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Built to Last? The Changing Role of Ocean Transportation Intermediaries: Disintermediation and Reintermediation

Christopher Clott[1], Bruce C. Hartman[2], Andrew Pudelek[1]

[1]State University of New York, Maritime College, Bronx, N.Y.; [2]California State University Maritime Academy, Vallejo, CA.

Introduction

Ongoing changes in the maritime container shipping industry and the introduction of new technologies are dramatically changing the role of the ocean transportation intermediary (OTI's). Full service intermediaries can secure space with ocean carriers, offer customer transloading, consolidation, trucking, freight forwarding, customs brokerage and a range of other services that are crucial to the movement of goods. In high volume markets such as the Transpacific trade lane, the role of intermediary has grown as the liner shipping firms utilize mergers, alliances, vessel sharing agreements and mergers in an effort to remain financially viable. Approximately 42% of Transpacific moves are handled by NVOCCs at the time of this writing (Mongelluzzo, 2016). Delayed vessel calls, poorly aligned chassis supply and changing carrier alliances have provided an opening to OTI's to sell themselves as supply chain experts who help their shipper customers navigate the complexities of international shipping by providing more value added services than the liner shipping operators (Landon, 2015).

As the need for skilled intermediaries has grown, new online platforms from advanced technology firms have the potential for disintermediation- 'cutting out the middle man' from transactions for a variety of core ocean freight processes like procurement, forwarding, and supply chain visibility (Steele, 2009). This has long been predicted since the advent of the Internet but has only now reached the critical mass of advanced technology programming and large scale equity investment that will lead to a similar software revolution in logistics as has transformed other aspects of the economy. The advent of new freight technologies will most likely lead to the demise of many OTI's who are not scaled to be able to utilize the software but also possibly create the formation of new skilled intermediaries (i.e. reintermediation) that create markets and enhance value to customers through innovations to produce customized lines of supply in an increasingly complex global distribution network. For example, a data aggregator firm such as Haven http://haveninc.com/ reintermediates freight logistics as a 'fare aggregator' similar to services set up for the passenger industry such as Kayak (https://www.kayak.com/).

Keywords: Ocean Transportation, Intermediaries, Disintermediation, Reintermediation

***Correspondence to Author:**
Christopher Clott
State University of New York, Maritime College, Bronx, N.Y.

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The purpose of this study is to look at how the changes outlined above are impacting ocean freight intermediaries in the high volume Transpacific market through a study of OTI's; in particular the operations in the Chicago, Illinois transportation hub of the United States. A number of intermediaries were created in the Chicago area over the last 30 years to take advantage of changes in U.S. regulation of ocean transportation as they related to less than container load (LCL) shipments. While intermediaries are commonplace in Europe and port cities, the growth of intermodal movements, particularly to and from Asia into U.S. inland hubs such as Chicago resulted in the creation of many intermediaries to service the trade. Over the last decade there has been a winnowing out of these firms. Some have left the industry, some have merged or been acquired by larger firms and some have remained in business largely intact. We will look at overall statistics on firms in the United States area from data provided by the Federal Maritime Commission. Evidence suggests that there is a constant flow of new entrants into the marketplace as well as firms that have achieved some longevity.

In this paper we demonstrate that in the US, OTI firms locate in clusters, near to air and ocean ports, and identify the clusters via analytics. Why is this so, if advanced IT and technology, which are mostly location independent, are driving the disintermediation and reintermediation of the business? We suggest that while technology may be important there is another factor in terms of expertise that intermediaries provide that is not so well captured by technology today. What is necessary for OTI firms to survive in the new era of shipping may be more than technology, despite how new technologies will change their role in the maritime industry.

Section 2 provides some background on freight forwarding and the OTIs. Section 3 discusses two types, Ocean Freight Forwarders (OFF) and Non-Vessel Owning Common Carriers (NVOCC) and major players and introduces their technology positions. Section 4 covers the economic geography of the OTIs registered with the US Federal Maritime Commission (FMC), and uses analytic techniques to identify geographical clusters, which seem to be in ocean and airport areas. Section 5 remarks on the Chicago area as an example port area cluster, and Section 6 draws some conclusions regarding the persistence of these clusters in port areas despite technology.

Background

Freight forwarding is an occupation with roots in Europe dating to the 13th century. The "Frachter" was a key intermediary between bankers and merchants that organized the inland movement of goods and handled customs dues and levies. As each new mode of transport was established, the forwarder was essential to handle transportation across national boundaries (Hill, 1972). While a historic occupation, worldwide courts have often found difficulty with the lack of clarity in duties and legal roles of forwarders, particularly as their role in door to door container cargo movement has become more complex. The service functions of the modern freight forwarder encompass consultancy, packaging, clearance, documentary, affreightment, consolidation, insurance, logistics, fiduciary, supervision, quasi-banking and transport (Schramm, 2012). These duties may increasingly move forwarders beyond merely an agent of the actual shipper into a role of a principal acting as a performing carrier for all or part of the overall freight movement, but legally in the U.S., the ocean freight forwarder is not a carrier (Cain, 2014).

Within the U.S., the distinction of what an ocean freight forwarder (OFF) does is governed by the Federal Maritime Commission that performs oversight over ocean transportation intermediaries. An OFF means a person that dispatches shipments from the U.S. via a common carrier and books or otherwise arranges space for those shipments on the behalf of shippers as well as process the documentation or perform related activities

incident to those shipments. The OFF does not have their own house bill of lading but they are booking the cargo with a common carrier who releases their own (master or house) bill of lading.

A non-vessel operating common carrier (NVO) by contrast is a common carrier that does not operate the vessels by which the ocean transportation is provided, and is a shipper in its relationship with an ocean common carrier. NVOs came into existence in the early 1970s as container shipping became the dominant form of moving finished goods and were codified and regulated by the Federal Maritime Commission pursuant to the Shipping Act of 1984 (Clott, 2000). Many ocean freight forwarders operate NVOs as part of their overall services to customers and both are considered ocean transportation intermediaries (OTI's) by the FMC.

U.S. based companies operating as OFFs or NVOs are required to obtain a license from the FMC and show financial responsibility through the posting of a surety bond. OFFs need to submit a $50,000 bond for an ocean freight forwarder license or $75,000 for an NVO license. For each unincorporated branch office in the United States performing OTI services, the OTI is required to provide the FMC with the addresses of those branch offices plus $10,000 for every unincorporated branch office in the U.S. performing the same activity. Licensed NVOs based in the U.S. or outside the U.S. must submit a $75,000 bond plus $10,000 for every unincorporated branch office. Unlicensed and non-U.S. based NVOs are required to submit proof of financial responsibility in the amount of $150,000; and are required to use a licensed OTI for any OTI services performed on its behalf in the United States. If not licensed under the FMC, foreign based NVOs must register with the Commission and submit proof of financial responsibility in the amount of $150,000. NVOs working in the trade between the U.S. and China must also file an Optional Rider of Financial Responsibility that adds another $50,000 to the NVO bond in order to meet the requirements of the Chinese government. OTI licenses and registered foreign based NVOCCs are required to renew their licenses every three years.

