

Time and Money Advantages of Logistics Clusters

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These clusters are agglomerations of logistics activities in a region or logistics park, and there can be huge cost-saving advantages to locating in them.

Direct operations transportation is typically preferred by shippers because it offers shorter travel times, less chance of misrouting, and a lower chance of handling damage to the shipment. The challenge for shippers is to accumulate enough freight to fill a conveyance to make direct operations economical.

It should be noted that because of the circuitous routing and extra handling involved in consolidated operations (CO) services, a conveyance does not need to be full in order to be cost effective in comparison to a CO service. For example, even shipments as small as 12,000 or 15,000 pounds sent in a truck that can hold 40,000 pounds may be less expensive to send using a truckload carrier, compared to using LTL. Such under-uti-

lization creates opportunities for collaboration between shippers in a cluster, sharing conveyances to reduce costs.

The Conveyance Cycle

Freight flows are not balanced, in the sense that some regions generate more outgoing flows by certain modes of transportation (e.g., mines and factories) while others absorb more incoming flows (e.g., major consumer population centers). Similarly, the trade imbalance between China and the United States means that cargo vessels laden with full containers move from Chinese ports to U.S. ports while little freight moves from the United States to China. However, carriers must somehow get both vessels and containers back in order to reload them. The same phenomenon exists in every mode of transportation. For example, while there is freight

that moves on trucks from the U.S. Midwest into Florida, very little moves back on trucks, creating a flow imbalance. Yet the trucks have to get back to regions where they can be loaded again—thus after dropping one load, they travel empty to pick up the next load. As a result, trucks, rail cars, ships, airplanes and containers keep moving in an endless sequence of loaded-empty-loaded-empty trips, as conveyances are repositioned for the next loaded move following each delivery.

Carriers naturally try to minimize the empty movements because those movements do not earn any revenue. Rather than

*The following is an excerpt from *Logistics Clusters: Delivering Value and Driving Growth*, Sheffi's book to be published in October by the MIT Press. The book delves into the reasons industrial clusters in general and logistics clusters in particular form and develop, their contribution to jobs creation, capital formation, and their efforts of environmental sustainability. This portion of the book looks at full conveyance-load and the availability of multiple carriers. The book is based on hundreds of interviews, case studies and data collected by Sheffi around the world. The excerpt is published with the permission of MIT Press.*

move empty conveyances back to the point of origin, DO carriers look for the next load at a point close to the last delivery place in order to minimize the length of the empty move. While all carriers are affected by flow imbalance, this is less of an issue for CO carriers since they operate a fixed network in which the vehicles are scheduled according to a predetermined plan.

In fact, the empty-miles percentage is one of the metrics by which truckload companies are measured. For example, the empty-miles percentage of Werner Enterprises, the fourth-largest truckload carrier in the United States, ranged from 11.4 percent to 13.5 percent over the five-year period of 2006 to 2010, with the lowest figure for 2010 as the economy in the United States was coming out of the recession. The largest truckload carrier, Swift

costs money—a 747 freighter sitting on the ground can consume \$1,500 to \$2,000 per hour in finance charges alone, and that doesn't include the cost of a parking space at an airport or the various maintenance and inspection activities required to keep the aircraft in air-worthy condition. Idle trucks, trains and ships also accumulate costs and represent lost opportunity for revenues.

To maximize the fraction of revenue (loaded) movements, carriers need to minimize the conveyances' idle time and empty movements. Such objectives create an impetus for DO carriers to gravitate to logistics clusters. Delivering freight into a logistics cluster means that there is a high likelihood that there will be a follow-on load going out of the cluster. This is due both to the large number of logistics operators in such a cluster and to the interchange-

Johnson, described during a 2011 conference in Atlanta, how co-location helps the two companies collaborate in more efficient distribution.

