

Port Authority of New York and New Jersey Resiliency Initiative

FINAL REPORT

August 2018

Submitted by:

Arash Azadegan

Associate Professor

Supply Chain Management Department

Rutgers Business School

One Washington Park, Newark, NJ 08820

External Project Manager

Maybelle Jadote, Business Continuity Program Manager

The Port Authority of NY & NJ

In cooperation with

Rutgers, The State University of New Jersey

And

U.S. Department of Transportation

Federal Highway Administration

Disclaimer Statement

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated under the sponsorship of the Department of Transportation, University Transportation Centers Program, in the interest of information exchange. The U.S. Government assumes no liability for the contents or use thereof.

The Center for Advanced Infrastructure and Transportation (CAIT) is a National UTC Consortium led by Rutgers, The State University. Members of the consortium are the University of Delaware, Utah State University, Columbia University, New Jersey Institute of Technology, Princeton University, University of Texas at El Paso, Virginia Polytechnic Institute, and University of South Florida. The Center is funded by the U.S.

1. Report No. CAIT-UTC-NC18	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Port Authority of New York and New Jersey Resiliency Initiative		5. Report Date August 2018	
		6. Performing Organization Code CAIT/Rutgers	
7. Author(s) Arash Azadegan		8. Performing Organization Report No. CAIT-UTC-NC18	
9. Performing Organization Name and Address Rutgers Business School One Washington Park Newark, NJ 07209		10. Work Unit No.	
		11. Contract or Grant No. DTRT13-G-UTC	
12. Sponsoring Agency Name and Address Center for Advanced Infrastructure and Transportation Rutgers, The State University of New Jersey 100 Brett Road Piscataway, NJ 08854		13. Type of Report and Period Covered Final Report 1/1/15 – 8/31/15	
		14. Sponsoring Agency Code	
15. Supplementary Notes U.S. Department of Transportation/OST-R 1200 New Jersey Avenue, SE Washington, DC 20590-0001			
16. Abstract <p>PANYNJ spends almost 39% on contract services, materials, equipment and other which is almost equal to the 41 % expenditure on employees. It can, therefore, be inferred that suppliers are equal stakeholders in the operations of the Agency. Given that nearly 85 % of these suppliers are located in NY & NJ the risk of concentration is high.</p> <p>This project provided resources to analyze vendor distribution, perform sample spend analysis and complete the groundwork in identifying possible Business Continuity software application vendors for the Port Authority.</p>			
17. Key Words Vendor distribution, spend analysis, BCP software application		18. Distribution Statement No restrictions	
19. Security Classification (of this report) Unclassified	20. Security Classification (of this page) Unclassified	21. No. of Pages Total 24	22. Price

Table of Contents

Title Page.....	1
Description of the Problem.....	2
Background.....	2
Approach.....	3
Methodology.....	4
Findings.....	4
Procurement Process at PANTNJ.....	4
Operating Cost Comparison.....	5
Vendor Mapping.....	9
Conclusions.....	17
Recommendations.....	17
References.....	19

List of Figures

Figure 1: 2014 Operating Cost Breakdown at PANYNJ.....	6
Figure 2: Vendor Mapping – Distribution of Domestic Vendors.....	10
Figure 3a: Spend Pattern for January 2015(lower level spends).....	13
Figure 3b: Spend Pattern for January 2015 (higher level spends).....	13
Figure 4: A Business Continuity View of “Spend”.....	14
Figure 5: A Purchasing Strategy View of “Spend”.....	15
Figure 6: Source of supply chain disruptions according to Manufacturers.....	15
Figure 7: How many suppliers do companies choose based on strong BIA?.....	16

List of Tables

Table 1: Staffing Breakdown at PANYNJ per Year.....	3
Table 2: 2014 Capital Assets for PANYNJ.....	6
Table 3a: 2014 PANYNJ Consolidated Statement of Revenues and Expenses.....	7
Table 3b: 2014 PANYNJ Gross Operating Revenues and Expenses.....	8
Table 4: Port of Long Beach – Operational Cost Breakdown per Year.....	8
Table 5: Port of Long Beach – Balance Sheet for 2013 and 2014.....	9
Table 6: Vendor Mapping – Distribution of Domestic vs. International Vendors.....	10
Table 7: Vendor Mapping – Distribution of Domestic Vendors.....	11

Port Authority of New York and New Jersey Resiliency Initiative

Final Report



DESCRIPTION OF THE PROBLEM

The Port Authority of New York and New Jersey (PANYNJ) can benefit from better understanding of the dependencies and risks associated with their supply chain.

PANYNJ, which spans several marine facilities including the Port Newark-Elizabeth Marine Terminal, is one of the largest freight assets in the country. The organization plays a key role in the New York metro area role and operates as the primary East Coast seaport complex, with over \$185.0 billion in revenues. Interestingly, almost the same value of goods (\$162.7 billion in yearly revenues) flows through the organization's extensive air cargo facilities, including John F. Kennedy International Airport (JFK) and Newark Liberty International Airport (EWR).

The extent of responsibility and scope of assets under the control of PANYNJ makes it prone to numerous types of risk (Dawes, Cresswell, and Cahan 2004, Frittelli 2008, Smythe 2013). Moreover, the extent of purchase and sourcing activities of the organization exposes it to a broad array of potential risks.

Background:

PANYNJ builds, operates, and maintains critical transportation and trade assets. Its network of aviation, rail, surface transportation and seaport facilities moves millions of people and transports vital cargo throughout the New York/New Jersey region. PANYNJ also owns and manages the 16-acre World Trade Center site, home to iconic One World Trade Center. The total value of the enterprise is estimated at \$349.2 billion.

Operating the local airports falls into the "Aviation" group. This group shows a gross operating revenue of \$2.5 billion per year, passengers traffic of around 115 million people and equipment (airplane) movement of 1.2 million per year. Regarding potential impact, one hour of operational disruption in this group equates to \$283,000 in revenues.

Operating tunnels, bridges and terminals falls into the TB&T group. This group shows a gross operating revenue of \$1.6 billion per year, passengers traffic of around 114 million vehicles (cars, trucks, boats, ships, etc.). Bus and PATH passengers per annum are around 156 million people. PATH (Port Authority Trans-Hudson) is a rapid transit system serving Newark, Harrison, Hoboken, and Jersey City in metropolitan northern New Jersey, as well as lower and midtown Manhattan in New York City. Regarding potential impact, one hour of operational disruption in this group equates to \$184,500 in revenues.

