side of the facility, inbound cargo loads (mainly containers) are unloaded and stored until needed, implying that the ICD is a buffer within e-commerce supply chains; it holds inventory and allocates outbound loads. On the other side of the facility, full truckloads are assembled according to demand and sent to specific e-fulfillment centers (EFC). EFCs are extensive facilities having a large number of items in inventory with the purpose of assembling individual orders in parcels bound to the final consumer.

- Distribution (second stage) allocates parceled orders towards facilities near the final delivery point. The concern is to establish a distribution structure that offers capacity, flexibility, and time performance through the selection of the most suitable distribution channels. EFC, therefore, have the option of routing parcels towards standard postal services, Third-Party Logistics

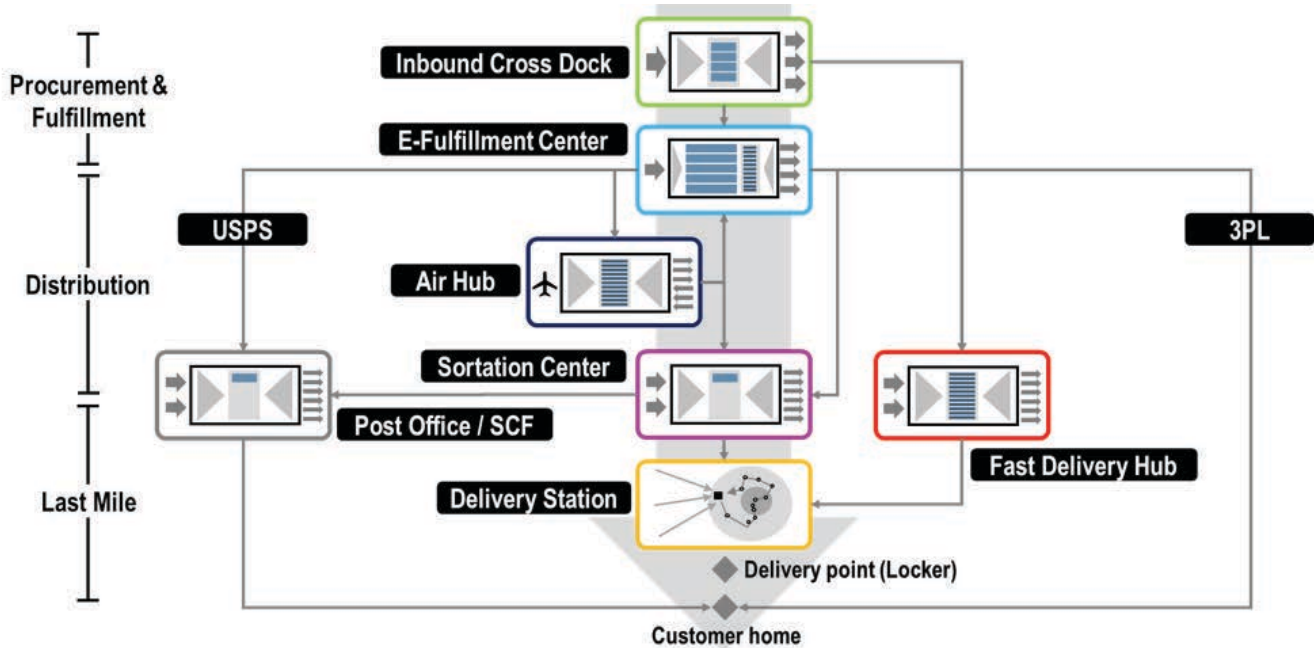


Figure 1 The E-Commerce Supply Chain of Amazon

providers (3PL) such as UPS and FedEx, and increasingly through Amazon’s distribution channels that include air hubs and sortation centers. Sortation centers (SC) are key facilities arranging shipments by their destinations within a metropolitan area. They sort parcels bound to an area into load units, such as a postal code, which includes sorting packages coming from different e-fulfillment centers. From the sortation center, parcels can be sent to local post offices, parcel delivery stations for last-mile delivery or to subcontracting delivery companies.

- The last-mile (third stage) brings parcels to their final destination, mainly through delivery routes from specialized facilities such as parcel delivery stations. From these facilities, parcels are usually loaded into delivery vans allocated along planned delivery routes. Another specialized facility linked with last-mile logistics is the fast delivery hub that carries a limited inventory of high demand items that can be delivered within a short timeframe. These hubs are occasionally co-located with an EFC but are more often standalone facilities located in high-density areas.

