Integrated Logistics Centers

Experience from North America and Options for China

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China's shift toward accelerated economic growth in central and western provinces and increasing levels of personal income and consumption are all consistent with the need for rail-enabled Integrated Logistics Centers (ILCs). Yet, while hundreds of logistics clusters have been developed in China over the past few years, modern, international standard rail- and multimodal-transport enabled ILCs are less common. Close, long-term collaboration between public sector authorities and private sector specialized firms, such as real estate developers, have proven effective in the development of North America's focused network of ILCs critical to facilitating transcontinental and other freight itineraries. This model can succeed in China as well.

Integrated Logistics Centers (ILCs)—well-connected clusters of multimodal transport, logistics, light assembly, manufacturing, and supporting services—play an increasingly important role in the logistics networks of North America and Western Europe. In the particular case of the U.S. logistics system, the most comparable to China based on lengths of haul, ILCs have facilitated "mini land bridge" (i.e., transcontinental) and other domestic and international long-haul containerized shipments supported by the country's rail intermodal network.[1] This has allowed shippers and logistics service providers to operate extended supply chains more efficiently, despite the increased operational complexity posed by longer distances, multiple modes, and several cargo hand-off points. But the role ILCs have played goes well beyond reducing logistics costs for firms. North American ILCs have become strategic tools for local and state governments to generate employment, stimulate economic activity, strengthen regional competitiveness, reduce urban congestion, and, critically, leverage limited public sector capital expenditures through public-private partnerships.

While logistics parks have proliferated in China at breakneck speed over recent years, true ILCs are less common, and in fact the likely over-supply of logistics parks at present may reduce ILCs' potential in the country. According to the China Federation of Logistics and Purchasing (CFLP), the number of logistics parks, loosely defined, in China—whether in the planning stage, under construction or fully operational—grew at an average annual rate of 24 percent between 2006 and 2012. That is approximately two and a half times the rate of growth of the overall Chinese economy during the same period. By June 2012 there reportedly were 754 logistics parks in China, approximately half of which operational, about a third under construction, and the rest in the planning and design phase. The challenge is that, according to trade journal reports,[2] the performance of many such parks is constrained in practice by a lack of capable logistics service providers and insufficient availability of basic infrastructure, such as utility (power, sewage, water) and telecommunication services. The sheer number of logistics parks being built casts doubt over the

[1] The term "rail intermodal" refers to the movement of containerized cargo from origin to destination where a portion of the journey takes place on rail. The U.S. rail intermodal network comprises the rail tracks, rolling stock, rail terminals, and cargo handling equipment used to transport containerized cargo (whether in containers or trailers) throughout the country, typically over long distances (e.g., 700 miles or longer).

[2] Geng (2008).

robustness of the economic, financial, and technical appraisals underpinning them (the presence of multiple, likely overlapping facilities within the same conurbation is reportedly not uncommon). And the fragmentation of logistics facilities negates one of the key advantages of logistics parks in general and ILCs in particular: economies of agglomeration. As Chen and Lee (2013) note, "many Chinese logistics parks were built in a rush, without sufficient justification and with no definitive objectives [. . .] the value of current logistics parks in China needs to be reevaluated."

This note will argue that China could substantially benefit from developing a focused network of well-planned, economically justified, financially viable, and carefully implemented ILCs supported by rail intermodal operations. Such a network could become a facilitator of manufacturing and services activity in China's rapidly-growing western provinces. The note will first define ILCs in the context of myriad similar terms in logistics. It will then describe the nature of agglomeration economies made possible by ILCs. It will then share the experience and lessons learned in public policy from two of the most successful ILCs in North America: the CenterPoint Intermodal Centers near Chicago, Illinois; and the AllianceTexas development near Fort Worth, Texas. Last, the note will derive implications for China.