Port Commerce is the group of facilities operating the commercial shipping ports in the PANYNJ umbrella of responsibility. These include Port Jersey, Port Authority Marine Terminal in Brooklyn, Port Authority Marine Terminal in Elizabeth, Port Authority Marine Terminal in Howland Hook and the Marine Terminal in Port Newark. This group shows a gross operating revenue of \$248 million per year, container traffic of 5.8 million (in twenty-foot equivalents),

international waterborne vehicles of 393,000 per year. Regarding potential impact, one hour of operational disruption in this group equates to \$15,700 in revenues.

Table 1 provides an overview of the staffing at PANYNJ based on the operating group. Clearly, PANYNJ is responsible for safety and security of the close to 7,000 people working in its facilities. Of note, is the 1,631 staff responsible for public safety and security. Based on these numbers over 23.3% of the workforce at PANYNJ is directly involved in public safety and security. Also of note, is the 1,965 staff responsible for other operational support activities. Based on these numbers over 28.8% of the workforce at PANYNJ is involved in support activities.

Table 1 – Staffing Breakdown at PANYNJ per Year

	2014	2013	2012	2011	2010	2009	2008
Authorized Port Authority staffing levels:							
Tunnels, Bridges and Terminals	873	873	881	881	911	911	940
PATH	1,073	1,070	1,070	1,070	1,081	1,081	1,088
Port Commerce facilities	169	169	170	170	172	172	179
Air Terminal facilities(a)	1,217	933	926	926	958	958	978
Development (b)	50	50	50	52	82	82	86
Other operational and support activities (c)	1,965	1,966	1,968	1,957	2,030	2,030	2,082
Subtotal	5,347	5,081	5,065	5,056	5,234	5,234	5,353
Public Safety and Security(a)	1,631	1,606	1,712	1,721	1,743	1,743	1,774
Total	6,978	6,777	6,777	6,777	6,977	6,977	7,127

PANYNJ has other groups of assets to protect and operate. From an operational standpoint, PANYNJ is a 24 x 7 x 365 all-weather operations, requiring careful attention to potential risks to the business and conducting routine business continuity and contingency planning. It is estimated that the combined damage of a loss in operation at PANYNJ would have a \$40 million per hour impact.

APPROACH

To better understand the risks facing PANYNJ from their supply chain, access to PANYNJ alongside resources were provided to a Rutgers University graduate student to spend time in becoming familiar with the PANYNJ procurement and risk management organizations. The preliminary approach was to have the student collect and analyze data regarding the procurement process and risk management process at PANYNJ and offer some benchmarking on how comparable ports operate.

METHODOLOGY

The methodology applied here was a combination of field research alongside with literature review. Together, with the help of a senior colleague, the student interviewed personnel at PANYNJ, collected necessary data on purchasing and risk management procedures used at the organization, and researched existing reports on comparable ports.

FINDINGS

1) Procurement Process at PANYNJ

Supply management and vendor relations at PANYNJ is conducted through the procurement department. Objectives of the department are outlined as “to procure quality goods, services, construction and professional, technical, and advisory services based on the principles of open competition and fairness with the highest level of integrity” (PANYNJ 2016).

The main functions of the procurement department include (1) Procurement Operations, (2) Commodities and Services, (3) Construction Procurements and Integrity Programs, (4) Integrity, Compliance and Contract Review, (5) Professional, Technical & Advisory (PTA) Services, (6) Technology & Physical Security Services, (7) Warehouse and Inventory Management and (8) WTC & Federal Procurement & Compliance.

Procurement Operations is responsible for centralized departmental operations. These include standardization and management of the vendor and bidding process. This group issues bids, RFPs (request for proposals) and contract documents, manages advertising, develops and maintains the website pages including on award and bid result activities. Tech support is also part of the responsibility of this group. Highly complex and high dollar amount procurements fall under the responsibility of *Commodity and Services group*. This group also addresses trade and non-trade services, janitorial services, snow removal, towing, customer care representatives, airport management, ground transportation, ferry and marine services, elevator/escalator, revenue-generating services, utility and energy procurements, security services, telecommunications, facility operation and maintenance services. Initiatives such as price preference programs are implemented through this group. The group uses RFPs (request for proposal), EQIB (electronic management of qualified institutional buyers), bidding processes and governmental contracts. A majority of the focus of this report relates to what these two groups are responsible for.

Construction Procurements and Integrity Programs group and manages the bidding and award processes for construction works. This includes minority supplier participation, supplier financial and bonding issues. *The Compliance and Contract Review* group is responsible for the development and maintenance of the standardized solicitation documents for bids, the Requests for Proposals, Requests for Qualifications/Quotes, Requests for Information and

guidelines and procedures. The *Professional, Technical & Advisory (PTA) Services* group manages the procurement of professional, technical and advisory services. Services under this function include architectural/engineering design and construction, accounting and auditing, aviation, port and regional planning. Similar to other group functions, this group is responsible for defining and managing the procurement process including solicitation management, document (letters, scopes of work, agreements, addenda, etc.) preparation, contract negotiations, authorization document review, ensuring funding compliance with the authorization documents, debriefing non-successful proposers, and other related activities.

Other functional groups within purchasing at PANYNJ include *Technology & Physical Security Services* group which handles complex and high dollar purchases such as access control systems, CCTV, hardware/software selection, state of the art technologies such as biometrics and situational awareness solutions. The *Warehouse and Inventory Management* group operates PANYNJ warehouses, which is responsible for materials planning to support facility and fleet operations. The *WTC (World Trade Center), Federal Procurement and Compliance* group manages the solicitation, negotiation of pricing, terms and conditions and award of contracts for Federal Transit Administration (FTA)-funded and other WTC site projects.

Working with any of the above groups often requires supplier evaluation and selection. The most common approach is through request for bidding or proposal (RFB, RFP). The standard process carries a heavy emphasis on contractor integrity and allows suppliers to easily protest the process of supplier selection (PANYNJ 2016). However, as will be outlined further, emphasis on supplier risk, supplier business continuity and related concerns on potential severance of material/service provision do not seem to be prevalently displayed.

2) Operating Cost Comparison

Figure 1 provides an outline of the operating cost breakdown for PANYNJ. Of particular importance is the percentage of funds allocated to contract services (27%), and materials and equipment (10%). These two slices would fall under the span of responsibility of the purchasing group.

Table 2 provides an outline of the capital assets and their depreciation for PANYNJ. Regarding machinery and equipment, PANYNJ has over eight billion dollars in depreciating assets that need to be replaced and repaired over time. This also shows the extent of the scope of responsibility for the procurement group. For the year 2017, contract services totaled \$880 million, and materials and equipment totaled \$252 million (PANYNJ 2017).