Both companies have distribution centers in Fairburn, Georgia, which is part of the Atlanta logistics cluster. Both companies sell to some of the same retail chain customers. One such shared customer is CVS Caremark Corporation, the giant health, beauty and household goods retailer. CVS has a distribution center in Vero Beach, Florida, a little over 500 miles from Fairburn. Both SC Johnson and Energizer approached CVS about trying to optimize their distribution operations through collaboration and coordination between the two of them and CVS. CVS, in turn, agreed to an experiment in the Vero Beach distribution center.

The essence of the collaborative effort was to consolidate loads for more efficient transportation using DO trucking. Prior to the project, SC Johnson shipped one trailerload per week from its Fairburn distribution center to the Vero Beach CVS DC, averaging 20,000 pounds of freight per shipment with a truckload carrier. Energizer shipped an average of 9,000 pounds each week to the Vero Beach distribution center using an LTL carrier. Because both shipments could easily fit in one 40,000-lb.-capacity trailer, the companies sought to consolidate their loads and share the costs of a single truckload shipment a week, keeping the same service frequency from Fairburn to Vero Beach.

CVS agreed to modify its order system so both SC Johnson and Energizer would get the order for shipping on the same day and have a single delivery appointment at the Vero Beach DC. Once CVS releases the order, a truckload carrier picks up at the SC Johnson facility, goes to the Energizer facility next door to pick up its shipment and drives the 500 miles to deliver the combined load to the CVS facility. Naturally, the proximity of SC Johnson and Energizer in the same location in Fairburn enabled the smooth planning and execution of the new process.

The results of this collaboration created multiple improvements. Both shippers reduced their transportation costs and improved their carbon footprint. Energizer improved its on-time delivery and reduced shortages and damage by avoiding break bulk LTL operations. SC Johnson reduced its transportation costs without affecting its

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Transportation, reported 13.24 percent in 2009 and 12.1 percent in 2010, as the economy improved. Private fleets—those owned by shippers and typically dedicated to that shipper's operations—report empty-miles figures that are typically twice those of common carriers such as Werner and Swift because private fleets only transport that single shipper's loads and thus have fewer reloading opportunities.

Empty miles for motor carriers in Europe are significantly higher. An estimated 25 percent of all freight vehicles in Europe run empty and over 50 percent run with only partial loads. Some of this is the result of structural flow imbalances, while the rest may be attributed to inefficient operations. The high percentage of empty miles in Europe is becoming a focus of green efforts to reduce the carbon footprint of trucking operations.

Of course, instead of moving empty, a conveyance can wait after delivery until another load materializes in the destination area. An idle conveyance, however, also

able nature of freight flows.

In addition, DO carriers, like truckload motor carriers, also need terminals, but unlike LTL carriers, these are not consolidation terminals but operational bases for maintenance and driver domiciles.

Locating such bases in a logistics cluster, which is served frequently by the carrier's vehicles, makes economic sense. Doing so, however, means that trucks have to be routed to the cluster location every so often, increasing the availability of trucks in the cluster and, in some cases, lowering inbound and outbound rates.

Horizontal Collaboration to Share a Conveyance

SC Johnson & Son Inc. is a manufacturer of home cleaning, pest control, air care, home storage, and auto care products, with annual sales of \$9bn. The Energizer Battery Company is the largest manufacturer of batteries in the United States, with more than \$4bn in sales. Michael Murphy, director of customer supply chain for SC

customer service. CVS also enjoyed positive impacts, including more predictable lead time and increased inbound dock efficiency resulting from the reduced number of inbound trucks.

The pilot program was so successful that SC Johnson then expanded the program to collaborate with other manufacturers located near its distribution centers in Georgia and Pennsylvania for deliveries to CVS distribution centers in the Southeast and Northeast of the United States. It was also expected to launch collaborative efforts with more manufacturers and more retailers.