**MARKET COVERAGE**

The functional organization of e-commerce supply chains relies on a spatial organization aiming at serving demand patterns that are commonly related to population density, with large metropolitan areas being the main demand generators. As of 2019, 453 Amazon facilities in the US accounted for a total footprint of 173.6 million square feet, the equivalent of 16.1 square kilometers. The majority of the footprint is occupied by 179 e-fulfillment centers (77% of the total footprint), which are the core support for e-commerce. Their size tends to be consistent and specialized in terms of if the

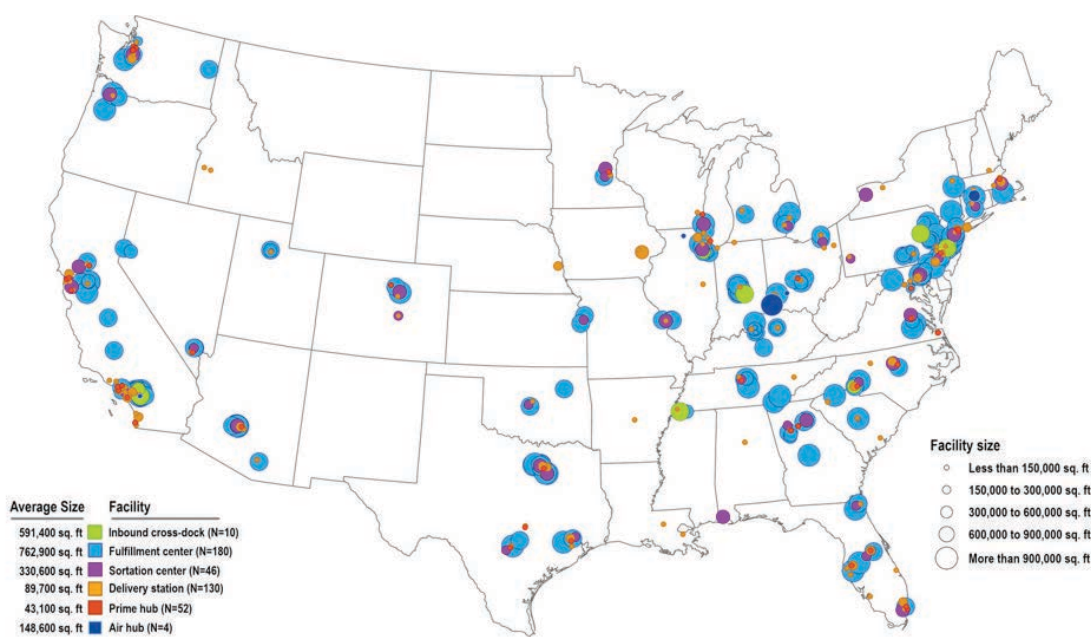


Figure 2: Amazon E-commerce Facilities, 2019

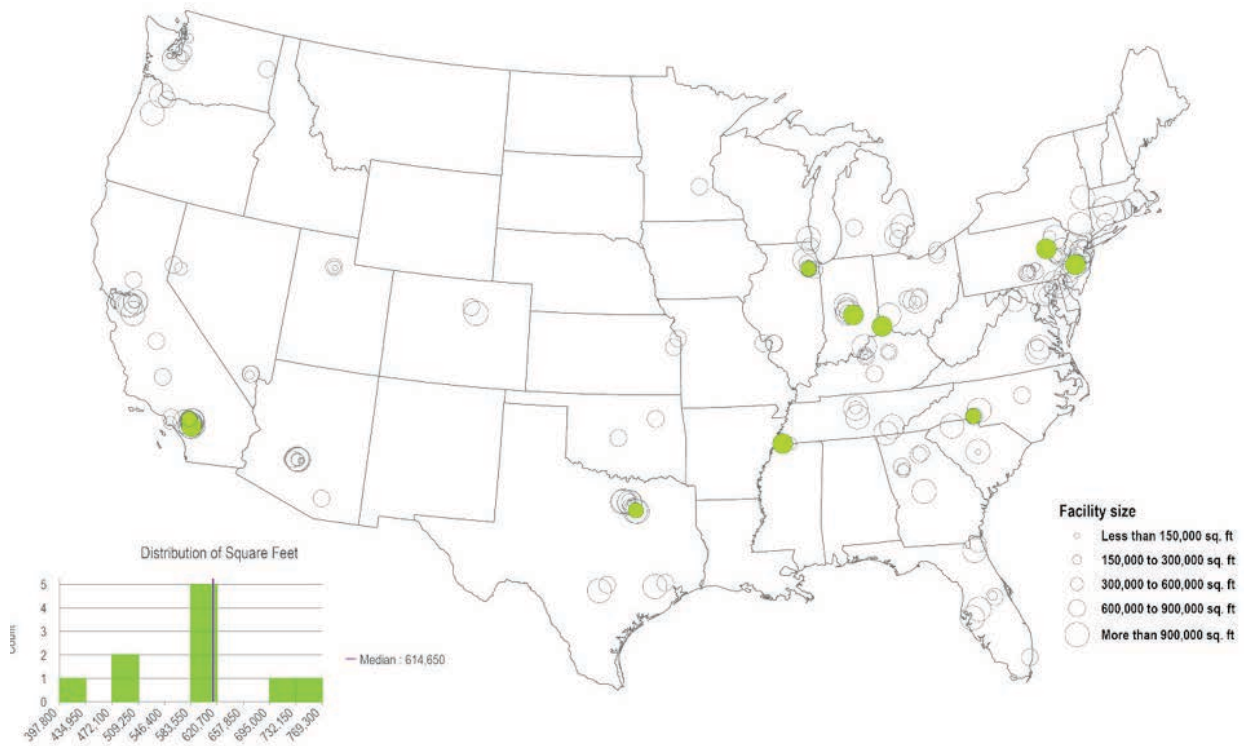


Figure 3: Amazon Inbound Cross Dock Facilities Network (n=10)

parcel is sortable (items fit in a small box of less than 10 kg) or non-sortable (items fit in a large box of less than 25 kg, or the item is a box such as for furniture and televisions). The second most crucial footprint concerns 130 delivery stations (10% of the total footprint), which are the last step in the e-commerce distribution chain.

The distribution of the facilities aims at positioning the inventory to fulfill intricate regional demand patterns and to minimize delivery time through the advantage of proximity, which remains the primary concern (Figure 2). The average size per facility type reveals apparent differences mainly based on a trade-off between economies of scale, market areas, lead time, and land cost.

In 2016, Amazon began establishing non-vessel-operating common carrier (NVO) agreements, allowing it to transport goods by maritime shipping without operating container vessels. This represents a step towards additional horizontal integration by enabling Amazon to secure shipping capacity and even make this capacity available to suppliers.

In 2018, Amazon imported the equivalent of 123,000 TEU, which is still modest compared to the 2.3 million TEU imported by the four main US retail giants (Walmart, Target, Home Depot, and Lowes). However, these figures exclude the inventory handled through the Fulfillment by Amazon (FBA) programme, where sellers are bringing their own inventory to ICDs or e-fulfillment centers