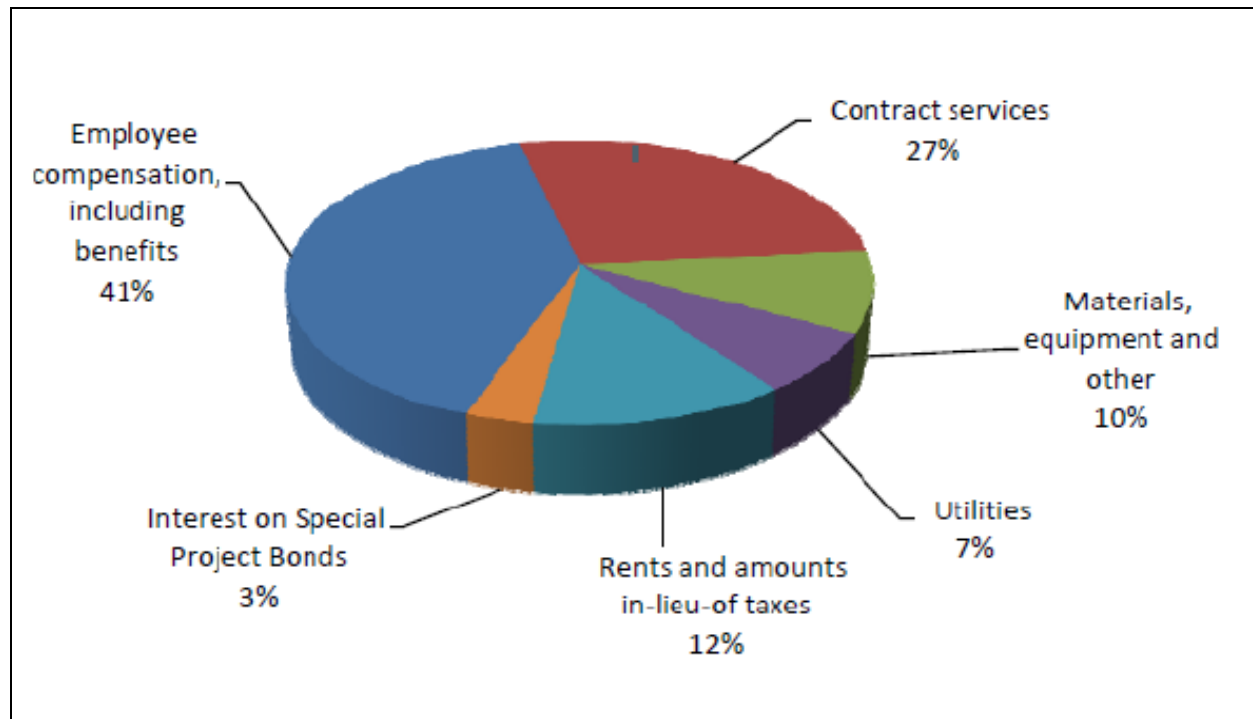


Figure 1. 2014 Operating Cost Breakdown at PANYNJ

Table 2 –2014 Capital Assets for PANYNJ

	Beginning of Year	Additions	Transfers to Completed Construction	Depreciation	Retirements / Dispositions	End of Year
(In thousands)						
2014						
Capital assets not being depreciated:						
Land	\$ 1,142,230	\$ -	\$ 60,033	\$ -	\$ (4,393)	\$ 1,197,870
Construction in progress*	12,075,052	4,077,839	(6,986,237)	-	-	9,166,654
Total capital assets not being depreciated	13,217,282	4,077,839	(6,926,204)	-	(4,393)	10,364,524
Other capital assets:						
Buildings, bridges, tunnels, other structures	10,095,250	-	4,512,392	-	(84,570)	14,523,072
Machinery and equipment	8,129,404	-	907,909	-	(5,401)	9,031,912
Runways, roadways and other paving	4,629,992	-	449,170	-	(6,693)	5,072,469
Utility infrastructure	3,898,809	-	1,056,733	-	(706)	4,954,836
Total other capital assets being depreciated	26,753,455	-	6,926,204	-	(97,370)	33,582,289
Accumulated depreciation:						
Buildings, bridges, tunnels, other structures	(3,904,721)	-	-	(282,350)	71,057	(4,116,014)
Machinery and equipment	(3,881,963)	-	-	(294,337)	5,401	(4,170,899)
Runways, roadways and other paving	(2,654,311)	-	-	(193,430)	6,548	(2,841,193)
Utility infrastructure	(1,883,762)	-	-	(162,032)	562	(2,045,232)
Total accumulated depreciation	(12,324,757)	-	-	(932,149)	83,568	(13,173,338)
Facilities, net	\$ 27,645,980	\$ 4,077,839	\$ -	\$ (932,149)	\$ (18,195)	\$ 30,773,475

Tables 3a and 3b show the consolidated statement of revenues and expenses for the years 2014, 2013 and 2012 for PANYNJ. Table 4 shows a similar set of financial outcomes for Port of Long Beach, a port with similar scope to that of PANYNJ. Operating expense for PANYNJ is 2.9 Billion, equating to 64% of revenues is similar to Port of Long Beach with 63.5%. Interestingly, the percent allocated to employee compensation (as a percent of operating expense) is significantly higher for PANYNJ (1.18 of 2.92 Billion = 40.4%), versus that of Port of Long Beach (47.8 of 227= 21.1%). However, the comparison may not be completely accurate, since much of the labor force for PANYNJ is focused on activities beyond port operations (See Table 1). Moreover, the emphasis placed on safety and security by PANYNJ justifies the additional labor costs.

Table 3a –2014 PANYNJ Consolidated Statement of Revenues and Expenses

	2014	2013	2012
		(In thousands)	
Gross operating revenues	\$ 4,481,812	\$ 4,184,039	\$ 4,050,016
Operating expenses	(2,923,254)	(2,596,268)	(2,589,447)
Depreciation and amortization	(996,633)	(940,254)	(961,958)
Net revenue/(expense) related to Superstorm Sandy	53,530	28,229	(30,000)
Income from operations	615,455	675,746	468,611
Non-operating expenses, net	(502,681)	(562,101)	(557,648)
Capital contributions and PFCs	933,439	914,199	1,223,580
Increase in net position	\$ 1,046,213	\$ 1,027,844	\$ 1,134,543

Additional information on facility operating results can be found in *Schedule E – Information on Port Authority Operations* located in the Statistical and Other Supplemental Information section of this report.