Since the Ocean Shipping Reform Act of 1998, many changes have occurred for OTI's particularly with regards to NVOs. While all NVOs operating in U.S. trades are required to still publish a tariff, contract rules have been evolving since the Act was signed into law by the federal government. In 2004, the Federal Maritime Commission loosened restrictions on NVOs by authorizing NVO Service Arrangements (NSAs) that could be signed with shippers. The contracts provided an equivalent to service contracts signed between vessel operators and shippers but terms of the contracts still needed to be publicly filed with the commission. An exemption from the tariff rate publication was allowed as of 2013 with Negotiated Rate Arrangements (NRAs) that do not have to be published in the tariff; however, they cannot include credit and payment terms, rate methodology, minimum quantities, dispute or arbitration clauses and other non-economic issues. NRAs cannot be amended during their term. A petition to eliminate the distinction between NSAs and NRA allowing agreements to include non-rate issues or advance filing of amendments was filed to the FMC by the National Customs Brokers and Forwarders of North America, which has a preponderance of smaller NVOs as its members. However, larger NVOs such as UPS (United Parcel Service) have argued for keeping the NSA procedures and filing requirements, as they require minimum quantity commitments that allow NVOs to compete with vessel operators for cargo. In addition, "neutral" NVO networks have evolved to provide greater reach for small and medium size NVOs serving particular trade lanes. Example firms are Saco Shipping GMBH https://secure.saco.de/en/home/ , Neptune Cargo Network http://neptunecargonetwork.com/ and Vanguard Logistics http://vanguardlogistics.com/

The Changing Role of OTIs

Ocean Freight Forwarders

The freight forwarding industry is transforming into a variety of new services as a value added reseller. Their historic function as a facilitator in the movement of physical goods allows them to provide customized services that are integral to global shipper requirements. A stable management culture and strong understanding of customers were cited in a 2012 study of industry leaders by the consultancy A.T. Kearney as key to OFF success as intermediaries between carriers and owners (Guerard and Martinez, 2012). While specific services for particular industries such as retail and manufacturing will vary, the traditional services of advising and booking of exporter cargo with carriers, arranging packing, marking, and invoicing cargo, attending to customs clearance through the use of Licensed customs broker/compliance, and reselling Shippers Interest insurance policies are still performed for customers. In addition, larger forwarders now operate complete logistics functions that include supply chain performance, 3PL warehouse and distribution, risk management and multimodal transportation.

Ocean freight forwarders are under intense pressure to adapt new technology applications to their business models as margins come under pressure from increased competition. Shorter product life-cycles, exchange rate volatility, more Just-in-time (JIT) manufacturing, and increased product complexity are among the issues that influence clients' needs. More volatility in the supply chain has made advance planning more difficult leading to service disruptions. The ongoing commodification of large sections of the global transportation industry and complex customer demands have required considerable investment in information systems. This has favored mega-forwarders who have the global reach and economies of scale to leverage ocean and air cargo rates that smaller players do not have. A number of mergers and acquisitions have taken place recently as larger global "mega-forwarders" attempt to scale in areas where they lacked coverage. Some shipping lines have sought to capture the upstream and downstream spend of their clients by establishing forwarding units such as Maersk with its Damco subsidiary and NYK Line with Yusen Logistics.

Small and medium size OFFs who often have niche countries, industries and customers and work on very tight profit margins compete with larger forwarders through freight forwarder networks such as Pangea http://pangea-network.com/, Freight Forwarders Family Worldwide Agents Network http://freightforwardersfamily.com, and Gross + Fuchs Group http://www.gross-fuchs.com/cms/front_content.php?idcat=3&idart=4&lang=1. The networks provide global coverage and service provider relationships that allow smaller firms to work closely with individual customers. But they must still comply with changing regulations and implement costly new EDI and information systems without the technical training that larger forwarders can utilize. Online platforms such as Freightos https://www.freightos.com/ seek to aggregate quotes from freight forwarding companies to offer freight services that can be compared similar to Expedia https://www.expedia.com for passenger services. As these firms grow they may become the new middleman between OFFs and their customers. (Bryan, 2016). At the other end of the OFF spectrum are technology providers backed by private equity markets who may or may not fall under the licensing requirements of the Federal Maritime Commission. For example, Flexport International https://www.flexport.com/ is a licensed OTI with modern technology while CargoSphere http://cargosphere.com/ is a technology developer selling their technology to other entities and thus not directly involved in the movement of freight. A number of recent start-up firms emerged in the technology area of forwarding in the last five years within the ocean freight market. The tech firms offer tracking, real

time booking management, and advanced analytics that reduce the need for customer service rate quoting and comparison of services of non-standardized processes. These start-up firms join older E-commerce networks such as Inttra http://www.inttra.com/ and GT Nexus www.gtnexus.com/ who provide cloud based solutions through EDI powered software systems. Acceptance of these providers has grown as more customers become familiar with freight procurement through e-commerce networks.

The growth of simplified app based freight booking systems based on technologies that have altered other industries appears poised for considerable growth in ocean transportation (Bryan, 2016) The disintermediation of the freight forwarding industry has been predicted since the advent of the Internet in the mid-1990s (Clott, 2000). Over the last two decades, a lack of concentrated technology investment, cloud computing capacity, multiple steps involved in international shipments, and the complexity of global supply chain operations requiring labor intensive expertise over far flung areas had necessitated the use by shippers of a traditional freight forwarder until very recently. Documentation that once required paper based bills of lading and letters of credit has become digitized. Online platforms to fulfill U.S. government Customs and Border Protection requirements for information are now in place and required for compliance. Beginning in 2017, the Automated Commercial Environment (ACE) will become the Single Window - the primary system through which the trade community will report imports and exports and the U.S. government will determine admissibility (CBP, 2017). The development of a Single Window changes freight forwarder activities by making all licenses, permits, certifications, and Partner Government Agencies (PGAs) data electronic. At this writing, there are projected to be 47 PGAs that will be tied into the Single Window at full implementation with fewer than 18 PGAs in place at this time. A greater emphasis on compliance, securing the borders, and screening will add complexity to the Single Window. While paper based activities will still exist for some countries outside of the U.S., high volume trade areas such as the Transpacific and European Union will also have single window systems that mirrors that of the U.S., with or without major trade agreements in place.