Key Definitions

Logistics as a discipline is ripe with technical jargon that all too often obscures points without necessarily adding analytical value to decision making; the agglomeration of containerized logistics activities is a case in point. The terms logistics village, logistics park, logistics cluster, logistics platform, logistics center, dry port, inland port, inland container depot (ICD), container freight station (CFS), and consolidation/deconsolidation center all refer to the agglomeration of a given set of logistics activities at a particular, well-defined location. And while there may be technical differences between these terms, it can be argued that these differences exist, primarily, at the margin. From a policymaking point of view, these terms refer, fundamentally, to the physical organization of logistics activities where co-location of—and collaboration among—complementary activities creates value. In this vein, the key distinction between logistics clusters is the extent of this co-location ("agglomeration") along the dimensions of multimodal transport connectivity, infra- and supra-structures to facilitate logistics services, and availability of human and technical (e.g., information technology) resources. For the purposes of this note, an ILC will be understood as an agglomeration of containerized logistics activities where the extent of activity co-location is *substantial and comprehensive* rather than limited.

The ready availability of multimodal transport connectivity is the most critical component of any cluster of logistics activities. In particular, successful North American ILCs are *anchored* by one or more rail intermodal terminals, supported by access to national and regional highways and the presence, with varying degrees of proximity, of one or more airports. In this context, "ready availability" of multimodal transport alludes to the fact that congestion, whether in highways or on rail, must be avoided or kept to a minimum for an ILC to become attractive. As a result, successful ILCs tend to be located in suburban locations, close enough to large conurbations so that these may act as natural volume-generating hinterlands but away from the congested access arteries to major cities.

The presence of multimodal transport connectivity enables an ecosystem of logistics activities that allow ILCs to bring together an integrated—in other words, comprehensive—set of services and logistics solutions. The latter include asset-based trucking, air, and rail

transport services;[3] freight forwarding and other non-asset based transportation services; dedicated and multi-tenant warehousing and distribution facilities; consolidation-deconsolidation facilities and container freight stations; light manufacturing and other industrial facilities; financial, insurance, and managerial office space; container storage, repair and scrapping facilities; chassis pools; and other support services.

Why Agglomeration Creates Value in Logistics

There is a vast literature in economics and management that demonstrates the advantages generated by industrial clusters (e.g., Silicon Valley in software);[4] logistics clusters are no different. According to Sheffi (2013), logistics clusters generate value[5] through (a) transportation-related operational advantages; and (b) inter-firm collaboration in the form of asset sharing. Sheffi observes that the agglomeration of transportation activities in a logistics cluster results in economies of scope, scale, density, and frequency, as follows:

a. *Economies of Scope* are generated from the directionally balanced nature of freight flows moving in and out of the cluster, which reduces the cost of transportation service provision. Non-clustered, fragmented logistics operations are typically characterized by imbalanced flows between headhaul and backhaul lanes. This forces carriers to incur high rates of empty ("deadhead") or low-load-factor moves in backhauls, which generate little or no revenue and therefore reduce operating efficiency. As the number of firms located in the cluster grows, increasing cluster density, the cluster's multi-directional freight generation potential rises and the incidence of economies of scope increases.

b. *Economies of Scale* arise from the larger freight volumes that a logistics cluster can generate relative to non-clustered operations. Larger volumes result in higher load factors, the use of larger transport units (e.g., larger -trailers, unit trains, vessels, and the like), and a higher incidence of direct point-to-point service, all of which reduce the cost of transportation service provision—including environmental externalities—per ton-kilometer transported. This may also result in further reductions in overall logistics costs for shippers via lower inventory carrying costs.

c. *Economies of Density* result from the agglomeration of freight-generating firms in close physical proximity, which reduces the cost of first- and last-mile consolidated logistics, such as the provision of less-than-truckload (LTL) services.[6]

d. *Economies of Frequency*, like those of density, also apply to consolidated (or less-than-full-load) logistics operations, whereby the presence of numerous freight-generating entities in a cluster will be able to fill a specific transport unit load (say, a marine container) more frequently by pooling their freight. This can

[3] "Asset-based" transport services are provided by firms that generally own (or lease) the underlying transportation assets used to move freight—such as trucks, aircraft, or rail tracks. This is in contrast with "non-asset based" transport services, which are provided by firms that generally do not own (or lease) transport assets, and instead act as intermediaries between shippers and asset-based transportation carriers. In North America, non-asset based logistics service providers play critical facilitating and strategic roles in the daily functioning of supply chains, and include, for example, freight forwarders and truck brokers.

[4] See, for example, Porter (1998).

[5] For the purposes of this note, the term "value" denotes both *enterprise value* at the firm level (typically measured by such metrics as returned on capital employed), and *economic value* (typically measured by such metrics as economic internal rate of return) at the local, regional, and national level.