Other companies in other clusters have similar initiatives. Over lunch in a garden restaurant in Rotterdam, Patrick Haex and Rene Buck of Buck Consultants International (BCI) shared with me the example of three Scandinavian companies in the forest and paper products business. Stora Enso, Norske Skog, and UPM consolidated their inbound flows on a single, dedicated, short sea-lane vessel. The vessel picks up inbound material in Sweden and Finland for delivery on a biweekly schedule into the Antwerp port and logistics cluster, where the three companies have distribution centers. By collaborating, the companies reduced their transportation and handling costs, and improved service through more frequent and reliable replenishments of the Antwerp distribution centers.

In another European example described by BCI, two tire manufacturers, Bridgestone and Continental, decided to co-manage their outbound distribution in order to better compete with Michelin, the market leader. To this end, the companies built an "H-shaped" joint regional distribution center outside Orleans, France, with each company occupying one side of the H. They used the middle bar of the H to stage and handle the combined outbound shipments. The collaborative DC operation resulted in lower costs and more frequent service to the dealers than would have been possible with each company operating independently.

A small Belgian company called Tri-Vizor bills itself as "the world's first orchestrator of horizontal collaboration." Its value proposition is to facilitate such "car pools for cargo." Its first project was to coordinate the shipments of two healthcare manufacturers: Baxter International and UCB Healthcare. In a fashion similar to the collaboration between SC Johnson and Energizer, the two pharma-

ceutical companies combined their TL and LTL shipments from Belgium to Romania into a single shipment to the Genk rail yard and from there onto a train to Oradea, Romania, from which the shipments were distributed to various Romanian cities.

The bigger a logistics cluster gets, with more shippers sending and receiving shipments to and from more places, the higher the likelihood and greater the ease of shipper-shipper ("horizontal") collaborations.

Shipment Properties: Intermingling Heavy and Light

Look inside a shipping container, an air freighter, or a fully loaded truck operating in a DO mode, and you might be surprised to see that it's half empty. Dense freight causes the conveyance to "weigh-out," while light objects typically cause the conveyance to "cube-out."

This dual definition of capacity creates another type of conveyance-sharing opportunity in a logistics cluster based on intermingling diverse types of cargo—some from distributors of dense goods and other cargo from distributors of light goods. Naturally, this can be economical only when the two types of freight share proximity of origins and proximity of destination, as is likely to happen in a movement from, to, and between logistics clusters.

This type of opportunity is more than theoretical. Patrick Haex and Rene Buck recounted several case studies concerning pairs of Dutch shippers that consolidate heavy bottles of canned goods with lightweight paper products. Specifically they mentioned Hero Netherland B.V., a beverages and packaged food company, collaborating with SCA Packaging in joint transport. Hero has dense and heavy shipments, while SCA's shipments are light and loose. Together, the combined shipments can simultaneously meet the weight and volume capacity of the conveyances for maximum efficiency.

The example of Caladero [Ed. note: as described in Ch. 1 of the book] mixing heavy pallets of fish with fluffy mohair yarn also falls into this category. As the diversity of customers increases in a cluster, the variety of cargoes increases, too, leading to more opportunities like this.

The Advantage of Multiple Carriers

One of the advantages of any industrial cluster is that it induces suppliers to locate close to their customers. The availability of

large volumes of freight in logistics clusters leads transportation carriers to serve the cluster and even locate operations centers and terminals there. The presence of 400 trucking companies in Memphis attests to carriers' desire to locate operations where they can find freight.

In Aragón, the number of commercial trucks registered increased from 7,529 in 2002 to 19,557 in 2007, as the PLAZA logistics park and the other, smaller parks developed and shippers moved into the Aragón cluster, attracting motor carriers to the area.

The presence of many transportation carriers in a cluster leads to a wide range of services, as well as to competitive and stable pricing. Both of these factors improve with the size of a cluster.

Increased Reach and Scope

As more shippers move into a cluster, more carriers join them to offer a variety of transportation services. In order to create some differentiation and serve their customers better, these transportation companies frequently offer new services as they come in, be it service to new destinations that were not served from the cluster before, nonstop service to destinations that formerly required going through a consolidation hub, or new types of services, such as temperature-controlled transportation and hazardous material transportation.