Widely expected to upend traditional documentation procedures in the next few years will be the advent of blockchain technology that allows shared ledgers on secure documents to be processed worldwide. Prototype firms such as Blockfreight https://ito.blockfreight.com/ are seeking to develop processes that will include banks, insurance providers, freight forwarders, shipping carriers, port operators and regulators. The parties involved in these transactions will determine the access and information shared with other related parties.

The nature of these distributed database transactions will alter transactional systems performed over centuries in the transportation of goods (Tapscott, 2016). The use of blockchain technology will change one of the oldest pieces of freight forwarder services in terms of document processing by preventing alteration of the transactions once recorded. Bills of lading, insurance certificates, letters of credit, specific country documents among others can all be put into a blockchain format that allows for the seamless transfer of international trade processing. Much of the growth of blockchain will have to do with its acceptance in major trade lanes by customers and OTIs and the expertise of skilled intermediaries who can provide the transparency required.

NVOCCs

The other ocean transportation intermediary under FMC oversight functioning independently or often as part of a global freight forwarder is the non-vessel operating common carrier (NVO). Traditionally, the NVO profited as a consolidator of small shipments on the spread between full and less than container load rates usually priced in the form of FAK (Freight All

Kinds) rates. The NVO charges a basic commodity rate to the individual shipper and pays the container rate to the steamship company. Less than containerload (LCL) cargo is brought to container freight stations (LCL) where they are stuffed or stripped of cargo. In recent years, beneficial cargo owners (BCOs) who would otherwise contract for full container loads directly with steamship lines have been turning to NVOs. In this role, NVOs function as direct customers of shipping lines, as they typically book the containers and organize the chain around them. The larger non-asset service NVO providers can get better prices from the steamship lines which they can resell to the Beneficial Cargo Owners (BCOs). This offers BCOs greater flexibility to move cargo on various ships rather than those within their slot-sharing agreements (Leach, 2016).

A number of mergers, vessel sharing agreements, shipping alliances, a major bankruptcy by Hanjin Shipping, and reduced sailing schedules as a result of larger container vessels deployed has steadily increased the role of NVOs in the trades. NVO controlled share of the U.S. Transpacific cargo business grew to 41.8% in the first half of 2016 from 30% in 2012 (PIERS, 2016; as cited in Mongelluzzo, 2016). Medium and smaller size BCOs (1-2000 TEU per annum) in particular have looked to NVOs to navigate around congestion delays at ports and provide flexible, price competitive options to BCO service contracts directly with the carriers. The NVO can look for vessel capacity over the entire market and provide end-to-end rates and services for customers. A reduction in ocean carrier sales staffs and basic services such as chassis provision have moved many small shippers away from direct bookings through vessel owning common carriers. Additional concerns such as port labor issues, carrier instability, delayed vessel calls, and demurrage costs incurred from congestion and late delivery from the terminal have moved many full container load shippers to work with NVOs. The liner shipping firms will need to adapt to large price sensitive NVO customers who are less "brand loyal" than a BCO. Seasonal shipment periods when space is tight may reduce NVO price competitiveness, but in a turbulent downward freight rate environment, as has been the case for the last decade, within over-tonnaged trade lanes like the Trans-Pacific, the result is an opportunity for major NVOs to increase market share.

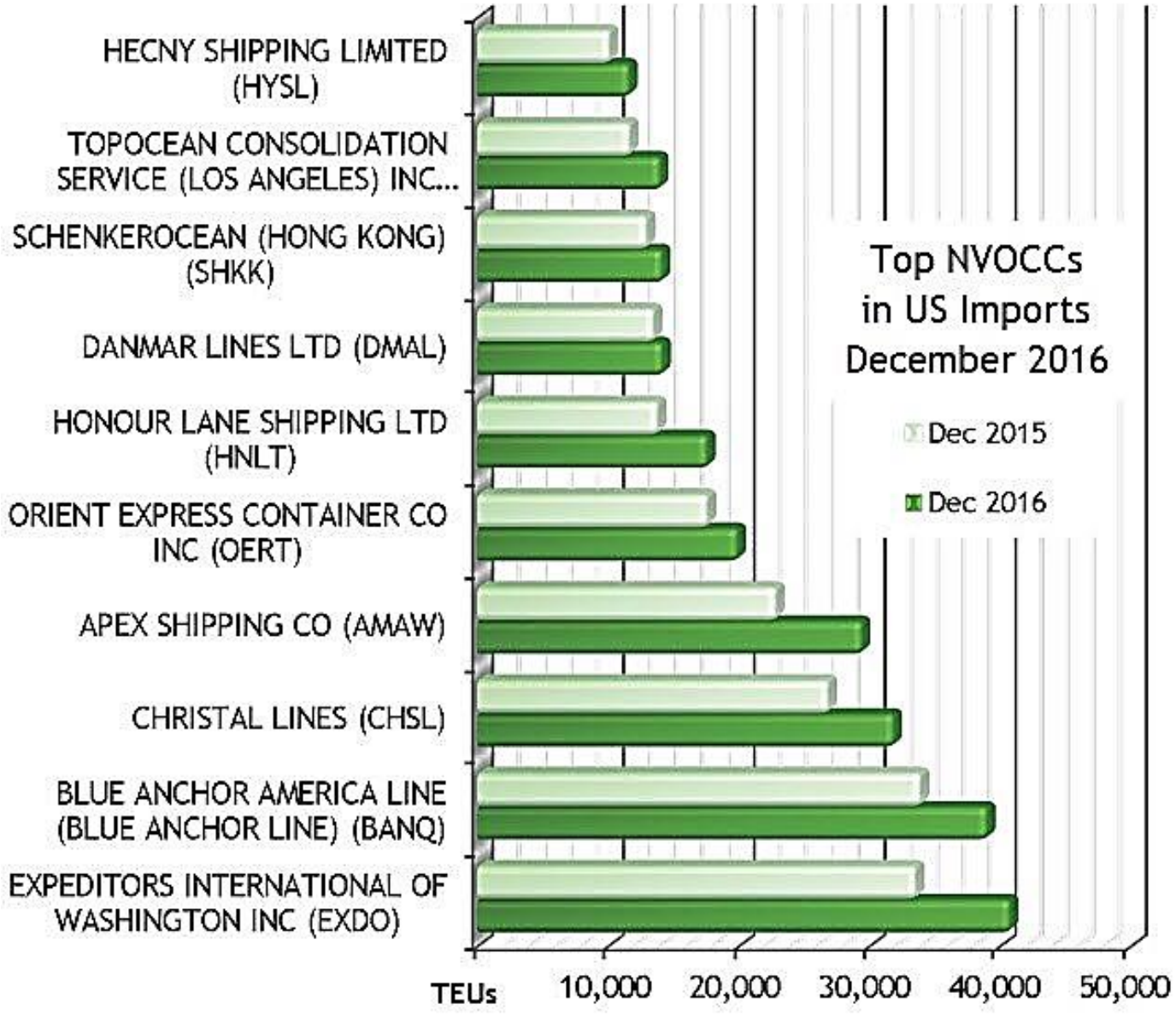
Similar to ocean freight forwarders, NVOs are subject to increased service commitments to justify their costs to shippers. Their expertise and nimbleness in the marketplace allows them to search for new options for shippers through additional ports of call and transporting of LCL and FCL (Full Container Load). Local NVOs with strong ties to intermodal trucking firms and 3PL providers can be as strong as the global NVOs as they are often tied in with logistics providers with functions such as purchase order management, vendor management, consolidation services and cross docking. The increased of market analytics based on apps and cloud-based technologies will heighten the ability of larger NVOs to incorporate data from contracts and spot freight rates to provide more transparent pricing on freight rates (Johnson, 2016). For NVOs that rely on volume from forwarders, CoLoadX http://coloadx.com/ is a digital ocean procurement firm that seeks to connect forwarders with NVOs. (Johnson, 2016).

