Journal of Transport Geography 51 (2016) 130–139

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo

Supply chain integration, landside operations and port accessibility in metropolitan Chicago

Christopher Clott [a], Bruce C. Hartman [b,*]

[a] SUNY Maritime College, New York, NY, United States

[b] College of Business and Health Administration, Intermodal Transportation Institute, University of St. Francis, Joliet, IL 60435, United States

ARTICLE INFO

Article history:
Received 21 November 2014
Received in revised form 6 December 2015
Accepted 13 December 2015
Available online xxxx

Keywords:
Urban freight corridors
Intermodal transport
Supply chain integration
Public–private collaboration

ABSTRACT

Seaports have traditionally been the focus of maritime logistics supply chains. Changing production patterns demanding greater end to end visibility by customers and accessibility to key inland population centers assume greater importance in the organization and design of transport resources and cargo flows. While synchronization of all aspects of the supply chain has become an operational necessity for firms, it is often held hostage to the efficiency of hinterland networks who must respond to a large group of stakeholders with sporadic coordination. This is particularly true when looking at the central US city and region of Chicago, a critical intermodal exchange point for truck, air and river barge traffic domestic and global, as well as a major central distribution location. This paper analyzes supply chain integration (SCI) efforts in the metropolitan Chicago region and considers efforts by public and private actors to collaborate for region-wide SCI improvements. Pareto analysis suggests that concentrated freight corridors exist, influencing freight planning for regional transportation networks more directly than diffused regional freight movements. If the corridor service becomes less responsive or congested the corridor will move to different end nodes within the broad region. Regional planning must thus address national, regional, and local moves. Private/public sector infrastructure firms should address functional cooperation on SCI by focusing on corridors as well as local improvements.

1. Introduction

Freight transport is a complex industry, as supply chains lengthen across countries, seas and continents. Rapidly growing world trade pursuing economies of scale led to the introduction of mega-container vessels with 12–19,000 TEU capacity, straining infrastructure of major maritime gateways and putting pressure on key intermodal connections to the hinterland. Effective management of supply chains to and from major inland ports has become a key factor differentiating product and service offerings and gaining accessibility to global customers for competitive advantage.

Developing an efficient inland terminal network is critically important when pursuing economies of scale, to get adequate road, rail and waterway transport to regional markets. The presence of required infrastructure combined with quality operations and services determines the success of international supply chains (Vanelslander and Musso, 2015). Research by Notteboom and Rodrigue (2005); Bergqvist et al. (2010); Wilmsmeier et al. (2011), and Lam and van de Voorde (2011), among others, discussed what drives intermodal development and its direction. Inland intermodal hubs can be thought of as "extended gates" for seaports to better control transport flows and adjust to match needs and conditions of their infrastructure (Van Klink, 1998). Management by ports and shipping companies of the inland supply side is necessary to ensure control over the entire chain in seeking cost and efficiency gains (Carbone and Gouvernal, 2007). Future competition among maritime supply chains will increasingly use inland transportation and inland terminal facilities as fundamental components of their strategies (Franc and Van der Horst, 2010; Joerss et al., 2015).

This study addresses questions of supply chain integration (SCI) involving intermodal port corridors, analyzing public/private efforts in the Chicago U.S. mega-region to improve infrastructure and operation. The Chicago region is the largest and most important container gateway in North America, connecting the US East Coast, West Coast, and Gulf of Mexico. Many studies have examined Chicago's major role in US freight movement but few study SCI within the region, partly because it is so large and diverse. The largest inland port in North America, its container volume throughput of 12.85 million TEU per annum exceeds Los Angeles/Long Beach and New York/New Jersey (OECD, 2012 p. 3). 46% of US intermodal movements touch Chicago, including 54% of intermodal movements to/from Seattle and Tacoma and 26% of movements to/from Los Angeles/Long Beach (Alam and Fekpe, 2013). The region has been a bottleneck for US supply chains over a long period; its infrastructure history involves internal political contention for resources (OECD, 2012). Despite its drawbacks, freight establishments in the region

* Corresponding author.
E-mail addresses: cclott@sunymaritime.edu (C. Clott), bruce@ahartman.net (B.C. Hartman).

http://dx.doi.org/10.1016/j.jtrangeo.2015.12.005
0966-6923/

continue to grow due to its high connectivity to all points via rail, road, air and water (Cidell, 2010). Chicago is both a major interchange point and a major distribution point, with access to a large portion of US population within 400 miles, making it different from most inland ports; synergies between these functions are not easily duplicated elsewhere (Esparza and Krmenec, 1996).

The movement toward lean and agile supply chains suggests that integration with key corridors cannot be ignored in planning freight movements. Our analysis identifies key freight corridors connecting Chicago using Pareto analysis. They indicate where supply chains use resources as a source of customer value and competitive advantage. Effectively operated corridors provide increased accessibility and mobility and increase logistical performance (Vieira et al., 2015; Hesse, 2013). If a corridor becomes less responsive due to congestion, its traffic will move to different end nodes (Rodrigue and Ducruet, 2013). Local moves give way to regional moves that can cross state lines. Focusing on key corridors lets us understand connections between chains and organize partnerships which might make the SCI investments needed. Such corridors often have substantial existing infrastructure investment to leverage. Corridor stakeholders are natural candidates for further partnership to create the improvements. We review in this light some efforts to improve bottlenecks impacting SCI within the Chicago freight region, and conclude with some suggestions for creating successful SCI in a region.