Every new service offered by logistics providers in a cluster immediately increases the range of services available to all existing shippers and logistics service providers in that cluster. Shippers can then leverage the new logistics services to offer new or improved service to their customers. A growing range of logistics services enables a growing range of shipper services and performance levels.

Competitive Transportation Offerings

Having a large number of transportation carriers serving a cluster increases competition among them, leading to lower prices to and from the cluster. Competition among transportation carriers in logistics clusters is stronger compared to competition among suppliers in other types of economic clusters, because of the minimal differentiation between transportation service providers.

But the competition is not limited to services offered between carriers of the same mode and similar types of services and equipment. It also takes place between

modes of transportation. While walking me through his hot and noisy steel plant, its floors covered with fine steel dust, Thad Solomon, general manager of NUCOR's plant in Memphis, explained the cost advantages of the Memphis cluster. These cost advantages arose, he said, because "we have options, we have competition, and it allows us to reach farther out there." Both the multiple modes (barge, rail and truck) and the very large number of carriers create a basis for cost-competitive transportation. "So that component of access to transportation and access to competitive logistics was absolutely key to our decision to come here," Solomon said.

Similarly, Cargill's international business development manager, Jon Thompson, and its commercial operations manager, Jeffrey Rott, explained the value of a multimodal location when they said that Cargill's plant in Memphis was built there because of access to both rail and river transportation. Cargill brings in corn to its Memphis plant, about half by rail and half by barge, while shipping sweetener and other corn byproducts two-thirds by rail and one-third by truck, with a small amount sent on specially designed barges. These amounts fluctuate so that Cargill can achieve the best combination of cost and service under all conditions. "Sometimes the river is cheaper and sometimes the rail is cheaper. This plant cannot survive on 100 percent of either one," Thompson told me.

A related argument comes into play with facilities and conveyances that are specialized in a certain type of operation but can also be used for another. Consider, for example "cold chains." Whereas most freight tolerates a wide range of temperatures, some freight requires more careful handling. Caladero's fish shipments that were described in Chapter 1 exemplify cold chain operations: supply chain operations at low, carefully controlled temperatures. Specialized transportation and storage services can provide anything from controlled room temperatures (not-too-hot and not-too-cold), refrigerated (i.e., 2–8°C), frozen (–20 °C) to deep frozen (e.g., –80°C). Such cold chains are used for fresh foods, temperature-sensitive pharmaceuticals, flowers, deep-frozen foods, and even deep-frozen lab-grown human tissue. In the Netherlands, Venlo Fresh Park has 130 companies specializing in handling fruit, vegetables, and ornamental plants with nearby

cold chain connections to highways, rail, airports and the Rotterdam seaport. Both Singapore's Air Logistics Park (ALPS) and UPS Supply Chain Solutions Inc. healthcare facilities in Louisville offer five temperature zones of handling.

The flexibility associated with cold-chain logistics comes from being able to use some of the same assets and handling equipment found on the non-cold chain side of logistics. For example, the same truckload carrier that brings in a refrigerated load of frozen food can leave with a load of computers, with the trailer's refrigeration unit turned off. For the carrier, this is better than having to drive empty or wait for

materials and manufacturing technologies used to make these surgical supplies, each kit costs upward of \$120,000, and most hospitals do not keep them on hand.

Instead, the hospital orders a kit and Medtronic puts it on a FedEx plane on Tuesday night. The kit arrives at the hospital on Wednesday morning, gets inspected, and is sent to the operating theater. Once the operation is over, the hospital repackages the kit and airfreights it back to Memphis the same day or the next day. Medtronic inspects the kit, cleans it, replenishes the used parts and sterilizes the kit for the next use. Furthermore, in the event of an emergency surgery, Medtronic sends the kit

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— Thad Solomon of NUCOR

another frozen food load that may take a long time to materialize. From the shippers' point of view, this increases the competition among carriers serving a logistics cluster even beyond the commonality of their equipment and technology to include related assets and operations.