The technology gap between large and small OTIs

Continual regulatory changes in importing and exporting have led to greater software requirements. Software designed for the U.S. OTI community must be U.S. Customs and Border Protection (CBP) Automated Commercial Environment (ACE) compliant and a small number of firms at this writing produce the software utilized by most of the industry. Mergers and acquisitions within the industry such as Four Soft and Lean Logistics platforms purchased by the global supply chain software firm Kewill, (owned by the private equity firm

Francisco Partners) have reduced the amount of previous customer service support. These 'bolted on' software packages are challenged by designed software such as produced by Flexport. The investment necessary to develop and implement a new IT system has become a major expenditure that may not work despite the best efforts of firms. DHL for example developed a "New Forwarding Environment" initiative IT modernization program that completely failed to work for the global offices or its customers (Waters, 2015). Automation of all offices worldwide can be a patchwork process that is hobbled by continual changes in regulations, compliance and systems. Table 1 gives the top 25 global freight forwarders, ranked by gross revenue. Figure 1 gives the top NVOCCs in US shipments.

Figure 1: Top NVOCCs in US Imports 2016. Source:Datamyne



As more "courier" companies such as DHL, UPS and FedEx have become licensed OTIs, the traditional broker/forwarder/NVOCC concept continues to evolve. The courier firms are vertically integrated intermodal companies unlike smaller OTIs with the scale to acquire technology firms, such as the recent acquisition by UPS of Coyote Logistics, a technology enabled, non-asset based freight brokerage firm. Customer service is a major challenge in the current trade environment where ocean carriers, labor unions and trucking companies

can have a direct impact upon product with reduced access to current information on product movements and increasing volumes of goods in transit. Efforts to have more transparency with regards to needed information, (the Federal Maritime Commission sponsored Supply Chain Innovation Initiative) will be beta tested in 2017 in the hopes of facilitating goods movement in high velocity locations (FMC, 2017).

IT technology capability may viewed through an Information Systems Success Model such as that of DeLone and McLean (2003); comparison, (Urbach, 2012); see Figure 2. This model posits six dimensions to measure success: Information quality, system quality, service quality, user satisfaction, intention to use and use, and net benefits to both the firm and its partners. Arrows in the figure indicate necessary relations for the subsequent dimension. The IS literature is full of schemes and metrics for these dimensions. Work has advanced the most on web analytics systems. Transport related systems have not yet come under careful academic scrutiny. However, we hear of frequent failures, such as that of DHL mentioned above, and it is well known that 75% of all IS development activities fail in some sense; that is fail on one or more dimensions of the model. One insight from such models is that the net benefits in OTI systems must accrue not just to the firm itself as ROI or profit, but also to customers. If the system does not increase user satisfaction and/or does not get used, the benefits will not be obtained. This is especially true for OTIs, which have external customers. The OTI intermediates between carriers, shippers, and many other supply chain players, and any IT solution must involve all those parties as users and/or providers of information. Further, failures of the system or the information will be seen as the responsibility of the OTI, and reduce the subsequent user satisfaction and net benefits to users.

Figure 2 DeLone and McLean IS Success Model, updated. Source: DeLone and McLean, 2003.