Operating Revenues

A summary of gross operating revenues follows:

	2014	2013	2012
		(In thousands)	
Gross operating revenues:			
Tolls and fares	\$ 1,553,625	\$ 1,462,957	\$ 1,337,372
Rentals	1,300,818	1,228,491	1,208,730
Aviation fees	1,058,416	934,459	904,666
Parking and other	321,760	315,111	338,178
Utilities	149,052	139,835	152,945
Rentals – Special Project Bonds Projects	98,141	103,186	108,125
Total	\$ 4,481,812	\$ 4,184,039	\$ 4,050,016

Table 3b –2014 PANYNJ Gross Operating Revenues and Expenses

	Year ended December 31, 2014			2013
	Operating Fund	Reserve Funds	Combined Total	Combined Total
(In thousands)				
Gross operating revenues:				
Tolls and fees	\$ 1,553,625	\$ —	\$ 1,553,625	\$ 1,462,957
Rentals	1,294,199	—	1,294,199	1,228,491
Aviation fees	1,058,416	—	1,058,416	934,459
Parking and other	321,760	—	321,760	315,111
Utilities	149,052	—	149,052	139,835
Rentals – Special Project Bonds Projects	98,141	—	98,141	103,186
Total gross operating revenues	4,475,193	—	4,475,193	4,184,039
Operating expenses:				
Employee compensation, including benefits	1,187,877	—	1,187,877	1,114,397
Contract services	797,516	—	797,516	684,411
Rents and amounts in-lieu-of taxes	362,627	—	362,627	301,582
Materials, equipment and other	277,174	—	277,174	220,859
Utilities	199,919	—	199,919	171,833
Interest on Special Project Bonds	98,141	—	98,141	103,186
Total operating expenses	2,923,254	—	2,923,254	2,596,268

Table 4 –Port of Long Beach – Operational Cost Breakdown per Year

	2014	2013	2012	2011	2010
Operating revenue	\$ 357	346	334	345	321
Operating expense	227	188	176	166	185
Income from operations	130	158	158	179	136
Other income (expense)	—	(4)	(16)	(50)	(13)
Capital grants	168	251	14	7	19
Investment earnings	3	1	3	5	8
Transfers	(18)	(17)	(17)	(37)	(36)
Change in net assets/net income	\$ 283	389	142	104	120
Return on investment	8.1%	12.3%	5.1%	3.9%	4.7%
Capital expenditures: (Includes personnel costs)	\$ 552	792	373	228	173
Personnel:					
Wages and benefits	\$ 47.8	45.3	43.2	41.7	40.8
Average # of employees	472.1	462.3	459.9	433.8	424.7
Increase (decrease)	2.11%	0.52%	5.51%	2.64%	5.91%
	2009	2008	2007	2006	2005
Operating revenue	312	359	371	353	331
Operating expense	184	196	180	161	149
Income from operations	127	163	191	192	182
Other income (expense)	(14)	(24)	(68)	(54)	(48)
Capital grants	11	4	10	2	2
Investment earnings	19	33	43	28	17
Transfers	(19)	(16)	(15)	(14)	(9)
Change in net assets/net income	124	160	161	154	144
Return on investment	5.1%	6.9%	7.5%	7.7%	7.8%
Capital expenditures: (Includes personnel costs)	189	92	171	92	82
Personnel:					
Wages and benefits	38.6	33.7	28.9	26.2	27.0
Average # of employees	401.0	370.4	340.3	358.2	357.8
Increase (decrease)	8.26%	6.94%	2.40%	0.12%	(0.02)%
See accompanying independent auditor's report					

Table 5 - Port of Long Beach – Balance Sheet for 2013 and 2014

	2014	2013
Port operating revenues:		
Berths and special facilities	\$ 346,257,749	335,869,457
Rental properties	9,359,785	9,374,145
Miscellaneous	1,262,494	1,000,480
Total port operating revenues	356,880,028	346,244,082
Port operating expenses:		
Facility maintenance	8,637,819	4,463,037
Infrastructure maintenance	17,831,958	20,348,800
Fire and safety	33,286,296	31,124,642
Other indirect operating	7,575,695	7,986,407
General and administrative	41,123,612	33,772,806
Total port operating expenses before depreciation and amortization	108,455,380	97,695,692

3) Vendor mapping

Location and concentration of suppliers can create sourcing risks. Having suppliers concentrated in a particular geographic region can increase the risk of supply disruption because multiple suppliers can be affected by adverse effects of disruptions simultaneously. Good sourcing practices include geographic diversification of suppliers to prevent physical/natural/man-made disruptions to affect one's operations.

As part of this project, the Rutgers group was able to analyze vendor distributions for a constrained period. We used a vendor master data dump from the SAP system and based on the zip codes plotted it on to Google maps to get an idea of the geographical spread of the vendor base. It was found that nearly 80% of the vendors are in the NY-NJ area which could be a significant risk in case of a localized disruptive event

Given the broad reach of PANYNJ's supply network, a better understanding of where their suppliers are located is quite important. The work in this area finds that PANYNJ has limited exposure to overseas (international vendors) with only 1.1% of its vendors (49) categorized as international suppliers (Table 6). However, a review of suppliers within the contiguous United States shows that a large majority are concentrated in the Northeast region and within the larger New York metropolitan tri-state area (Figure 2). Table 7 outlines the distribution of suppliers per state. Of the 4,411 domestic suppliers, 1,546 (35.1%) are located in New York state, 1,156 (26.2%) are located in New Jersey. The next highest concentration of suppliers is in Illinois with 238 (5.3%) and Pennsylvania with 232 (5.2%). While more thorough analysis and breakdown based on commodity type is necessary for an effective vendor mapping exercise, the figures shared here indicate the potential for too much concentration of suppliers in the vicinity of PANYNJ operations, which may be a supply risk concern.

Table 6 – Vendor Mapping - Distribution of Domestic vs. International Vendors

Row Labels	Count of Vendor Code
DOMESTIC VENDOR	4411
INTL. VENDOR	49
Grand Total	4460