[6] Consolidated logistics, such as less-than-truckload and less-than-containerload shipments, refer to the aggregation ("consolidation") of cargo belonging to multiple shippers into a single unit load, such as a truckload or a container, instead of the unit load being fully allocated to a single shipper. The co-location of multiple freight-generating firms (such as manufacturers) that may share unit loads reduces the cost of providing consolidated services, as it increases load factors and facilitates pickup and delivery over the "last mile".

shave days out of supply chain cycles by preventing individual firms from having to wait until enough freight is generated on their own to fill a given unit load before commencing transportation.

The sharing of high-fixed cost physical assets and other valuable resources, such as human resources, is a fifth value-creation advantage of logistics clusters. This can be referred to as the generation of *Economies of Co-location*. For example, logistics clusters facilitate the optimal allocation of transportation capacity (say, airfreight carrying capacity) among carriers or third-party logistics service providers (3PLs) when they are co-located. If a carrier has spare capacity, it can make it available to a competing carrier in need of capacity at the same location, capacity that would have otherwise moved empty (and therefore been lost) in a non-clustered setting. Similarly, clusters facilitate the sharing of labor resources, such as qualified warehousing and cargo handling staff, either through staffing agencies acting as middleman between service providers or organized by the service providers themselves. All these cases result in better capacity utilization, higher return on capital employed, and value creation.

Given that the above advantages build on and increase with scale, more integrated (i.e., more comprehensive) logistics clusters—such as ILCs—are more conducive to generating operational and resource utilization efficiencies than less integrated clusters. This is the primary distinction between ILCs and other clusters, as the latter may lack one or more critical elements of transport infrastructure (e.g., rail connectivity) and/or service provision.

Developing ILCs in Practice

CenterPoint Intermodal Centers Elwood-Joliet (CIC) and AllianceTexas (AT) are the two most important ILCs in North America. Both ILCs share many of the definitional characteristics outlined above: they are anchored by two rail intermodal terminals operated by the Class 1 railroads BNSF and Union Pacific;[7] they have ready access to major east-west and north-south highways; they are in close proximity to large airports (in the case of AT, the cluster itself houses an airport); they are home to an extended, densely arranged ecosystem of warehousing, distribution, manufacturing, and service facilities; they are located in suburban locations that are both close to major freight-generating hinterlands and well located relative to their broader regional and national connectivity; and they both play a key role in the rail intermodal, long-haul supply chains that have been essential to the everyday functioning of the U.S. economy over the past 15 years.

By 2012, for example, CIC had become the largest inland port in the U.S. and the country's third largest port of any kind (including all maritime ports—only Los Angeles/Long Beach and New York/New Jersey were larger), with annual handling volumes of 3.1 million TEUs and a potential capacity of up to 6 million TEUs. AT, however, was the pioneer ILC of North America. Developed in the late 1980s and now considered "the grandfather of U.S. inland ports,"[8] AT is a 6,800-hectare master-planned site with approximately 3 million square meters of developed mixed-use properties as of year-end 2012. Indeed, when developing its CIC intermodal terminal, BNSF used the carrier's AT facility as prototype.

Beyond the service delivery and operational similarities shared by CIC and AT, both ILCs were planned and developed in ways that ultimately led to their current success. The key elements of this development experience are as follows:[9]

[7] In North America, Class 1 railroads are the largest railway operators by revenue. Currently, a total of 7 North American railway operators are classified as Class 1.

[8] Jones Lang LaSalle (2011).

[9] This section builds heavily from Envision Freight (2011) and Steele et al. (2011). The reader is referred to these sources for a detailed, chronological account of how CIC and AT were developed.