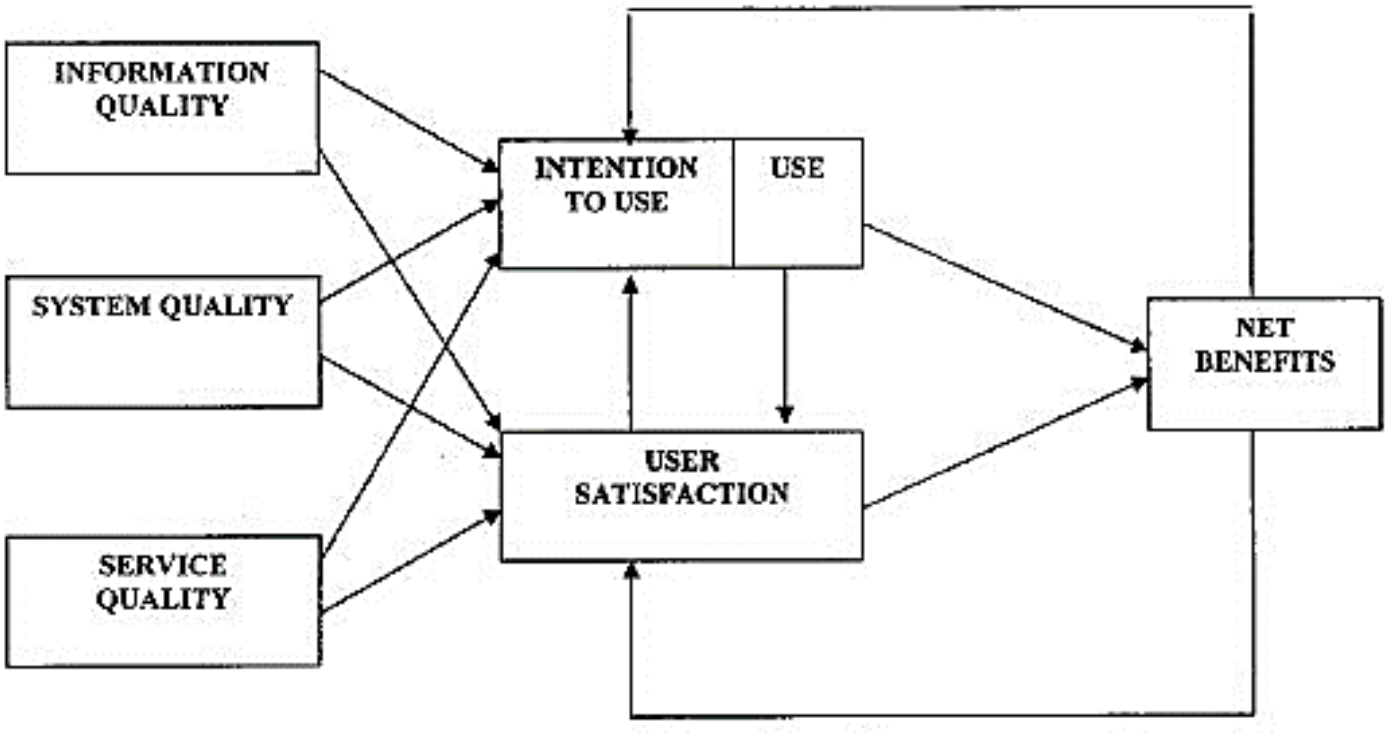


Table 1 A&A's Top 25 Global Freight Forwarders List, Ranked by 2015 Logistics Gross Revenue/Turnover and Freight Forwarding Volumes*

Provider	Gross Revenue (US$ M)	Ocean TEUs	Air Metric Tons
DHL Supply Chain & Global Forwarding	29,562	2,930,000	2,109,000
Kuehne + Nagel	21,100	3,820,000	1,250,000
DB Schenker	17,160	1,942,000	1,128,000
Nippon Express	15,822	855,002	711,354
Sinotrans	7,314	2,801,300	522,600
Expeditors	6,617	1,043,880	872,480
Panalpina	6,091	1,593,900	836,200
UPS Supply Chain Solutions	8,215	615,000	935,300
DSV	7,574	855,319	311,193
Hellmann Worldwide Logistics	3,987	888,284	561,240
CEVA Logistics	6,959	642,370	451,000
Bolloré Logistics	4,998	844,000	580,000
GEODIS	5,864	677,465	299,032
DACHSER	6,264	568,500	275,300
Agility	3,907	513,500	372,700
Yusen Logistics	3,835	547,000	344,000
Kerry Logistics	2,723	785,600	282,200
Kintetsu World Express	3,729	463,000	457,000
C.H. Robinson	13,476	485,000	115,000
UTi Worldwide	3,696	512,550	353,300
Toll Group	5,822	542,000	114,000
Damco	2,740	744,000	180,000
Hitachi Transport System	5,612	330,000	190,000
Logwin	1,175	593,000	137,000
NNR Global Logistics	1,683	140,540	264,068

*Revenues and volumes are company reported or Armstrong & Associates, Inc. estimates. Revenues have been converted to US$ using the average exchange rate in order to make non-currency related growth comparisons. Freight forwarders are ranked using a combined overall average based on their individual rankings for gross revenue, ocean TEUs and air metric tons. (Armstrong & Associates, 2016).

OTI Demographics

We obtained data on US-registered OTIs from the US Federal Maritime Commission (FMC). The data show that the number of licensees has been generally increasing since 2001; however there has been considerable fluctuation in the number of foreign licensed OTIs; see Figure 3.

OTI economic geography

There has been much research on industry clusters (van der Linde, 2002; Porter, 1998) and logistical clusters in transportation centers (Sheffi, 2012). One would expect that OTIs would be a component of such clustering; however, use of information-based systems might be expected to remove the need for OTIs to be located within export logistics centers. Also one would expect that as ocean trade patterns change, clustering suggests that OTIs would move as well, unless the effect of the advanced electronic information systems removes their need to be located at a port of entry.

We used the FMC's currently available data on OTIs to determine their locations in the US. There are 6214 registered OTIs, of which 4728 are US based; 1486 are foreign. The data appear to be self-entered by the OTIs, and therefore location information contained quite a few errors, which needed to be cleaned. Table 2 shows the distribution of FFs and NVOCCs by state. States with large international trade by air or water have the largest concentration of OTIs. Figure 3 shows each OTI as a dot on the map. While it is hard to see exact locations at the national scale, clearly the concentrations of red are at air and water ports of entry/exit. Figure 4a shows the top 10 states in a Pareto chart; they constitute more than 99.99% of US OTIs; no other state has more than 66. Similarly for the foreign OTIs, Figure 4b shows the top 20 countries; they again constitute more than 99.99% of the registrants. No other country has more than 9 registered OTIs.

Figure 3 Percentage changes of number of OTIs, total and Foreign licensed and non-licensed.