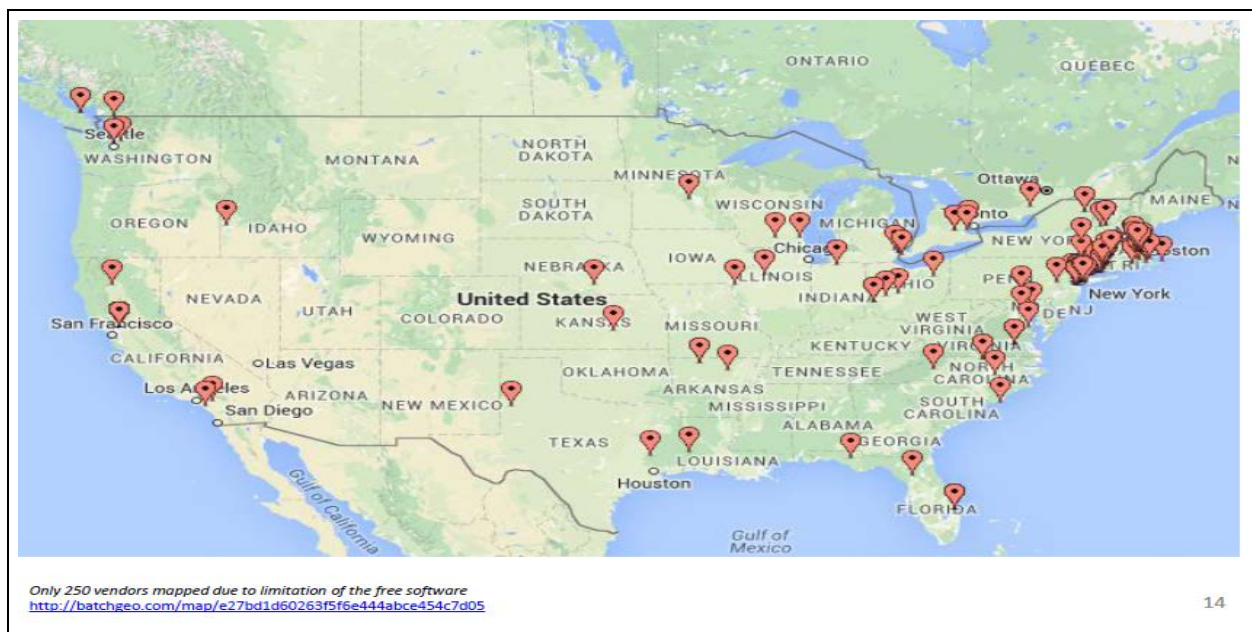


Figure 2 – Vendor Mapping - Distribution of Domestic Vendors

Table 7 – Vendor Mapping – Distribution of Domestic Vendors

DOMESTIC VENDOR	4411
AL	12
AR	4
AZ	34
CA	97
CO	25
CT	64
DC	73
DE	8
FL	94
GA	79
IA	14
ID	2
IL	238
IN	9
KS	5
KY	12
LA	5
MA	97
MD	101
ME	1
MI	35
MN	22
MO	28
MT	1
NC	29
NE	6
NH	9
NJ	1156
NM	1
NV	3
NY	1546
OH	49
OK	12
OR	2
PA	232
RI	4
SC	10
SD	1
TN	9
TX	133
UT	13
VA	87
VT	7
WA	17
WI	21
WV	6
WY	1

4) Linking Spend Analysis to Supply Risk Management

Spend analysis is an activity aimed to provide a thorough understanding of how the company's purchasing activities allocate expenditures. Spend analysis involves collecting, cleansing, categorizing and analyzing expenditure data. The primary purpose of spend analysis is to reduce procurement costs, to improve the purchasing process efficiency and to provide evidence that can help in compliance audits (Pandit and Marmanis 2008). Also, reducing purchasing cycle times (procure to pay cycles) is another benefit of completing Spend Analyses. In short, performing detailed spend analysis helps companies find new areas of savings that previously went untapped, and hold on to past areas of savings that they have already negotiated (Smeltzer and Carter 2001, Monczka et al. 2009).

A solid spend analysis relies on three factors. The first is the visibility and granularity with which the spend analysis can be conducted. With more specificity to how money is spent, the analysis can provide more detail and ways to improve company "spend." How well the analysis is conducted is the second factor. Allocating resources (i.e., procurement personnel) ample time and access to complete the analysis can improve the outcome. Finally, the process is an important factor. Feedback on what the results of the spend analysis allows for procurement staff to correct and adjust their approach.

A preliminary spend analysis at PANYNJ shows that for January 2015, the number of suppliers the organization purchases from are at \$10,000 or lower. A review of spend analysis based on 188 suppliers actively purchased from during January of 2015 shows that the total spends for these vendors was at \$61 Million. Among these, four suppliers carried the high-value transactions at approximately \$5million in total (Figure 3b). Most other transactions were below \$10,000 for the month studied (Figure 3a). Further, a total of five vendors show transactions above \$50,000. Around 13 vendors show transactions between \$10,000 and \$50,000.

Further review of how these high-value vendors were selected, when they are paid and how the negotiations were conducted can enhance purchasing efficiencies. Moreover, the vulnerability for a supply disruption could lie in the sub \$10,000 transactions which form a bigger chunk of the transaction volume. The large transactions would for sure be on everyone's radar.

Spend analysis can also provide benefits to risk management. Figure 4 provides an overview of how supplier spends relates to the financial impacts of supply disruptions. The figure highlights that despite their low transaction amount, many low-cost commodity suppliers can be the source of supply chain disruptions. In the figure shared, despite their low transaction many such supplier can cause disruptions that can cause financial damage above \$250,000. This is particularly salient to PANYNY, considering that a large majority of their transactions are below \$5,000 on a per month basis.