Flexibility Through Multimodal Operations

Logistics operations use more than a single mode of transportation, depending on service requirements, to optimize costs—and sometimes more than just costs. Consider, for example, Medtronic's distribution operation in Memphis, outlined to me by Rob Varner, senior director of Medtronic's North America distribution operations.

When a surgical team in Boston prepares for a prescheduled spine operation on Thursday, the hospital orders a spinal kit from Medtronic on Tuesday. Although CAT scans help the surgeon plan the surgery, the surgeon wants to be ready for whatever he or she finds during the operation. To get all the parts and tools needed, the surgeon needs a full kit filled with all manner of plates, rods, odd-shaped brackets, and screws in a range of sizes of parts. Because of the advanced

using next-flight-out (NFO) service, mostly via Delta Airlines, which has a passenger hub in Memphis. With NFO service, a courier delivers the kit to the airline counter in Memphis, and the airline then takes the kit onto the next flight to the destination city, where the courier delivers it directly to the hospital. Depending on flight schedules, such shipments can take only a few hours from order to delivery.

Thus the availability of both FedEx and Delta Airlines hub operations in Memphis allows Medtronic to offer both standard and emergency service from its Memphis distribution center. The significant presence of competing carriers in Memphis, such as UPS and other passenger airlines, means that the dominant transportation service providers have to keep their rates and services competitive.

As a cluster grows, it attracts carriers from different modes of transportation and different service levels. Each mode and service offers a different combination of cost, hauling capacity, travel time, service reliability, and reach. Having several modes of transportation increases the flexibility of shippers in the logistics cluster to adjust to various requirements and economic condi-

tions. It also allows them to serve customers efficiently with different service requirements and different price sensitivities. Time-sensitive goods (such as critical repair parts, emergency medical supplies, documents, and high-value goods) often go by air while less time-sensitive shipments may go by truck or even rail—depending on the distance and shipment size involved.

All logistics parks as well as regional and national economic development agencies have brochures that promote the benefits of multimodal operations by citing distances to major highways, rail terminals,

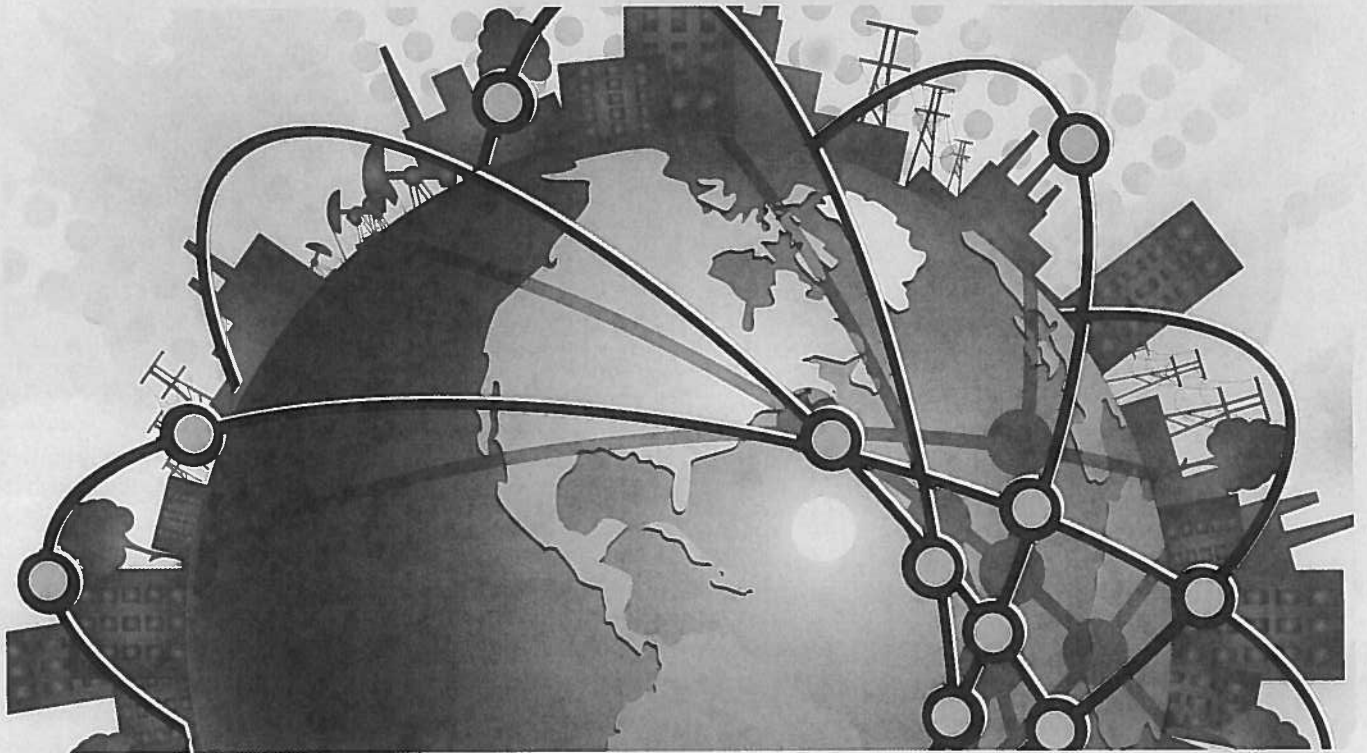
FedEx, because they can go anywhere absolutely positively overnight. Once they get here, everything doesn't need to be there overnight so they may use [LTL motor carrier] American Freightways, they may use [parcel carrier] UPS Ground, or they may use [TL carrier] Swift."