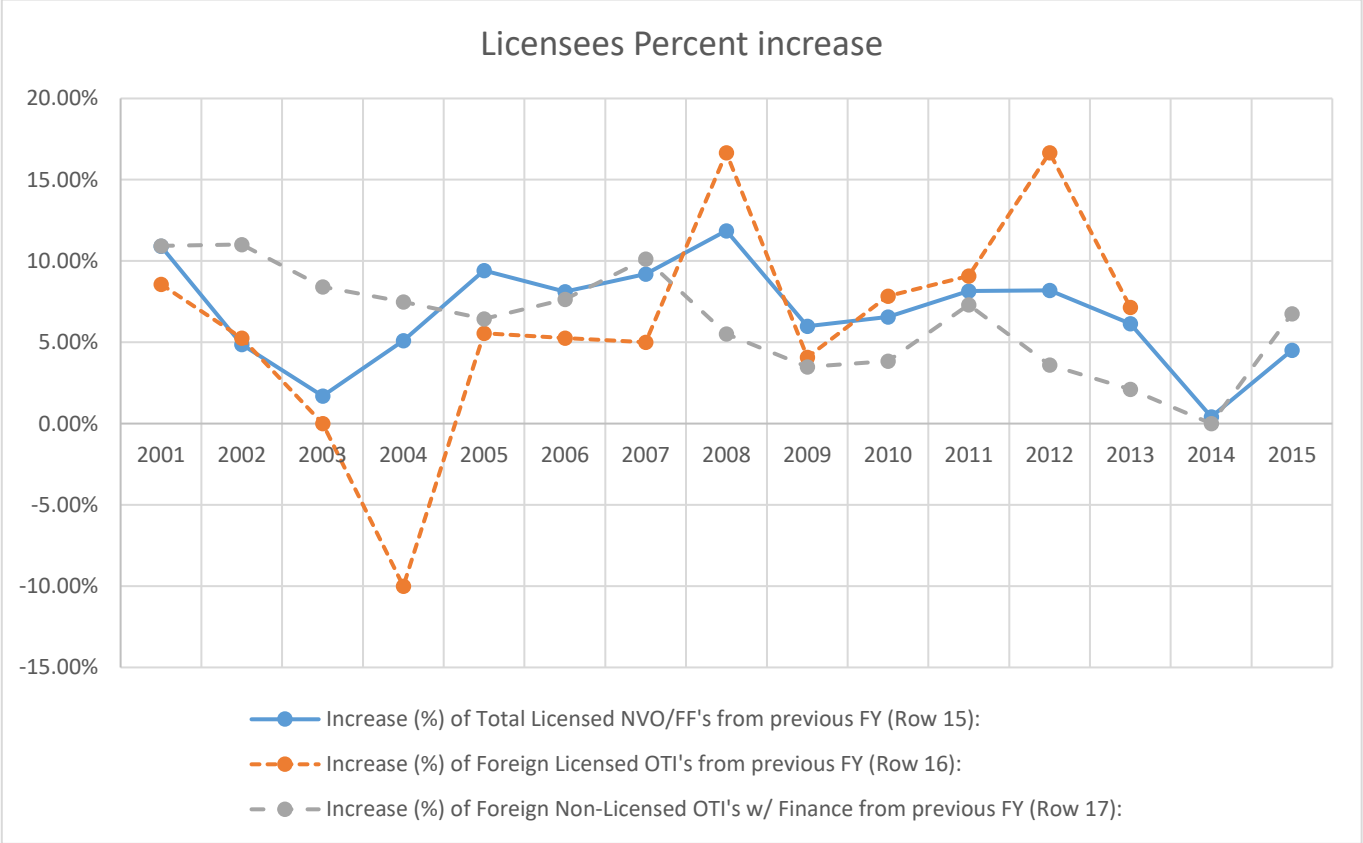


Figure 4a Pareto Chart of top 10 states and 4b top 20 nations. Source: author calculations.

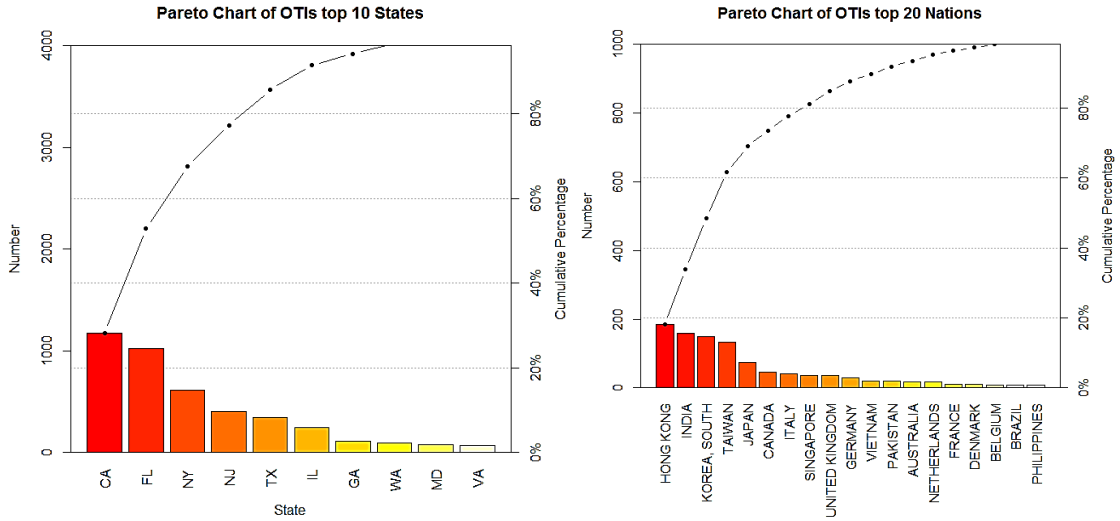


Table 2 Number of Freight Forwarders and NVOCCs by state. Source: author calculations from FMC data.

	State	No. of FF	No. of NVO	No. of Both	No. of Total
1	Foreign	0	1486	0	1486
5	CA	546	1044	416	1174
10	FL	747	798	518	1027
34	NY	305	524	216	613
31	NJ	256	330	181	405
42	TX	267	236	158	345
15	IL	154	209	119	244
11	GA	91	84	61	114
47	WA	78	61	43	96
21	MD	63	53	37	79
44	VA	56	34	24	66
20	MA	45	39	24	60
37	PA	43	45	31	57
27	NC	36	30	22	44
35	OH	31	31	22	40
19	LA	31	12	10	33
23	MI	26	23	20	29
38	PR	15	20	8	27
24	MN	21	19	14	26
40	SC	21	13	10	24
2	AL	23	16	16	23
36	OR	20	8	7	21
7	CT	12	10	5	17
41	TN	16	13	12	17
25	MO	15	12	11	16
4	AZ	11	11	7	15
6	CO	12	9	7	14
48	WI	11	8	5	14
16	IN	13	8	8	13
30	NH	6	5	3	8
39	RI	6	4	3	7
9	DE	4	4	2	6
8	DC	5	1	1	5
13	HI	3	4	2	5
18	KY	5	5	5	5
33	NV	3	3	1	5
17	KS	3	2	1	4
29	NE	4	4	4	4
43	UT	4	3	3	4
3	AR	1	3	1	3
12	GU	3	2	2	3
14	IA	3	1	1	3
45	VI	1	3	1	3
22	ME	1	1	0	2
26	MS	2	1	1	2
28	ND	2	2	2	2
32	NM	2	1	1	2
46	VT	2	2	2	2

We decided to investigate further by seeing if clusters could be defined analytically by a clustering algorithm. After geocoding the cities using the US Census bureau website, we applied the hierarchical clustering method using the hclust algorithm in R with Wald's D method, and Euclidean norm distance, to the latitudes and longitudes.

Let $A = \{a_1, \ldots, a_{n_1}\}$ and $B = \{b_1, \ldots, b_{n_2}\}$ be nonempty subsets of $\mathbb{R}^d$. Define the between-within, or e-distance $e(A, B)$, between A and B as

$$e(A,B) = \frac{n_1 n_2}{n_1 + n_2}\left(\frac{2}{n_1 n_2}\sum_{i=1}^{n_1}\sum_{j=1}^{n_2}\|a_i - b_j\| - \frac{1}{n_1^2}\sum_{i=1}^{n_1}\sum_{j=1}^{n_1}\|a_i - a_j\| - \frac{1}{n_2^2}\sum_{i=1}^{n_2}\sum_{j=1}^{n_2}\|b_i - b_j\|\right). \quad (1)$$

(Szekely, G. & Rizzo, M., 2005)

Table 3 shows the results of grouping into 21 clusters. Positions of clusters are defined by the mean latitude and longitude of the cities in the cluster. From the map, one sees the locations for the most part conform to air and particularly water ports. Clusters were labeled with four-letter names representing the US geography. Figure 4 is a dot plot of the OTIs, on the US map and Figure 5 maps the clusters on the US, showing how they coordinate with the major air and sea ports in the US.