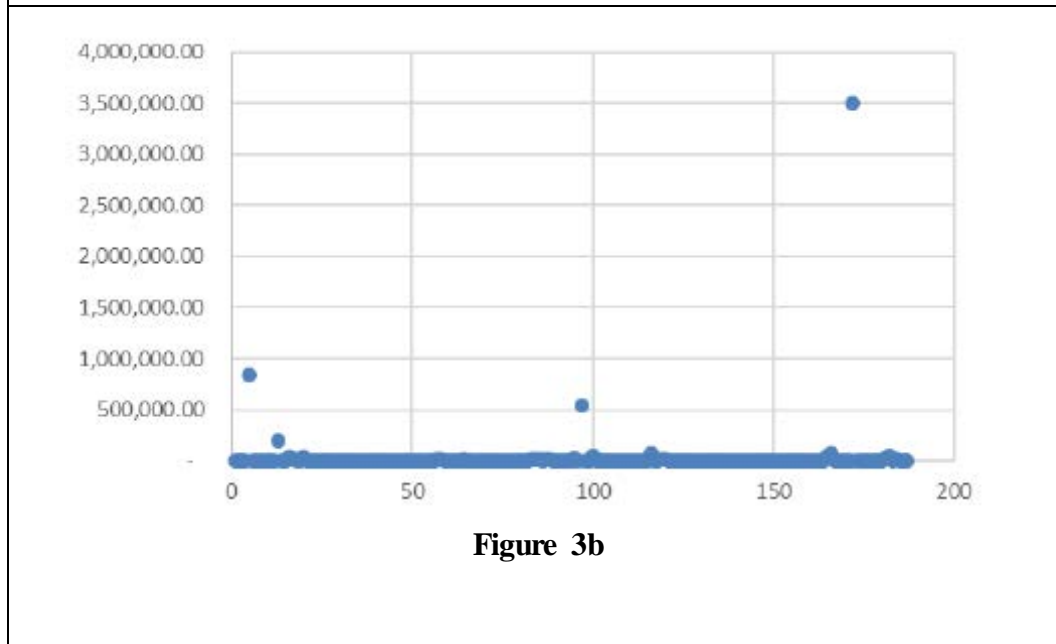
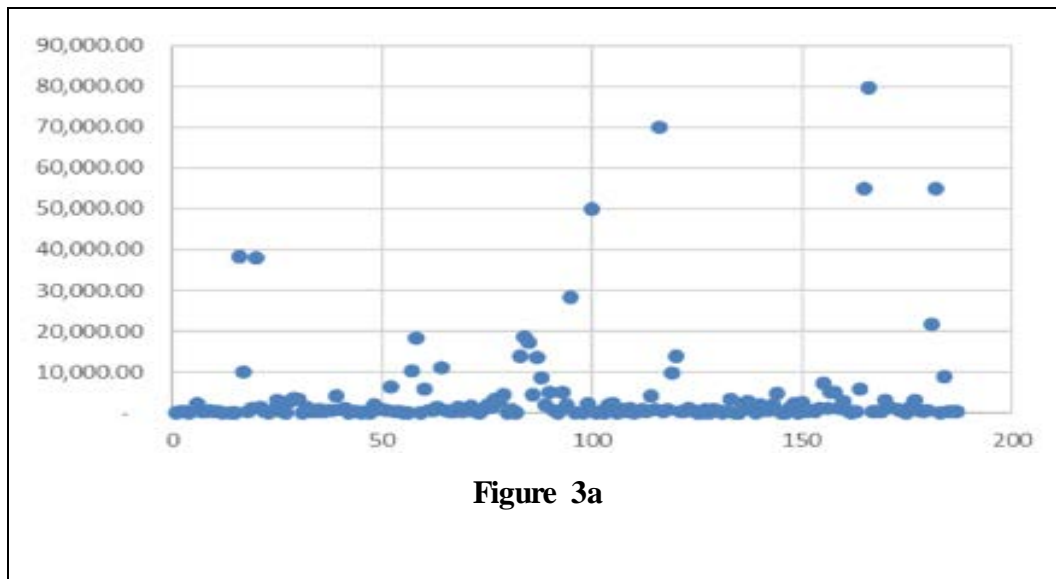


Figure 3a –Spend Pattern for January 2015 (lower level spends), Figure 3b –Spend Pattern for January 2015 (higher level spends)

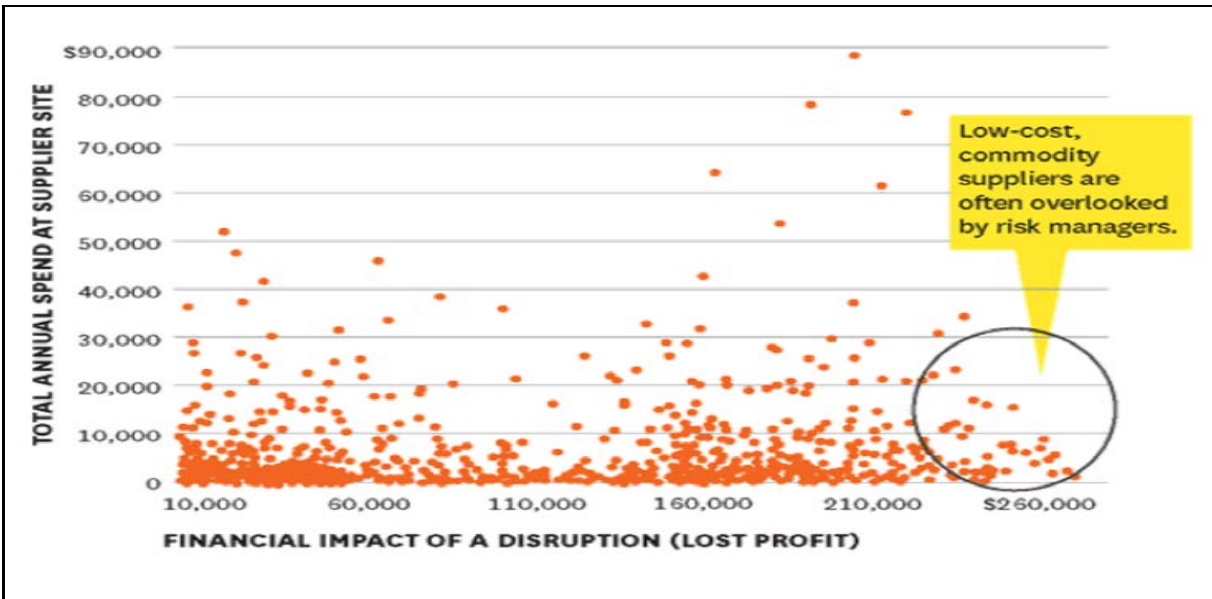


Figure 4 – A Business Continuity View of “Spend”

Spend analysis can, therefore, be the first step to provide a nuanced approach to supply chain risk management. A next step in differentiating the suppliers in each transaction level into categories that highlight the supplier’s importance and buyer’s dependence. Supply managers often use the Kraljic Portfolio Matrix for the purpose (Kraljic 1983). Figure 4 provides a summary of how Kraljic categorized supplies. The first category is routine items. These items are low risk and have a low impact on organizational profitability. The most commonly used example in this segment is office stationery. Sourcing strategies used for routines items is a focus on efficiency and improving administrative transaction costs. For example, electronic auctions and the use of catalogs are ways that procurement managers can minimize their time spent on routine items.

The first category is routine items. These items are low risk and have a low impact on organizational profitability. The most commonly used example in this segment is office stationery. Sourcing strategies used for routines items is a focus on efficiency and improving administrative transaction costs. For example, electronic auctions and the use of catalogs are ways that procurement managers can minimize their time spent on routine items. The second group is that of leverage items. These items have high profitability, but a low-risk factor. The buying firm carries the balance of power in the relationship with suppliers and can leverage this power to gain better buying terms. Procurement professionals usually exploited this status to gain lower prices, better delivery terms or get the supplier to be more flexible on options offered. The roles are reversed in bottleneck items. In purchasing these items risk is high, but profitability is low. The market for bottleneck items includes few suppliers. They can even act oligopolistically and raise prices. Supply relationship with bottleneck suppliers is demanding of the buyer’s time, even though they may not offer much regarding the bottom-line efficiency. Finally, strategic items are those where there is high supplier risk but also high-profit impact items cover. Strategic

items are critical to the buyer and the supplier. Often the two sides work to develop deep relationships because it is in both of their interest.