a. *They are Public-Private Partnerships (PPPs).* Both CIC and AT were conceived of and planned jointly by a public sector authority and a private sector real estate developer. Once operational, everyday management of the center was the responsibility of the developer, while the public authority regulated service delivery and approved further development plans. At CIC, for example, the Illinois state government established the Joliet Arsenal Development Authority (JADA) in 1995 to plan the development of the land now occupied by the logistics center. JADA produced a Strategic Plan for the development of this land and sold the land to private developers—originally to a company called Transport Development Group, which later sold the property to CenterPoint, the current owner and developer of the site. In AT's case, the site was planned and implemented as a joint effort between the City of Fort Worth, Texas, the Federal Aviation Administration (FAA), and Hillwood, a private real estate developer. The developers' technical specialization, market orientation, and shareholder value creation mandate were and continue to be a primary driver of success for the sites: such attributes, which public sector authorities generally lack, reduce the risk of building redundant facilities in crowded markets and prevent policy making based on choosing 'winners'. Public sector authorities, on the other hand, play critical roles of their own in integrating ILCs into the broader community, industrial, and urban fabric surrounding these facilities.

b. *Their development required substantial collaboration among public sector entities and consultations with local communities*. It is estimated that CenterPoint, the developer of CIC, directly worked with 50 national, state, and local government agencies over the course of developing this project. This included agreements, inter alia, to (a) demolish existing structures at the target site; (b) donate land to minimize the center's impact on nearby residential and environmentally protected areas; (c) issue a "flexible zoning" designation for the site to allow both manufacturing and distribution activities within it; and (d) provide CenterPoint with tax incentives for development of the land. In all, planning and approving the development of CIC took approximately five years.

c. *The PPP structure of these sites resulted in the mobilization of substantial private sector funding compared to a relatively modest provision of public sector funds*. In the case of AT, for example, approximately US$160 million in public sector contributions were required to develop the site during the early stages of planning and construction (1986-1989). On its part, Hillwood contributed the acquisition of land, financed and conducted project design and preparation, and was responsible for marketing and business development activities. Between 1989 and 1995, however, as tenants (shippers and logistics service providers) began to establish a presence at AT, the investment contribution from these private entities reached US$1.25 billion, dwarfing the initial investment by public agencies. By year-end 2012, public sector investment accounted for only 5.4 percent of the US$7.7 billion in cumulative investments at AT since inception.

d. *Among the objectives pursued by the establishment of these centers, public sector aims were as important as—and highly complementary of—private sector aims.* For example, in the case of CIC, JADA was created by the state government of Illinois with the explicit goal of generating private sector jobs and boosting tax revenues. As for AT, the FAA was interested in relieving congestion at Dallas-Fort Worth International Airport (DFW) by developing a general aviation and freight-focused airport in the vicinity of DFW. Similarly, the City of Fort Worth was interested in promoting local and regional economic growth.

e. *While small compared to the size of private sector investments over time, initial public sector capital expenditure contributions were critical to the early stages of development*. During the planning phase of CIC, the project obtained funding from the Illinois Department of

Commerce and Community Affairs (DCCA) to replace the site's water and sewage system. DCCA, in conjunction with the Illinois Department of Transport (IDOT), also financed improvements to the site's access roads. At AT, the Texas state government provided US$30 million in funding for improvements to state roads; the City of Fort Worth contributed US$45 million towards the construction of local roads and basic utility infrastructure (water, sewage, gas, and power); and the FAA contributed US$85 million towards the construction of Alliance airport. The timely and well-coordinated provision of such basic infrastructure proved critical to the development of the sites and their ability to facilitate multimodal connectivity and reliable logistics services.

f. *Government oversight of the sites has been an important component of their operational effectiveness.* There is no doubt that the ability of these ILCs to capture increasing volumes of freight and logistics activity results from the specialized, best-in-class operations of asset-based carriers (such as Class 1 railroads) and non-asset based logistics services providers (such as global freight forwarders and other 3PLs) located at the sites. But government oversight has been a critical facilitator of this in the background. At CIC, JADA developed a transportation plan to address increasing concerns of congestion risk in and around the cluster. First developed in 2004 and later updated in 2010, the plan brought together numerous local stakeholders under the JADA Study Oversight Committee (SOC), which facilitated decision making. The plan recommended a shortlist of transportation projects to alleviate congestion and called for the creation of a public entity to promote and coordinate the implementation of these projects.

g. *The economic impact of these sites eventually became enormous*. According to Hillwood,[10] by year-end 2012 AT had generated approximately US$43 billion in business sales and paid slightly more than US$1 billion in cumulative property taxes since inception. In 2012 alone the cluster reached annual sales of US$3 billion, paid US$22 million in taxes, and directly employed 35,000 people. Meanwhile, by the same year CIC had generated US$2 billion in investments since inception, approximately 90 percent of which provided by private sector sources, and housed 1 million square meters of industrial facilities.[11]

Implications for China

From an economic geography point of view, China's transportation network is closest to that of North America, suggesting that the same principles that made ILCs successful in the latter can work in China as well. As economic activity is progressively transferred from China's eastern seaboard towards western provinces—a result of not only labor cost pressure in large eastern cities but also explicit government policies to support this shift—the long-distance supply chains that this is generating could increasingly rely on rail-enabled ILCs, while being less reliant on the mono-modal or single-commodity focused logistics parks that appear to be the norm at present.