Table 3: 21 clusters using hclust algorithm, sorted by total of OTIs. Source: author calculations.

Cluster ID	Mean Latitude	Mean Longitude	Number of cities	Total of OTIs	Cluster Name
10	40.74219	-74.1666	285	1077	NYNJ
9	33.9432	-118.016	140	1011	LAX
17	26.10974	-80.2276	53	911	MIA
15	29.8137	-95.6978	40	289	HOU
1	42.12247	-88.0376	79	253	CHI
6	37.88772	-121.993	55	168	SFO
3	38.69102	-76.9331	59	157	VAMD
14	47.21581	-121.997	36	117	WA
20	28.29221	-81.9036	43	113	ORL
5	41.13212	-82.7719	66	111	OH
11	34.16163	-84.6932	43	111	GA
13	42.36468	-71.1836	44	75	MA
12	34.60476	-80.5495	36	74	NSC
8	30.9562	-88.3766	20	68	GULF
2	32.90506	-96.9991	25	51	DFW
7	36.60379	-108.817	21	42	4COR
18	39.00485	-92.9789	23	33	MO
4	18.28196	-66.0647	18	30	PR
19	45.18866	-94.0332	19	29	MN
21	21.34681	-157.934	2	5	HI
16	13.49207	144.8071	3	3	GU

With only 20 clusters, Dallas, an air freight center, and Houston, an air and water freight center, do not split. More than 21 clusters produces minimal additional splitting.

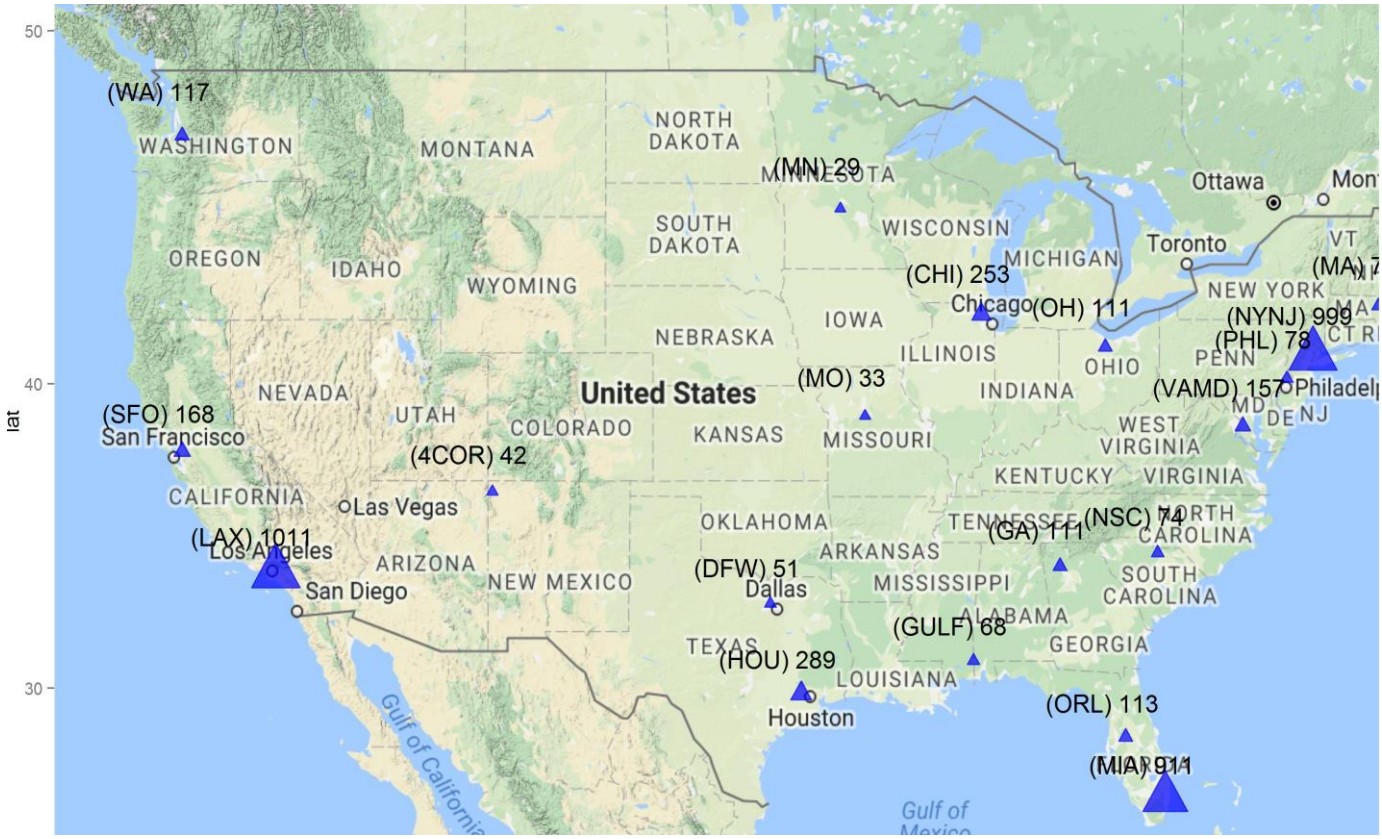
It is clear that OTIs locate in clusters that can be analytically identified, around prominent import-export locations in the US. OTIs locate in close proximity to "Customs Ports" in heavy freight centers. This allows quick interaction with Customs when a shipment requires documents or is otherwise called for inspection. Local sales would be the other major factor in location. Many of the newer firms are information-system based, and in theory would not need to be near a trade center at all. It is also not clear that the newer firms draw on skills that are more likely to be available in an international trade cluster location. Neither information system skills nor telephone sales skills need to be localized in such a way.

We conclude that there are two potential reasons. First, in the act of selling transport, it may be of some value to make personal contact with operators of asset-based resources which are fixed to the locations, such as port terminal operators, customs officials, and drayage and warehouse or transload operators. Personal calls may be necessary for problem resolution and deal-clinching. Second, OTI practitioners may be able through port, terminal, and warehouse visits to acquire subtle knowledge of how the operations work in specific that may be instrumental in allowing them to represent the services to best advantage. These soft advantages of location are decidedly hard to quantify, but seem to play an important role in location selection for OTIs.