From a risk management perspective, a focus on bottleneck and strategic items is the first line of defense for the procurement group. As related to spend analysis, using the findings based on the level of the transaction can be extended by categorizing suppliers into the four categories. High risk suppliers with high transaction value are the first concern for procurement to evaluate.

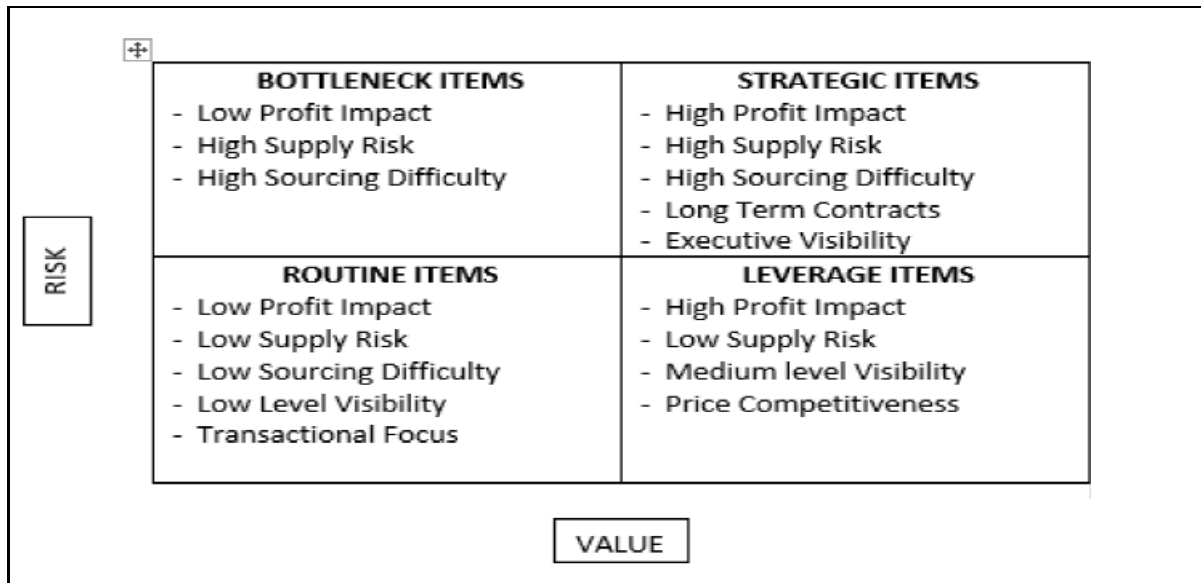


Figure 5 - A Purchasing Strategy View of "Spend"

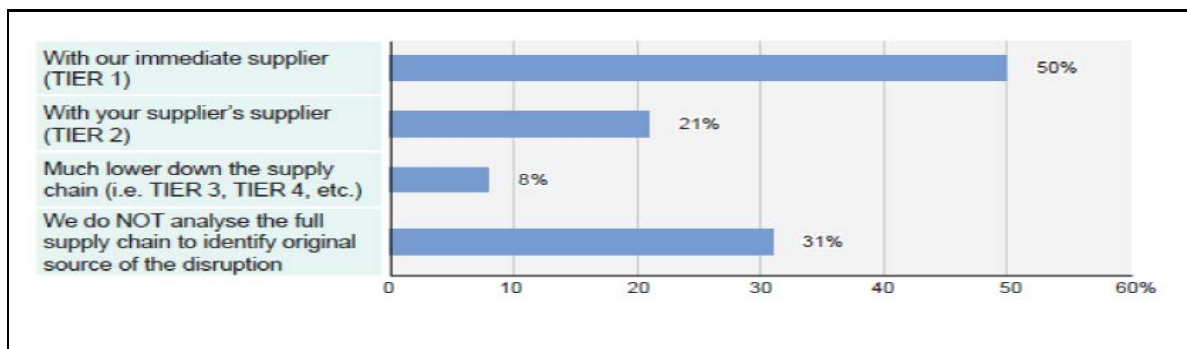


Figure 6 - Source of supply chain disruptions according to Manufacturers

Risk management in the supply chain may need to extend beyond the first tier suppliers. A recent report by BCI (Business Continuity Institute) suggests that a large percentage of supply chain disruptions are initiated in downstream tiers of the supply chain (Business Continuity Institute 2015). When companies were asked about the supply chain incidents they were aware of, the predominant source of disruptions was listed as their immediate (tier 1) suppliers (Figure 6).

However, the combined effects of the second tier and lower tiers of the supply chain (i.e., third-tier suppliers, fourth tier suppliers and below) showed to be responsible for 29% of the incidents (Business Continuity Institute 2016). Interestingly, 30 percent of the respondents were unable to identify the source of the disruption, suggesting that their supply chain visibility is not as strong as necessary to identify this key matter in supply chain risk management (Figure 12).

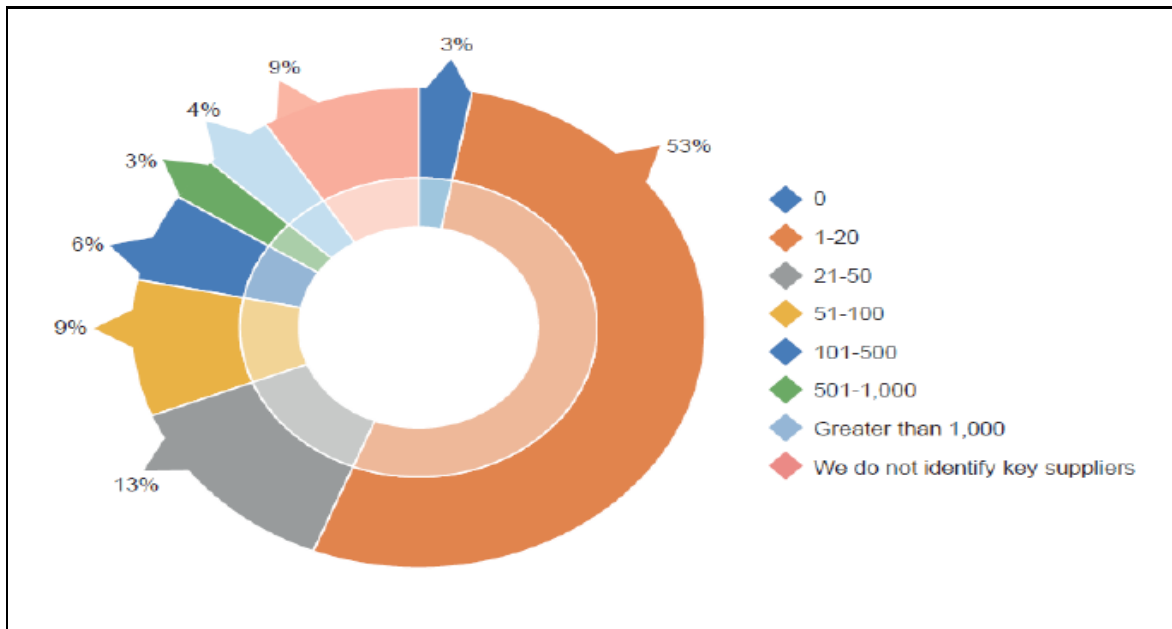


Figure 7 - How many suppliers do companies choose based on strong BIA?