Liquidity Leads to Price Stability

During a group discussion in the futuristic Accenture office in Singapore, Eelco Hoekstra, president of Royal Vopak, described a cluster's ability to smooth volatility in terms of liquidity in the local

with the highs and the lows canceling each other.

Naturally, liquidity is driven, in part, from the commodities traded. "Singapore has developed as a price center for oil product," Hoekstra added, and he then summed it up: "I think that's why Singapore works—you see that once it has liquidity, it attracts more because of price setting." The same holds true for oil in Rotterdam and Houston as well as other commodities in certain locations around the world—the price setting attracts flow, bringing in both demand and supply for transportation.



ports and airports. Clusters offering three co-located modes (air, truck and rail) include Zaragoza in Spain and Alliance-Texas. Memphis prides itself on being quadramodal (air, truck, rail and barge). Rotterdam offers five modes (ocean, barge, rail, truck and pipelines) and a sixth mode of air if you count the large air cargo hub in Amsterdam's Schiphol only 20 miles to the north. A cluster might be renowned for one mode (e.g., air express in Memphis or Louisville), but the presence of other modes provides added options and economies for shippers.

At their Memphis headquarters, I interviewed Neely Mallory, president of Mallory Alexander International Logistics, and fourth generation of the Mallory family heading the company. He told me, "My theory on it is they come here because of

logistics market. Liquidity in this context is defined by the ready availability of conveyances for shippers and the ready availability of freight for carriers. As with any market, liquidity helps bring price stability. "With this liquidity, which is important, you get price-setting, because the more volume you bring into a market, the better supply and demand work, the more stable the price," explained Hoekstra. Non-cluster locations and small hubs will have higher volatility in freight volumes and conveyance availability, which leads to price volatility. In contrast, a large hub with many diverse flows of freight and many competing carriers will, in general, offer more stable prices as a result of the so-called "risk pooling" effect—while some shippers' requirements may be high on a particular day, others' may be lower,

While certain commodity flow leads to liquidity both in the underlying commodity price and the resulting transportation demand/supply balance, large clusters enjoy transportation liquidity even without serving as a hub for specific commodity trading. The ubiquitous nature of transportation means that the size of the transportation activity alone is likely to lead to liquidity in the demand for and supply of transportation services, and therefore to price stability. Such stability allows both shippers and carriers to plan their activities with more certainty.

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