CRIntermodal, the rail intermodal arm of China Railway Corporation (CRC),[12] has had some success in developing rail-enabled logistics centers. CRIntermodal has announced plans to build and operate a network of 18 intermodal terminals across China. Nine of these terminals are currently in operation at the key logistics markets of Shanghai, Chongqing, Chengdu, Wuhan, Xi'an, Qingdao, Dalian, Zhengzhou, and Kunming. All of these terminals, as built, have elements of ILCs. For example, in Chongqing, a market that has attracted sizable investments by major multinational manufacturers like Foxconn

[10] AllianceTexas (2013).

[11] CenterPoint Properties (2013).

[12] CRIntermodal is a joint venture between China Railway Container Transport Co., a subsidiary of CRC; NWS Holdings; China International Marine Containers (CIMC); Luck Glory; and DBML, a subsidiary of Deutsche Bahn.

and Hewlett-Packard, CRIntermodal's terminal is equipped with a unit-train capable, 850-meter long loading/unloading terminal and is strategically located in the vicinity of several logistics and industrial parks, as well as major highways. Similar setups have been implemented at the other operational terminals, although limited data on the terminals' actual performance (e.g., freight volumes, productivity metrics, regional economic impact, and the like) are not yet available.

The extent to which the development of CRIntermodal terminals was planned in consensus with local, provincial, and national government agencies, with a focus on joint operational planning, and in collaboration with nearby existing logistics parks, is less clear. It would be beneficial for CRIntermodal and government agencies at the relevant levels to work together towards maximizing the impact of the CRIntermodal terminals, particularly for those currently at the planning stage. This can result in better multimodal connectivity at the terminals and a more robust resolution of conflicting uses of land. The creation of authorities tasked with overseeing, planning, and regulating the intermodal terminals and their hinterland can be an effective way of promoting the development of the ecosystem of infrastructure and services that can turn isolated assets—such as a rail intermodal terminal—into integrated logistics centers.

Perhaps the most important lesson from North America applicable to China is the use of privately-held, specialized real estate developers—overseen and regulated by a designated public authority with aligned goals—to develop and manage future ILCs. These developers can be the mechanism by which limited public sector funds can be leveraged into substantial private sector investment. They can also facilitate the task of attracting "flagship" shippers and logistics service providers to the cluster. International experience, not least in North America, has shown that once 1 or 2 critical tenants join the cluster, others quickly follow. In the case of AT, for example, once Nokia, the cellular phone manufacturer, decided early on to invest in a distribution center at AT in 1994, several supporting companies followed. Securing Nokia's commitment, however, required a concerted marketing and business development effort on the part of Hillwood, the real estate developer. Private sector participation is also more likely to result in adequate financial and economic appraisals in support of the planning and development of ILCs on the basis of cargo volume expectations rather than supply-driven considerations.

ILCs should be seen as strategic nodes in the logistics network—not to be confused with the more limited clustering extent of more traditional "logistics parks"—and managed accordingly. China has so far developed hundreds of logistics parks, although the true capabilities and economic viability of these is not well known. Not all logistics parks can or should be ILCs. In the U.S., for example, it is estimated that there are fewer than 12 full-fledged ILCs. Local, provincial, and national governments in China should coordinate their efforts towards managing viable existing clusters as ILCs or developing future ones on the basis of PPPs, ideally headed by specialized developers. CRIntermodal could then be an *anchor tenant* of some or all such centers.

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This note is part of the China Transport Note Series to share experience about the transformation of the Chinese transport sector. For comments, please contact Luis Blancas (lblancas@worldbank.org) or Gerald Ollivier (gollivier@worldbank.org).