Companies also seem to lack the ability to determine whether their key suppliers carry business impact analysis (BIA). Business impact analysis is a process that identifies and evaluates the potential effects (financial, life/safety, regulatory, legal/contractual, reputation and so forth) of natural and man-made events on business operations. When asked how many of their key suppliers are selected based on BIA, more than nine percent of the respondents had not identified their key suppliers at all. Moreover, more than 33% of the organizations had less than 21 key suppliers, and 4% had less than 1,000 identified based on BIA. Considering that a typical buyer can work with 1,000 suppliers, the numbers are somewhat of a concern (Figure 7).

Specific to PANYNJ and this research project, the ground work in identifying BCP software application vendors: Based on Gartner Magic Quadrant reached (Hill et al. 2009) out to 17 vendors, the Rutgers student facilitated demo sessions and evaluated the solutions along with the Application SME. PANYNJ has a legacy solution from Sungard which is approaching the end of life, and they have to migrate to a new one soon. Based on the operating expenses summary, there appears to be substantial involvement of 3rd party service providers in the operations. As a consequence, their involvement in the BCP activities is highly desirable in order to execute the

plans. As the new Emergency Notification System and BCP software are introduced into the operations of the Agency, it might be a good time for a greater change management initiative.

CONCLUSIONS

Below we offer a highlight of what was found from this preliminary investigation on the status of risk management in the supply chain at PANYNJ.

PANYNJ spends almost 39% on contract services, materials, equipment and other which is almost equal to the 41% expenditure on employees. It can, therefore, be inferred that suppliers are equal stakeholders in the operations of the Agency. Given that nearly 85% of these suppliers are located in NY & NJ the risk of concentration is high.

Most suppliers to PANYNJ are small and medium-sized firms (SMEs) with no financial muscle to run a dedicated business continuity program. If the Metropolitan Resiliency Network runs such a “Community BCMP,” that provides an excellent platform for such firms to plug into and be part of a regional initiative.

RECOMMENDATIONS

Below we offer a highlight of what we recommend as next steps on what can be done to enhance risk management in the supply chain at PANYNJ.

- 1) We noted the possibility of further supply risk management analyses by combining spend analysis and Portfolio Analysis above. Also, PANYNJ has categorized business processes into Categories 1 to Category 5. Identifying vendor dependencies in these processes and prioritizing them based on the 1-5 category can be beneficial by providing less dependency on the procurement function since BCP documents would have the processes identified.
- 2) Future Supply Chain Internship / Student Project could be undertaken to develop further the information shared here. These can include:
 - a. Vendor identification/measurement framework for supply continuity.
 - b. Strategy for continuity of non-inventoried goods and services.
 - c. Strategy to manage small, mid-size, family-owned, MWBE (Minority and Woman-Owned Business Enterprises)?
- 3) Office of Emergency Management (OEM) at PANYNJ routinely organizes and conducts tabletop exercises (TTX) to test and train on crisis and emergency preparedness. These exercises are excellent ways to institutionalize the responses in case of disruptions. Other suggestions would be to

- a. Run simulated workshops case analysis based on researched current global incidents (Wang 2017) ¹.
- b. Blue-Sky crisis management sessions: These would be learning and development based; have some lateral or blue sky thinking. E.g. recreate Tianjin-like incident and check preparedness, interface with industry e.g. roundtable with pharma and PA Aviation / Port Commerce for any sort of contamination of imported material in transit arriving at the shores of the country etc.
- c. PANYNJ can identify vendors involved in critical functions and mandate their participation in the various TTXs. Other vendors should be encouraged to leverage the MRN and information regarding various training & development initiatives should be made available to them.

¹ Example of service providers include:

social simulator: https://socialsimulator.com/usa/?gclid=CjwKCAjwkrbBRB9EiwAhIN8_KE-HPgfC_fhyLFtzo7tHcp40_LaTqW6FG1gipHrcW3Rd8BH1T3ZKR0C63AQAvD_BwE, <http://www.crisis-solutions.com>, and <https://www.onlycrisis.com/services/crisis-simulation/>

REFERENCES

- Business Continuity Institute. 2015. *Supply chain resilience report*. Caversham, UK.
- Business Continuity Institute. 2016. *Supply chain resilience report*. Caversham, UK.
- Dawes, Sharon S, Anthony M Cresswell, and Bruce B Cahan. 2004. "Learning from crisis: Lessons in human and information infrastructure from the World Trade Center response." *Social Science Computer Review* 22 (1):52-66.
- Frittelli, J. 2008. "Port and maritime security: background and issues for congress." *Port and Maritime Security* 11.
- Hill, Janelle B, Michele Cantara, Marc Kerremans, and Daryl C Plummer. 2009. "Magic quadrant for business process management suites." *Gartner Research* 164485.
- Kraljic, Peter. 1983. "Purchasing must become supply management." *Harvard business review* 61 (5):109-117.
- Monczka, Robert M, Robert B Handfield, Larry C Giunipero, and James L Patterson. 2009. *Purchasing and supply chain management*: South-Western.
- Pandit, Kirit, and Haralambos Marmanis. 2008. *Spend analysis: The window into strategic sourcing*: J. Ross Publishing.
- PANYNJ. 2016. A Guide to Procurement at The Port Authority of NY & NJ
- PANYNJ. 2017. "Annual Report."
- Smeltzer, Larry R, and Joseph R Carter. 2001. "HOW TO BUILD AN E-PROCUREMENT STRATEGY." *SUPPLY CHAIN MANAGEMENT REVIEW*, V. 5, NO. 2 (MAR/APR. 2001), P. 76-83: ILL.
- Smythe, Tiffany C. 2013. *Assessing the impacts of Hurricane Sandy on the Port of New York and New Jersey's Maritime responders and response infrastructure*: Natural Hazards Center.
- Wang, Ming. 2017. "Using Crisis Simulation to Enhance Crisis Management Competencies: The Role of Presence." *Journal of Public Relations Education* 3 (2):96-109.