Section 2 discusses port development and drivers and a model of supply chain integration activity. Sections 3 and 4 study the scale, scope, and regional nature of supply chain transport to and from Chicago using Pareto analysis. In Section 5 we discuss efforts at infrastructure improvement from an SCI perspective. Section 6 concludes indicating how our approach might help regional policy makers achieve freight SCI.

2. Inland port evolution and supply chain integration

2.1. Inland port development

Notteboom and Rodrigue (2005) viewed inland port development as a combination of load centers and priority corridors where inland nodes are active in shaping the supply chain. Centrality and intermediacy of inland nodes can be affected by government policy (Ng and Gujar, 2009) and by changes in port service demand (Wilmsmeier et al., 2011). Inland port development spurred clustering of logistical activities in locations integrated with supply chain management strategies (Rodrigue et al., 2010). Monios and Wilmsmeier (2012) reasoned that space and scale of competitive development strategies can be understood by the drivers (e.g. port authority, port terminal, rail operator, public organization) and direction. High capacity inland transport corridors allow competing ports to extend their cargo base and gain competitive advantage (Bergqvist and Woxenius, 2011). More sophisticated services and/or agile manufacturing cannot happen without an efficient logistics infrastructure; this takes place at new centers of distribution, often at the urban periphery.

2.2. SCI improvement efforts

Supply chain integration can be defined as "a process of redefining and connecting entities through coordinating or sharing information and resources (Katunzi, 2011, cited in Droge et al., 2012). It creates linkages between partners who have different interests in the same supply chains, and/or who have similar interests but participate in multiple supply chains. A terminal operator could improve its drayage dispatching through scheduling, with little integration. But sharing information about schedules with other terminal operators, carriers, shippers, or port authority, to articulate traffic with other terminals, would achieve more SCI. Shared advance arrival notification, rail schedules for inland distribution, arrival times at transloaders, distributor inventory levels, and demand rates increase SCI.

Hinterland cities want economic development opportunities they believe seaports can provide through investment in their infrastructure. However, seaports cannot always influence decisions made by rail carriers or distribution centers based upon proximity to large population markets (Clott, 2014). Ocean carrier alliances also have significant legal impediments; they cannot negotiate with railroads and motor carriers at present (Clott, 2015). A focus on freight corridors offers some potential to better coordinate efforts affecting many supply chains.

Lam and van de Voorde (2011) used scenario analysis to model ocean carriers' relations with upstream partners (customers) and downstream partners (ports), classifying SCI by *function* (customer service, inventory, transportation, and order processing) and strategic *level* (strategic, tactical, and operational time horizon). Fig. 1 shows typical methods of SCI excellence sought at each level (rows m) within each function (columns n). Transportation (function 3) improvements are central to our study. Regions with service constraints, lack of value added services, or likely delays will be unable to attain required service levels for some supply chains. Accessibility to transport of the proper mode also influences service levels, and cost of location impacts both transport and service capability (Widdows, 2015; Hesse, 2013; Lam and van de Voorde, 2011).

Inventory (function 2) is important in SCI. Just-in-time policies reduced inventory at one end of the chain at the expense of the other end, leaving chains open to risk and reduced flexibility. Risk mitigation forces them to place inventory in route locations, to increase flexibility and balance the chain for risk and demand variations. Order processing improvement (function 4) is often information or IT related and not as concerned with governance or infrastructure. Ability to commit to order priorities, part of demand management, depends on sound knowledge of capabilities of the other 3 functions. Customer service (function 1) at the operational level (area 31 in the figure), is most used by liner companies who collaborate with a supply chain partner (Lam and van de Voorde, 2011). It is often information based, combining capable systems with high visibility of material in the supply chain, but requires coordination with the other three functions.

Increased use of supply chain intermediates like third party logistics (3PL) firms occurs because they provide information hubs where spot data can be processed for dynamic pricing, routing, or consolidation to facilitate markets, ordering, and customer service. Much integration can occur through information flows without reference to physical location. But logistics companies, attracted by accessibility to markets, infrastructure, labor availability, and low cost, will often cluster at corridor junctions, furthering concentration of distribution firms in an area (Notteboom and Rodrigue, 2005; Cidell, 2010). These firms exploit corridors which can meet their customers' requirements.

Setting desirable service levels is intimately connected with corridor selection. Infrastructure improvements affect transportation capability and directly impact customer service, especially at the strategic and tactical scope. They require considerable foresight to improve and are hard to change in the short run (Talley, 2014). Traditional infrastructure development and regulatory policies cannot satisfy immediate and forecasted demand levels; governmental action is often necessary to improve freight distribution (Vieira et al., 2015; Vanelslander and Musso, 2015).

3. The study area

For well over a century, the Chicago mega-region has been a railway hub and inland gateway city (Cidell, 2010). Over a billion tons of freight worth over $3 trillion moves through it each year. The Tristate Midwest area of Illinois, Indiana and Wisconsin, with $523 billion GDP, ranks 3rd in economic output in the US (OECD, 2012). Approximately one-third of US freight tonnage originates, terminates or passes through the Chicago metropolitan region (CMAP, 2012). Six of the seven Class 1 North