if the inventory is small or specialised. These trends underline a particular focus on 10 ICD facilities (Figure 3) with a locational preference for two gateways (Los Angeles / Long Beach and New York), one on each coast, to handle the bulk of imported containers. Outside coastal ICDs, inland ICDs are located at major intermodal hubs with the purpose of transloading containers coming from other maritime gateways. Through a mix of port-centric and inland logistics, Amazon is able to route containerised freight flows according to the inventory requirements of its IFCs.

**IMPLICATIONS FOR PORT OPERATIONS**

Large e-commerce providers and conventional retailers increasingly focusing on the e-commerce dimension of their operations are commanding larger cargo volumes, directly or indirectly, but also the main gateways where this cargo transits. The emergence of e-commerce has led to the setting of complex distribution channels with a hierarchy of facilities that are supplied by a smaller number of points of entry. The locations of inbound cross-docking facilities servicing Amazon in the US are illustrative of an emerging port/inland logistics handling the specific requirements of e-commerce. The evidence thus underlines that ports and maritime shipping are increasingly impacted by e-commerce, which is part of the digital transformation shaping the industry.

**ABOUT THE AUTHOR**

Dr Jean-Paul Rodrigue is a Professor at Hofstra University, New York. His research interests mainly cover the fields of transportation and economics as they relate to logistics and global freight distribution. Specific topics over which he has published extensively cover maritime transport systems and logistics, global supply chains, gateways, and transport corridors.

**ABOUT THE ORGANIZATION**

PortEconomics is a web-based initiative aiming at generating and disseminating knowledge about seaports. It is developed and empowered by the members of the PortEconomics group, who are actively involved in academic and contract research in port economics, management, and policy. Since October 2012, Port Technology International and PortEconomics have been engaged in a partnership. [www.porteconomics.eu](http://www.porteconomics.eu).

**ENQUIRIES**

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