Unfortunately the FMC does not have data year by year so that the trends can be followed. Such data would need to be reconstructed from their records of additions and deletions over the past ten years. That is a project for another paper.

Figure 4 Locations of US based OTIs, concentrated in international trade centers.

Figure 5 Twenty one Clusters of OTI cities using Wald's method, regionally labeled, with aggregate number of OTIs in the cluster. (Source: author calculations)



Case Study – Chicago

The Chicago Region located in the U.S. state of Illinois is unique in its breadth and reach to virtually every global freight corridor transiting to and from the U.S. The area's global OTI community numbering approximately 250 firms is well established with both larger and smaller firms clustered in the region to facilitate goods movement and procurement. The region was one of the initial areas for establishment and development of U.S.-based NVO's and is still considered a key organizational point for the OTI transportation cluster.

Similar to other geographic areas, the OTI firms in Chicago have evolved and centralized operations to scale new technologies and offer end to end services to customers. Installing costly new systems, training staff to utilize systems and remaining compliant with changing U.S. government regulations must be done while maintaining acceptable profit margins can be challenging in the current environment. Personal relationships and contacts with customers built over years may become less important in a more automated technology sector than they once were, however the completed disintermediation of the OTI is not likely in the Chicago region as long as new regulations, programmatic changes in procurement, and customer service to fulfill specific needs is still necessary. Niche businesses in this sector serving specific complex global markets also suggest the need for expertise at this time. It is likely though that further development will continue in automating large parts of the former OTI process.

With the concurrence of the Chicago Customs Brokers & Forwarders Association (www.ccbfa.org), a 50 year old professional association of over 200 members, we surveyed several Chicago area based OTI providers to determine how changes in the field are impacting their businesses, similar to a questionnaire conducted by Wen and Lin (2016) to collect data on customers of ocean services between southern China and Taiwan. Many

firms have been in business for decades while others are more recent in their establishment which mirrors trends at the national level.

We asked about key trade lanes the Chicago area OTI's work with. Respondents indicated that the European Union countries, Trans-Pacific countries, Middle East and South America are key areas. India, Brazil and China were specifically mentioned as challenging countries to work with. Among the biggest overall challenges to their businesses are freight rates and the need for stabilized rate levels, thin profit margins, ocean carriers downsizing their staffs thus reducing customer service, and freight rate differentials between NVO and BCO pricing. Communication with ocean carriers was mentioned by several respondents as a major challenge at this time. Coordination of export compliance, pick-up and delivery of cargo with trucker agents, and ACE implementation issues were also challenges at present.

We wanted to understand how technology changes have impacted OTI businesses and challenges associated with implementing new technologies. Respondents pointed to the upfront costs of introducing new technologies and a lack of standard/consistency between carriers for required E-Documentation and electronic booking. Different information reporting requirements with ocean carriers and transportation partner agents require accurate shipment status information that is often challenging to obtain with more online tracking needed. Integration issues of data analysis result because data is often "predicted" or not accurate and up to date on carrier websites. Managing different websites for bookings and master instruction submission with carriers and utilizing multiple systems is a major challenge for OTIs. One respondent suggested that "because communication and shipment movement is so automated, there is a lost art in understanding how problem solve when electronic methods are not working properly". Simply trying to keep ahead of the technology changes is also considered a major challenge at this time.

To 'survive and thrive' in the current environment OTI respondents see creativity and niche markets/products as necessary. Investments in technology and human resources to retain highly qualified labor is necessary but NVO competition has meant that low rate levels put pressure on meeting budgetary goals. Maintaining good customer service and ease of booking keeps clients satisfied. Ensuring qualified people, competent instruction in trade and goods relationships with trade partners and carriers are considered necessary to maintaining business. Ensuring access to information and having some degree of flexibility by other sectors of global trade such as ocean carriers and organized labor is important. Despite the pressures on OTI's, respondents still see the appeal of the industry for younger people. OTIs remain as critical entry points for individuals who wish to go into international business.

Conclusion

Multiple observers have suggested major changes are necessary for OTI's to remain viable in future years (Johnson, 2016; Gueard and Martinez-Simon, 2012). Increased consolidation and further disintermediation of the industry to facilitate cloud based booking systems that can be done simply and easily may well occur in the near future. At this writing though, the role of ocean freight forwarders and NVOCCs is still an invaluable necessity for expediting the movement of goods from sellers to buyers. OTIs still handle a major portion of the cargo flow of international trade, hence the need for regulations and procedures to govern their activities. The need for OTIs to offer differentiated, unique, difficult to replicate services and avoid commodity type activities will be necessary to their continued growth.

What will change for OTIs is the removal of manual tracking of shipments, most phone calls and many customer interactions due to the advent of apps offering storied learning, chatbots, and decision algorithms. Block chain technology will make the documentation process far more transparent than it has been and cargo

flows across the supply chain that is connected will flow more seamlessly than the sequential handoffs that are performed at present. Datasets can be easily created with the Internet of Things that will show when and where loads are that will most likely negate the need to work with individual carrier websites. New data sources with combined information, predictive data, devices and sensors will provide far more visibility to products than ever before. Tracking systems will be put in place to offer door to door pickup across the global spectrum.

One of the major challenges regarding the information revolution is security and privacy. To participate in the benefits of enhanced information exchange, firms need to modify their views and policies on information collaboration. Increased cooperative access to information may perhaps erode some minor competitive advantage of a firm; but the larger 'pie' created by increased simplification of maritime trade will far outweigh the minor losses due to revelation of some minute trade specifics. Especially in a time when prices and terms are highly competitive, we know that with sophisticated buyers, knowledge of price becomes less important, since they are all competitive; terms and service capability become the differentiators. Thus specifics of transactions and transits, revealed through access by query to large databases, will be more valuable shared than closely held.

The above technologies will transform the nature of the OTI but not replace them. Their role as the conduit of international trade from ship to rail to truck to warehouse will still require their presence and perhaps preeminence as the key channel member within the international logistics realm. The important coordination function they fill means that they cannot locate away from port areas. There will continue to be a need for OTIs to locate in clusters near ports of entry and exit, due to 'soft' factors regarding salesmanship and negotiation regarding localized services, even though the information may be available from anywhere to anywhere. Size and scale are important but an understanding of customers and coordination relationships, and a diversity of key services offered will be essential to OTIs' continued ability to survive and thrive in the 21st century. We therefore believe centers like Chicago and major sea and air port geographies will continue to be sources of innovation in the Ocean Freight Forwarding field, resulting in both new entrants and their subsequent consolidation into larger firms.

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